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Flying Horse North
Master Development Drainage Plan

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HR Green Project No: 211030.01

Prepared For:

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Engineer's Statement

This report and plan for the drainage design of the development, Flying Horse North, was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the *El Paso County Drainage Criteria* Manual and is in conformity with the master plan of the drainage basin. I understand that El Paso County does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

9/20/2022

Gregory Panza, PE Date

State of Colorado No. 37081

For and on behalf of HR Green Development, LLC

Developer's Statement

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

Flying Horse Development, LLC

By: _____

Title: _____

Address: _____

_____

El Paso County:

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

_____ _____

Jennifer Irvine, P.E. Date

County Engineer/ECM Administrator

Master Development Drainage Plan – Flying Horse North

I. General Purpose, Location and Description

a. Purpose and Scope

The Purpose of this Master Development Drainage Plan (MDDP) is to describe the onsite and offsite drainage patterns, existing and proposed storm infrastructure as it relates to preliminary water quality and stormwater detention, areas tributary to the site and the planned storm water management for the Flying Horse North development for Filings No. 2, 3 and remaining filings. Flying Horse North Filing No. 1 combined Preliminary Drainage Report (PDR) and Final Drainage Report (FDR) was previously written by Classic Engineering and included in Appendix F. The items discussed in this report are preliminary in nature and final drainage calculations and design will be required as development proceeds. This report provides a general drainage concept and guidance for future development of Flying Horse North.

b. DBPS Investigations

Flying Horse North is split by the Arkansas River Basin and South Platte Basin. Within each of those river basins, the site stretches across the Black Squirrel Basin and East Cherry Creek Drainage Basins.

The Black Squirrel Drainage Basin Planning Study (DBPS) Preliminary Design Report prepared by URS Corporation was reviewed to determine existing plans and constraints that would influence the design of the Flying Horse North Development. The proposed plans for Flying Horse North are in general conformance with the DBPS.

Currently Flying Horse North Filing 1 is located within a major portion of the Black Squirrel Creek Drainage Basin of the development. A Preliminary Drainage Report and Final Drainage Report for this area was prepared in June 2018 by Classic Consulting and it is the intent of this MDDP to follow the general drainage approach for this area where densities for the development will remain similar to the report.

For the portion of Flying Horse North which lies within the East Cherry Creek Drainage Basin, a DBPS does not currently exist and the MDDP will comply with standard El Paso County regulations regarding drainage within this corridor.

c. Stakeholder Process

There are no amendments to the current DBPS.

d. Agency Jurisdictions

Listed below are the jurisdictions that this project will conform to:

El Paso County

Federal Emergency Management Agency

e. General Project Description

Flying Horse North is in El Paso County. The development is bordered by Highway 83 to the west, Black Forest Road to the east, Cathedral Pines to the south, and High Forest Ranch to the north. The area contains approximately 1,459 acres within the whole Section 36, Township 11 South, Range 66 West of

the Sixth Principal Meridian, and a portion of Section 30 and 31, Township 11 South, and Range 65 West of the Sixth Principal Meridian.

This MDDP will cover approximately 912.5 acres of 973 residential units, which is shown in the figure below. This development will include estate lots, low through high density residential lots, commercial development, an 18-acre hotel site, open space and park areas, fitness center and a clubhouse.

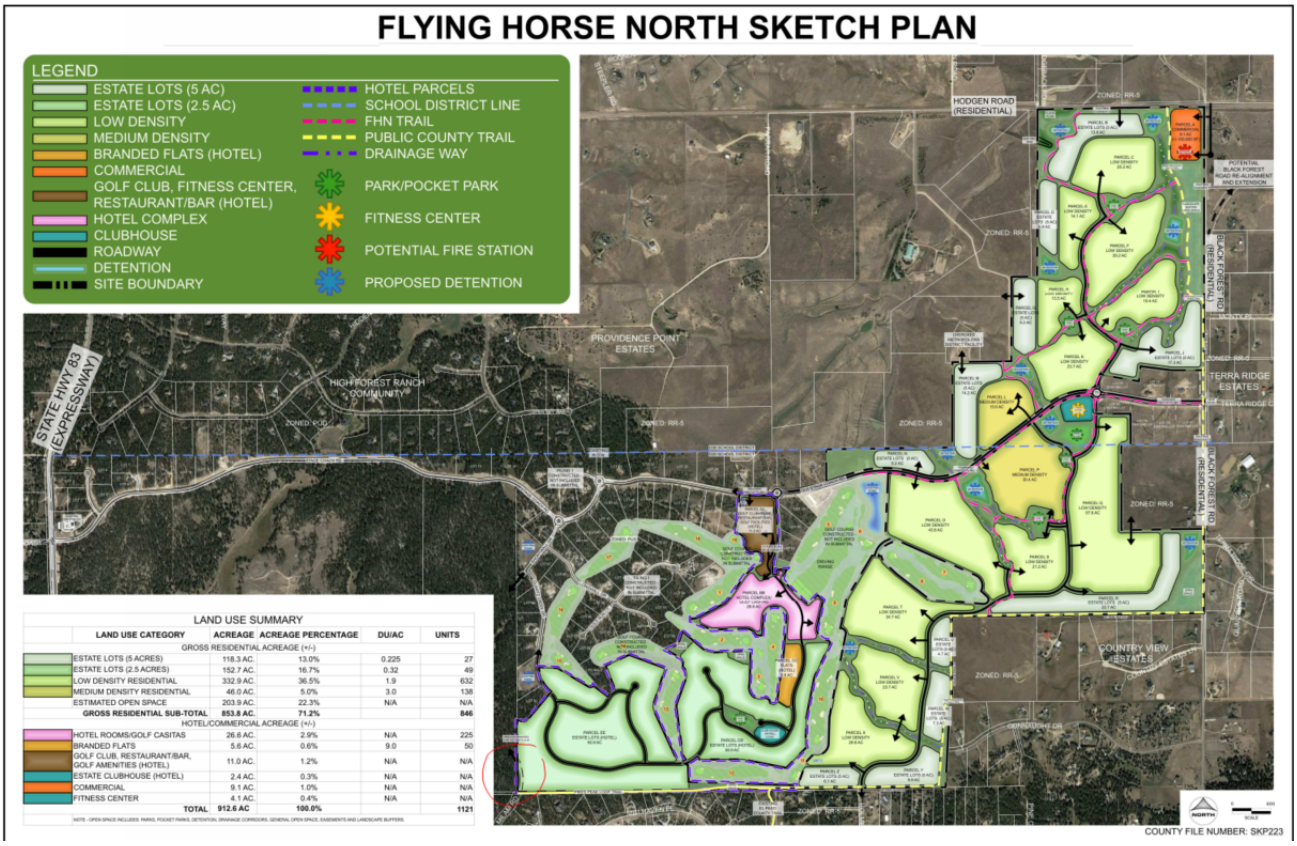


Figure 1 - Site Map

f. Data Sources

Listed Below are the technical resources reviewed in the preparation of this MDDP:

El Paso County Drainage Criteria Manual (DCM)

Mile High Flood District

NOAA Atlas 14

NRCS Soil Survey for El Paso County Area, Colorado

FEMA FIRM 08041C0305G and FIRM 08041C0315G (eff. 12/7/2018)

El Paso County Assessor Property Records

Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1 – June 2018

Flying Horse North Irrigation Reservoir Embankment Design Report – August 2018

g. Applicable Criteria and Standards

Per the DBPS and El Paso County Criteria Manual, flows from the proposed site will be limited to historic flows to maintain the stability of the existing channels within the drainage basins. The master plan follows the Drainage Criteria Manual for El Paso County which refers to the City of Colorado Springs Drainage Criteria Manuals as amended.

II. Project Characteristics

a. Location in Drainage Basin, Offsite Flows, Size

Flying Horse North is located within both the Black Squirrel Drainage Basin and East Cherry Creek Basin. Predominantly, the existing Filing No.1 and part of the proposed Filing No. 2 is located within the Black Squirrel Drainage Basin. This drainage basin encompasses 10.9 square miles of mostly forested area and generally slopes from east to west and outfalls into Monument Creek. Black Squirrel is a sub-basin of the Arkansas River. The remaining filings and part of Filing No. 2 is located within the East Cherry Creek Basin. There is not a current planning study of the drainage basin, but generally it slopes from southwest to northeast. The basin eventually flows into the South Platte River.

As the site generally lies at the top of each of the respective basins, minimal offsite flows are conveyed onto the site. The Black Squirrel Creek Drainage basin has no offsite flow come onto the site sans those flows generated as part of Filing 1 of Flying Horse North. The development which is within the Black Squirrel Creek Drainage Basin is unchanged from the FDR shown in Filing 1.

For the East Cherry Creek basin, 4 drainage basins are conveyed onto the site on the southwestern portion of the basin. These basins are labeled A, C, F and Q. The respective contributing flows from these basins is shown in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
A	18.99	20.84	43.83
C	36.39	33.36	71.27
F	25.25	24.27	51.63
Q	72.29	64.68	137.80

These four basins are generally conveyed through the development via natural drainage ways. The proposed ponds discussed later within this report have been sized to pass through the offsite flows.

b. Compliance with DBPS

This MDDP is in general conformance with the guidelines outlined in the Black Squirrel DBPS and current drainage flows of the East Cherry Creek Basin. Flying Horse North will construct multiple full spectrum detention facilities to limit the effects of development and mimic natural flow patterns.

Existing downstream infrastructure is currently limited to the historic drainage channels and minimal downstream improvements exist. As such, the site follows the DBPS and restricts offsite flow rates to not exceed historic flow rates. The sites ultimate outfalls will generally be along the same historic tributaries. Although outfall rates will be at or below historic, the cumulative volume of runoff will increase and therefore downstream facilities may see an increase in the duration of flows. This may provide a net benefit to the downstream facilities by providing more water to assist with the sustenance of vegetation however it should be noted that increased volume may expedite potential erosion or channel movement.

c. Site Characteristics

Per the NRCS web soil survey, the site is made up entirely of Type B soils. The ridge line between the Arkansas River and South Platte River Basins creates different soil environments for each. The portion of site that is within the Black Squirrel Drainage Basin, which includes Flying Horse Norse Filing No. 2 and No. 3, are predominately Elbeth sandy loam. The remaining filings are within the East Cherry Creek Basin which consists of Peyton sandy loam and Peyton-Pring complex. See Appendix A for the NRCS soil map.

Current ground cover varies between the two basins as well. Filings No. 2 and 3 are predominantly covered by Ponderosa Pine trees as a part of Black Forest and pasture. The remaining filings are short- to mid-grass prairie grasslands and former farmland which consists of non-native weeds and grasses. This portion of the site has very few, if any, trees and a minimal number of shrubs are found on the site.

d. Major Drainage Ways and Structures

No major drainage ways exist within the development; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries of the East Cherry Creek and Black Squirrel Creek. Additionally, as part of the Flying Horse North Filing 1 development, a large irrigation pond was built for water storage and flood control. This drains to the north and to the aforementioned unnamed tributary.

Existing minor drainage channels within the site are planned to be maintained to the maximum extent possible within parkways and greenways with the development. These will continue to be used for conveyance of storm drainage flows.

The Franktown Parker Dam (080130) is located near the northwest corner of site. The dam is designated as a jurisdictional dam and has a low hazard class. It is located along East Cherry Creek. See Appendix A for characteristics and location of dam.

e. Existing and proposed land uses

The existing site is open rangeland on the eastern portion of the site and the western site is single family homes on large (~2.5 acre) home site within a heavily forested area. As part of Filing 1, a road was constructed along with facilities to support a golf course. Structures, outside of the homes are scattered throughout the overall development which will either be removed as part of the project or were built as part of Filing 1. The proposed development will consist of estate, low and medium lots, along with a future hotel site and multiple green spaces and small parks. The current land plan assumes approximately 897 dwelling units will be constructed on the site, not including an approximate 225 provided the proposed hotel.

Land Use	MAX DU/AC
Estate Lots (2.5 Acres)	0.32
Estate Lots (5 Acres)	0.2
Low	1.9
Medium	3.0

III. Hydrologic Analysis

a. Major Basins and subbasins

Major Basin Description

- Previous basin study: Black Squirrel Drainage Basin Planning Study
- Per FEMA FIRM 08041C0305G and 08041C0315G (eff. 12/7/2018), Flying Horse North has the East Cherry Creek run through the northwest portion of the site. Currently, FEMA shows a LOMR effective April 4th, 2019 Base Flood Elevations and Zone A. Per the El Paso County Land Development Code Chapter 8 Section 8.4.2.B.1.e.i, the base flood elevations for Zone A will be determined once the platted lots are solidified and are confirmed within 300-ft of the current floodplain designation. Certification of the flood elevations will be via the FEMA CLOMR/LOMR process or Floodplain Certification Letter.
- There is a large irrigation pond that accounts for water storage and water control on the east side of the site.

The site has been divided into several major drainage basins per where each basin is tributary to a full spectrum detention pond facility. These basins and associated sub basins are described in more detail in the next section of this report.

Existing Subbasin Description

The site's flows are split by the major ridgeline of the Arkansas River Basin and South Platte Basin. Within the South Platte Basin, flow is generally carried northeast throughout the site. On the other side of the ridgeline, the Arkansas River Basin flows in a southwest direction. Subbasin IDs with single letters are part of the South Platte Basin and Subbasin IDs with double letters are part of the Arkansas River Basin.

- Subbasin A is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B1. The basin is 18.99 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 20.84 cfs and 43.83 cfs respectively.
- Subbasin B is located north of Subbasin A. The basin drains towards the northwest into a natural drainageway that flows directly to an existing irrigation pond. The basin is 59.74 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 103.48 cfs and 221.28 cfs respectively.
- Subbasin C is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B2. The basin is 36.39 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 33.36 cfs and 71.27 cfs respectively.
- Subbasin D is located north of Subbasin B. The basin drains towards the northwest and towards the existing irrigation pond. The basin is 38.84 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 31.56 cfs and 67.84 cfs respectively.
- Subbasin E is in a central location of the site and includes the existing irrigation pond. The basin drains towards the north and towards existing irrigation pond. The basin is 106.53 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 223.69 cfs and 483.10 cfs respectively.

- Subbasin F is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin G. The basin is 25.25 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 24.27 cfs and 51.63 cfs respectively.
- Subbasin G is directly north of Subbasin D and east of Subbasin E. The basin drains towards the northwest and towards Subbasin E with the irrigation pond. The basins consist of the existing golf course. The basin Is 52.19 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 79.17 cfs and 166.51 cfs respectively.
- Subbasin H is located directly downstream of Subbasin E and on the north side of Stagecoach Rd. The basin drains towards the north through a natural drainageway. There are existing lots on the west side of the basin. The basin is 20.63 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 18.59 cfs and 39.78 cfs respectively.
- Subbasin I is located west of Subbasin E and northeast of the major ridgeline between basins. The basin drains towards the northwest and towards an existing culvert. There are existing lots on the west side of the basin. The basin is 31.93 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 34.58 cfs and 72.63 cfs respectively
- Subbasin J is located downstream of Subbasin I. The basin drains towards the northeast to an unnamed tributary of the East Cherry Creek. The basin is 28.47 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 56.31 cfs and 120.46 cfs respectively.
- Subbasin K is located south of proposed section of Stagecoach Rd. The basin drains towards the northwest and into an existing 48” culvert. The basin is 93.15 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 92.05 cfs and 195.43 cfs respectively
- Subbasin L is downstream of Subbasin K and is located on the north side of the proposed section of Stagecoach Rd. The basin drains towards the northwest to a natural drainageway of East Cherry Creek. The basin is 16.39 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 107.58 cfs and 228.73 cfs respectively.
- Subbasin M is located on the east side of the site and between Subbasin N and V1. The basin drains towards the northwest and into an existing 30” culvert. The basin is 13.85 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 11.48 cfs and 24.61 cfs respectively.
- Subbasin N is located south of Subbasin O and north of proposed Stagecoach Rd. The basin drains towards the northwest to a nearby unnamed tributary and eventually East Cherry Creek. The basin is 49.00 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 64.68 cfs and 143.11 cfs respectively.
- Subbasin O is located south of Subbasin P. The basin drains towards the northwest and towards the north. The basin is 24.76 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 22.69 cfs and 48.54 cfs respectively.
- Subbasin P is in the northeast corner of the site and downstream of Subbasin O. The basin drains towards the northeast to an unnamed tributary of East Cherry Creek. The basin is 43.80 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 38.52 cfs and 82.17 cfs respectively.

- Subbasin Q is located off site and on the southeast corner. The basin drains towards the northeast and towards Subbasin R. The basin is 72.29 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 64.68 cfs and 137.80 cfs respectively.
- Subbasin R is located on the east side of site adjacent to Black Forest Rd. The basin drains towards the northeast. The basin is 54.98 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 108.65 cfs and 232.13 cfs respectively.
- Subbasin S is located north of Subbasin Q. The basin drains towards the southeast and overland towards Subbasin R. The basin is 24.36 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 25.99 cfs and 54.65 cfs respectively.
- Subbasin T is located off site and on the southeast corner. The basin drains towards the southeast and towards Black Forest Rd. The basin is 5.24 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 4.04 cfs and 8.68 cfs respectively.
- Subbasin U is located east of subbasin V and is composed of existing 2.5 acre lots. The basin drains offsite towards the southeast and follows historic drainage patterns. The basin is 5.86 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 4.15 cfs and 8.95 cfs respectively.
- Subbasin V is located on the east side of the site in between Subbasin M and U. The basin drains towards the north and towards Subbasin X via culvert. The basin is 38.57 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 29.63 cfs and 63.92 cfs respectively.
- Subbasin W is located north of Subbasin U on the site. The basin drains offsite through an existing 24” CMP culvert. The basin is 3.96 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 3.45 cfs and 7.33 cfs respectively.
- Subbasin X is located on the northeastern corner of the site. The basin drains north towards an unnamed tributary of East Cherry Creek. The basin is 190.88 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 167.76 cfs and 361.56 cfs respectively.
- Subbasins AA and CC are located on the west side of the site along the major ridgeline. Both basins were developed in Filing No. 1 and are included in the analysis to provide a better understanding for the flows draining towards Black Squirrel Creek. The basins drain towards the southwest. The basins are 33.8 acres and 37.15 acres, with a composite impervious value of 10% and 10% and runoff rates for the 5 and 100 year of 38.76 cfs and 80.22 cfs and 6.53 cfs and 13.57 cfs respectively.
- Subbasin BB is located downstream of Subbasin AA. The basin drains towards the southwest and towards Subbasin GG. A section of the area of the basin was developed in Filing No. 1 and consists of 2.5-acre lots. The basin is 37.15 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 40.62 cfs and 84.15 cfs respectively.
- Subbasin DD is located west and downstream of Subbasin EE. The basin drains towards the west. A portion developed in Filing No. 1 consists of the Flying Horse North Golf Course and 2.5-acre lots. The basin is 70.07 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 58.42 cfs and 123.69 cfs respectively.

- Subbasin EE is upstream of subbasin DD. The basin drains towards the west. A portion of the area was developed in Filing No. 1 consists of the Flying Horse North Golf Course and 2.5-acre lots. The basin is 69.47 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 81.16 cfs and 167.45 cfs respectively.
- Subbasin FF is located downstream of Subbasins DD and EE. The basin drains towards the southwest. The north half consists of 2.5-acre lots and part of the Flying Horse North Golf Course constructed during Filing No. 1. The basin is 17.62 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 162.77 cfs and 340.42 cfs respectively.
- Subbasin GG located downstream of Subbasin FF. The basin drains towards the southwest and towards an existing detention pond developed in Filing No. 1. The basin is 16.35 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 14.93 cfs and 31.99 cfs respectively.
- Subbasin HH is located on the west side of the site. The basin drains towards the west and and unnamed tributary of Black Squirrel Creek. The basin is 12.61 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 13.01 cfs and 27.42 cfs respectively.
- Subbasin II is located in the southwest corner of site. The basin drains towards the west and to an unnamed tributary of Black Squirrel. The basin is 97.53 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 81.77 cfs and 175.60 cfs respectively.
- Subbasin JJ is in the southcentral part of the site. The basin drains towards the south and to an unnamed tributary of Black Squirrel Creek. The basin is 8.9 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 9.74 cfs and 20.50 cfs respectively.
- Subbasin KK is in the southcentral part of the site. The basin drains towards the south and to an unnamed tributary of Black Squirrel Creek. A portion of the area is occupied by the existing Flying Horse Golf Course. The basin is 8.12 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 7.51 cfs and 15.99 cfs respectively.
- Subbasin LL is in the southcentral part of the site. The basin drains towards the south and to an unnamed tributary of Black Squirrel Creek. The basin is 6.1 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 6.88 cfs and 14.48 cfs respectively.

Proposed Subbasin Description

- Subbasin A is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B1. The basin is 18.99 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 20.84 cfs and 43.83 cfs respectively.
- Subbasin B1 is located north of Subbasin A. The basin drains towards the northwest and towards proposed Detention Pond 11. Current planning documents call for low density dwelling units. The basin is 59.74 acres, with a composite impervious value of 29.83% and runoff rates for the 5 and 100 year of 66.93 cfs and 133.69 cfs respectively.
- Subbasin B2 is located northeast of Subbasin B1. The basin drains towards the northwest and towards the proposed Detention Pond 11. Current planning documents call for low density dwelling units. The basin is 19.99 acres, with a composite impervious value of 24.55% and runoff rates for the 5 and 100 year of 17.99 cfs and 37.14 cfs respectively.
- Subbasin C is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B2. The basin is 36.39 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 35.31 cfs and 75.28 cfs respectively.
- Subbasin D is located north of north of Subbasins B1 and B2. The basin drains towards the northwest and towards Detention Pond 15. Current planning documents call for low density dwelling units. The basin is 40.87 acres, with a composite impervious value of 37.20% and runoff rates for the 5 and 100 year of 61.12 cfs and 117.38 cfs respectively.
- Subbasin E is in a central location of the site and includes the existing irrigation pond. The basin drains towards the north and towards existing irrigation pond. Current planning documents call for two small parking lots. The basin is 106.53 acres, with a composite impervious value of 14.35% and runoff rates for the 5 and 100 year of 74.68 cfs and 157.91 cfs respectively.
- Subbasin F is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin G. The basin is 25.25 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 24.27 cfs and 51.63 cfs respectively.
- Subbasin G is directly north of Subbasin D and east of Subbasin E. The basin drains towards the northwest and towards Subbasin E. Current planning documents call for a small amount of low density dwelling units, where most of the basin consist of the existing golf course. The basin is 31.45 acres, with a composite impervious value of 12.48% and runoff rates for the 5 and 100 year of 27.18 cfs and 57.12 cfs respectively.
- Subbasin H is located located directly downstream of Subbasin E and on the north side of Stagecoach Rd. The basin drains towards the north and towards Detention Pond 10. Current planning documents call for medium density dwelling units. There are existing lots on the west side of the basin. The basin is 21.96 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 17.86 cfs and 37.8 cfs respectively.
- Subbasin I is located west of Subbasin E and northeast of the major ridgeline between basins. The basin drains towards the northwest and towards proposed Detention Pond 16. There are existing lots on the west side of the basin. Current planning documents call for a commercial golf club. The basin is 28.99 acres, with a composite impervious value of 34.66% and runoff rates for the 5 and 100 year of 40.37 cfs and 78.06 cfs respectively

- Subbasin J is located downstream of Subbasin I. The basin drains towards the northeast to an unnamed tributary of the East Cherry Creek. Current planning documents do not call for any changes to this basin. The basin is 28.07 acres, with a composite impervious value of 10% and runoff rates for the 5 and 100 year of 24.25 cfs and 51.19 cfs respectively.
- Subbasin K is located south of proposed section of Stagecoach Rd. The basin drains towards the northwest and towards proposed Detention Pond 7. Current planning documents call for high, medium, and low density dwelling units and a few pocket parks. The basin is 114.73 acres, with a composite impervious value of 38.08% and runoff rates for the 5 and 100 year of 200.94 cfs and 382.3 cfs respectively
- Subbasin L is downstream of Subbasin K and is located on the north side of the proposed section of Stagecoach Rd. The basin drains towards the northwest into proposed Detention Pond 8. Current planning documents call for medium density dwelling units. The basin is 15.89 acres, with a composite impervious value of 24.82% and runoff rates for the 5 and 100 year of 15.97 cfs and 32.4 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin M is located on the east side of the site and between Subbasin N and V1. The basin drains towards the northwest and towards proposed Detention Pond 6. Detention Pond 6 outlets into a culvert under proposed Stagecoach Rd. and eventually to Subbasin N. Current planning documents call for medium density dwelling units, potential fitness center, and a park. The basin is 26.83 acres, with a composite impervious value of 33.19% and runoff rates for the 5 and 100 year of 46.54 cfs and 89.08 cfs respectively.
- Subbasin N is located south of Subbasin O and North of proposed Stagecoach Rd. The basin drains towards the northwest towards proposed Detention Pond 5. Detention Pond 5 outlets to a nearby unnamed tributary and eventually East Cherry Creek. Current planning documents call for medium density dwelling units along with a pocket park. The basin is 41.57 acres, with a composite impervious value of 29.60% and runoff rates for the 5 and 100 year of 73.48 cfs and 141.24 cfs respectively.
- Subbasin O is located south of Subbasin P. The basin drains towards the northwest and towards Detention Pond 3. Current planning documents call for medium density dwelling units. The basin is 52.52 acres, with a composite impervious value of 30.10% and runoff rates for the 5 and 100 year of 63.86 cfs and 127.4 cfs respectively. The pond will discharge at predevelopment rates and into Pond 1 via a swale.
- Subbasin P is in the northeast corner of the site and downstream of Subbasin O. The basin drains towards the northeast to proposed Detention Pond 1. Current planning documents call for low density dwelling units. The basin is 43.71 acres, with a composite impervious value of 20.71% and runoff rates for the 5 and 100 year of 40 cfs and 82.83 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin Q is located off site and on the southeast corner. The basin drains towards the northeast and towards Subbasin R. The basin is 72.29 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 64.68 cfs and 137.8 cfs respectively.

- Subbasin R is located on the east side of site adjacent to Black Forest Rd. The basin drains towards the northeast and towards Detention Pond 9. Current planning documents call for low density and 1-acre lots. The basin is 76.38 acres, with a composite impervious value of 21.81% and runoff rates for the 5 and 100 year of 56.59 cfs and 116.06 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin S is located north of Subbasin Q. The basin drains towards the southeast and overland towards Subbasin R. Current planning documents call for low density dwelling units. The basin is 21.67 acres, with a composite impervious value of 40.88% and runoff rates for the 5 and 100 year of 30.83 cfs and 58.96 cfs respectively.
- Subbasin T is located off site and on the southeast corner. The basin drains towards the southeast and towards Black Forest Rd. The basin is 5.24 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 4.04 cfs and 8.68 cfs respectively.
- Subbasin U is located east of subbasin V2 and is composed of existing 2.5 acre lots. The basin drains offsite towards the southeast and follows historic drainage patterns. The basin is 5.86 acres, with a composite impervious value of 2% and runoff rates for the 5 and 100 year of 4.96 cfs and 10.51 cfs respectively.
- Subbasin V1 is located on the east side of the site in between Subbasin M and V2. The basin drains towards the north and towards Subbasin X3 via culvert. Current planning documents call for low density dwelling units. The basin is 11.57 acres, with a composite impervious value of 38.62% and runoff rates for the 5 and 100 year of 13.99 cfs and 27.67 cfs respectively.
- Subbasin V2 is located south of subbasin X3 and proposed Stagecoach Rd. The basin drains towards the north and towards subbasin X3. The flows are directed through a culvert and eventually to Detention Pond 4. There are no proposed dwelling unit for the area, as there are existing 2.5 acre lots that cover the basin. The basin is 15.34 acres, with a composite impervious value of 15.00% and runoff rates for the 5 and 100 year of 16.15 cfs and 33.25 cfs respectively.
- Subbasin W is located on the north side of subbasin U. The basin drains offsite to the southeast. The basin is 3.76 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 3.58 cfs and 7.46 cfs respectively.
- Subbasin X1 is located on the northeastern corner of the site. The basin drains north towards proposed Detention Pond 2. Current planning documents call for low density dwelling units, potential fire station and a pocket park. The basin is 76.38 acres, with a composite impervious value of 29.50% and runoff rates for the 5 and 100 year of 80.91 cfs and 163.27 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin X2 is located south of Subbasin X1 The basin drains towards the northeast towards proposed Detention Pond 4. Current planning documents call for low density dwelling units along with a pocket park. The basin is 36.33 acres, with a composite impervious value of 33.33% and runoff rates for the 5 and 100 year of 41.46 cfs and 82.46 cfs respectively.
- Subbasin X3 is located south of Subbasin X2. The basin drains towards the north and towards Detention Pond 4. Current planning documents call for low density dwelling units and a pocket

park. The basin is 65.75 acres, with a composite impervious value of 13.53% and runoff rates for the 5 and 100 year of 47.59 cfs and 100.73 cfs respectively.

- Subbasins AA and CC are located on the west side of the site along the major ridgeline. Both basins were developed in Filing No. 1 and are included in the analysis to provide a better understanding for the flows draining towards Black Squirrel Creek. The basins drain towards the southwest. The basins are 33.8 acres and 37.15 acres, with a composite impervious value of 10% and 10% and runoff rates for the 5 and 100 year of 39.23 cfs and 81.18 cfs and 6.53 cfs and 13.57 cfs respectively.
- Subbasin BB is located downstream of Subbasin AA. The basin drains towards the southwest and towards Subbasin GG. Current planning documents call for a small portion of 2.5-acre estate lots. The remaining area of the basin was developed in Filing No. 1 and consists of 2.5-acre lots. The basin is 37.15 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 40.62 cfs and 84.15 cfs respectively.
- Subbasin DD is located west and downstream of Subbasin EE1. The basin drains towards the west. Current planning documents call for 2.5-acre estate lots and a 2.4-acre clubhouse. The portion that was developed in Filing No. 1 consists of the Flying Horse North Golf Course and 2.5-acre lots. The basin is 69.5 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 57.78 cfs and 122.41 cfs respectively.
- Subbasin EE1 is located west of Subbasins EE2 and EE3. The basin drains towards the west. Current planning documents call for a small section of 2.5-acre estate lots. The remaining portion consists of the Flying Horse North Golf Course constructed in Filing No. 1. The portion that was developed in Filing No. 1 consists of the Flying Horse North Golf Course and 2.5-acre lots. The basin is 50.87 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 53.25 cfs and 110.3 cfs respectively.
- Subbasin EE2 is located along the west side of the major ridgeline. The basin drains towards the southeast and entirely towards proposed Detention Pond 13. Current planning documents call for a hotel complex/golf casitas. The basin is 16.36 acres, with a composite impervious value of 75.00% and runoff rates for the 5 and 100 year of 35.71 cfs and 63.62 cfs respectively. The pond will discharge at predevelopment rates into a swale via the ponds outlet structure.
- Subbasin EE3 is located south of Subbasin EE2. The basin drains towards the west and Subbasin EE2. Current planning documents call for high density dwelling units. The basin is 16.36 acres, with a composite impervious value of 55.00% and runoff rates for the 5 and 100 year of 10.38 cfs and 19.33 cfs respectively.
- Subbasin FF is located downstream of Subbasins DD and EE. The basin drains towards the southwest. Current planning documents call for 2.5-acre estate lots on the south side of the basin. The north half consists of 2.5-acre lots and part of the Flying Horse North Golf Course constructed during Filing No. 1. The basin is 18.1 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 20.78 cfs and 43.07 cfs respectively.
- Subbasin GG located downstream of Subbasin FF. The basin drains towards the southwest and towards an existing detention pond developed in Filing No. 1. Current planning documents call for

2.5-acre estate lots. The basin is 16.35 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 15.49 cfs and 32.48 cfs respectively.

- Subbasin HH is located on the west side of the site. The basin drains towards the west and and unnamed tributary of Black Squirrel Creek. Current planning documents call for 2.5-acre estate lots. The basin is 12.7 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 13.56 cfs and 28.16 cfs respectively. Per El Paso County Engineering Criteria Manual – Appendix I Section 1.7.1.B, large lot single family sites greater than or equal to 2.5 acres in size and that have a maximum imperviousness of less than 20% are excluded from water quality capture volume (WQCV).
- Subbasin II1 is located in the southwest corner of site. The basin drains towards the west and to proposed Detention Pond 14. Current planning documents call for 2.5-acre estate lots. The basin is 50.43 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 34.94 cfs and 74.39 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of Black Squirrel Creek via the ponds outlet structure
- Subbasin II2 is located north of Subbasin II1 and downstream of Subbasin II3 in the southwest corner of site. The basin drains towards the west and to Subbasin II1 via a proposed culvert. Current planning documents call for 2.5-acre estate lots. The basin is 23.13 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 28.04 cfs and 57.88 cfs respectively.
- Subbasin II3 is located north of Subbasin II1. The basin drains towards the west and to Subbasin II2 via a proposed culvert. Current planning documents call for 2.5-acre estate lots. The basin is 23.97 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 28.32 cfs and 58.65 cfs respectively.
- Subbasin JJ is in the southcentral part of the site. The basin drains towards the south and to an unnamed tributary of Black Squirrel Creek. Current planning documents call for low density and 1-acre dwelling units. The basin is 8.9 acres, with a composite impervious value of 20.70% and runoff rates for the 5 and 100 year of 11.49 cfs and 22.8 cfs respectively.
- Subbasin LL is in the southcentral part of the site. The basin drains towards the south and to an unnamed tributary of Black Squirrel Creek. Current planning documents call for low density and 1-acre dwelling units. The basin is 6.2 acres, with a composite impervious value of 12.09% and runoff rates for the 5 and 100 year of 7.36 cfs and 15.07 cfs respectively.
- Subbasin KK is in the southcentral part of the site. The basin drains towards the south and to an unnamed tributary of Black Squirrel Creek. Current planning documents call for 2.5 acre lots. The rest of the area is occupied by the existing Flying Horse Golf Course. The basin is 8.4 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 8.14 cfs and 16.95 cfs respectively.

The above-mentioned basins are large planning area basins and as drainage reports are developed for the individual developed parcels additional drainage reports and calculations will be required. It is expected that storm drainage infrastructure consisting of inlets, storm sewer and open drainage channels will be constructed as the property develops.

- Although mentioned above, offsite basins include basins A, C, F, and Q. Flow contributing to the site from these basins will be routed through the proposed detention ponds. Flow rates are shown below.

Offsite Flow Summary					
Basin Description	**Ultimate Design Point**	**Basin Area (ac)**	**Receiving Detention Pond**	**5 Year Peak Runoff (cfs)**	**100 Year Peak Runoff (cfs)**
A	A	18.99	Pond 11	20.84	43.83
C	C	36.39	Pond 11	33.36	71.27
F	F	25.25	Irr. Pond	24.27	51.63
Q	Q	72.29	Pond 9	64.68	137.80

b. Methodology

Design rainfall was determined utilizing Table 6-2 from the City of Colorado Springs Drainage Criteria Manual to determine the 5-year and 100-year rainfall values for the 1-hour events. The 1-hour rainfall depths are 1.5 and 2.52 in/hr respectively.

Composite percent impervious calculations were completed for each subbasin based on the density of lots and can be found in Appendix B. The El Paso County Drainage Criteria Manual Table 5-1 was used for reference when correlating land use to percent impervious values and located in Appendix F. Impervious values for 5-Acre Lots, 2.5-Acre Lots, Medium Density, Low Density, and Commercial Lots had impervious values of 10%, 15%, 45%, 55% and 75% respectively. The rainfall and percent impervious values were then used as inputs into the Colorado Urban Hydrograph Procedure (CUHP) spreadsheets to determine runoff values for both pre-development and post-development site.

CUHP is an evolution of the Snyder unit hydrograph and is calibrated for use along the Colorado Front Range. 1 Hour rainfall amounts are input into the program to produce a storm hyetograph that is then uses to calculate a storm hydrograph for each basin depending on the subbasins properties including slope, length, shape, impervious area, pervious depression storage area, and various infiltration rates. Tabular hydrographs are then computed and can be used in EPA SWMM. The CUHP results are included within Appendix B.

EPA SWMM was used to determine flow routing via the kinematic wave method. Subbasins were routed to their respective design points and detention ponds for both the developed and predeveloped condition to determine peak runoff amounts for the 5-year and 100-year storm events. Information from these models along with information and calculations performed in the Mile High Flood District BMP spreadsheets was used to determine pond sizing calculations and release rates.

c. Basin Hydrology

A summary of the flows for both the predeveloped and developed cases for each basin, subbasin and Pond are found on next page along with the full computation found in Appendix B.

Existing SWMM Basin Summary				
Basin Description	**Basin Area (ac)**	**% Impervious**	**5 Year Peak Runoff (cfs)**	**100 Year Peak Runoff (cfs)**
A	18.99	2.00	20.84	43.83
B	59.74	2.00	103.48	221.48
C	34.87	2.00	33.36	71.27
D	38.84	2.00	31.56	67.84
E	127.86	2.00	223.69	483.10
F	25.25	2.00	24.27	51.63
G	52.19	2.00	79.17	166.51
H	20.63	2.00	18.59	39.78
I	31.93	2.00	34.58	72.63
J	28.47	2.00	56.31	120.46
K	93.14	2.00	92.05	195.43
L	16.39	2.00	107.58	228.73
M	13.87	2.00	11.48	24.61
N	49.00	2.00	68.16	143.11
O	24.76	2.00	22.69	48.54
P	43.80	2.00	38.52	82.17
Q	72.29	2.00	64.68	137.80
R	54.98	2.00	108.65	232.13
S	24.36	2.00	25.99	48.54
T	5.24	2.00	4.04	8.68
U	5.48	2.00	4.15	8.95
V	38.47	2.00	29.63	63.92
W	3.76	2.00	3.45	7.33
X	190.88	2.00	167.76	361.56
AA	33.49	10.00	38.76	80.22
BB	37.15	10.00	40.62	84.15
CC	6.33	10.00	6.53	13.57
DD	70.06	10.00	58.42	123.69
EE	69.47	10.00	81.16	167.45
FF	17.62	2.00	162.77	340.42
GG	16.35	2.00	14.93	31.99
HH	12.61	2.00	13.01	27.42
II	97.53	2.00	81.77	175.59
JJ	8.72	2.00	9.74	20.50
KK	8.12	2.00	7.51	15.99
LL	6.10	2.00	6.88	14.48

Proposed SWMM Basin and Pond Summary						
Basin Description	Basin Area (ac)	% Impervious	5 Year Peak Runoff (cfs)	100 Year Peak Runoff (cfs)	5 Year Pond Volume (ac-ft)	100 Year Pond Volume (ac-ft)
P	43.71	20.71%	40.00	82.83		
			Pond 1		1.03	1.97
X1	76.38	29.50%	80.91	163.27		
			Pond 2		6.56	8.80
O	52.52	30.10%	63.86	127.40		
			Pond 3		3.79	6.37
X2	36.33	33.33%	41.46	82.46		
X3	61.99	13.53%	47.59	100.73		
V2	15.34	15.00%	16.15	33.25		
V1	11.57	38.62%	13.99	27.67		
			Pond 4		7.21	7.35
N	41.57	29.60%	73.48	141.24		
			Pond 5		1.86	2.55
M	26.83	33.19%	46.54	89.09		
			Pond 6		0.84	0.94
K	114.73	38.03%	200.94	382.30		
			Pond 7		8.38	12.59
L	15.89	24.82%	15.97	32.40		
			Pond 8		1.05	1.09
S	21.67	40.88%	30.83	58.96		
R	56.16	21.81%	56.59	116.06		
Q	72.29	2.00%	64.68	137.80		
			Pond 9		6.28	10.31
H	21.96	10.00%	17.86	37.80		
			Pond 10		0.66	0.94
B2	19.99	24.55%	17.99	37.14		
B1	59.74	29.83%	66.93	133.69		
A	18.99	2.00%	20.84	43.83		
C	36.39	2.00%	35.31	75.28		
			Pond 11		1.94	3.23
J	28.07	10.00%	24.25	51.19		
			Existing Pond 12			
EE2	16.36	75.00%	35.71	63.62		
EE3	6.67	55.00%	10.38	19.93		
			Pond 13		1.33	1.61
II3	23.97	10.0%	28.32	58.65		
II2	23.13	10.0%	28.04	116.62		
II1	50.43	10.0%	34.94	74.39		
			Pond 14		1.06	3.99
D	40.87	37.20%	61.12	117.38		
			Pond 15		1.94	3.23
E	106.53	14.35%	74.68	157.91		

I	26.99	34.66%	40.37	78.06		
			Pond 16		1.40	1.79
JJ	8.9	20.70%	11.49	22.8		
KK	8.4	12.09%	8.14	16.95		
LL	6.2	10.00%	7.36	15.07		
			Pond 17		1.09	1.23
G	31.45	12.48%	37.69	107.75		
			Irrigation Pond			
JJ	8.90	20.70%	11.06	28.04		
LL	6.2	12.09%	5.85	15.68		
KK	8.4	10.00%	5.9	16.72		
			Natural Drainage Way			
DD	69.5	10.0%	42.26	120.76		
EE1	50.87	10.0%	42.6	154.16		
			Existing Flying Horse North Detention Pond 6			
CC	6.33	10.0%	4.74	13.39		
FF	18.1	10.0%	100.02	325.29		
			Existing Flying Horse North Detention Pond 7			
GG	16.35	10.0%	11.25	32.04		
AA	33.8	10.0%	28.57	80.08		
BB	37.15	10.0%	29.52	83.01		
			Existing Flying Horse North Detention Pond 8			
HH	12.7	10.0%	9.86	27.77		
			Natural Drainage Way			
T	5.24	2.00%	2.92	8.56		
U	5.86	10.0%	3.63	10.37		
W	3.76	10.0%	2.6	7.36		
			Natural Drainage Way			

IV. Hydraulic Analysis

a. Major Drainageways

There are no major drainage ways exist within the development; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries of the East Cherry Creek and Black Squirrel Creek.

V. Environmental Evaluations

a. Significant Existing or Potential Wetland and Riparian Areas Impacts

As part of this work, the developer has engaged Bristlecone Ecology, LLC to perform environmental studies of the site that will be submitted with the planning documents. Major information in the report concerning wetlands concludes that there is a wetland associated with Black Squirrel Creek. Black Squirrel Creek is known to be a jurisdictional stream.

At this time, there are no improvements proposed for Black Squirrel Creek. The minimal impact to the stream will keep the natural habitat intact and the natural function of the Creek as it is to maintain the wetland habitat.

b. Stormwater Quality Considerations and Proposed Practices

As part of the development, full spectrum detention facilities will be installed to provide water quality for the development. The facilities will be designed using El Paso County criteria and provide stormwater quality by slowing the release of stormwater captured by the ponds and allowing solids to settle out. Additionally, when possible, the existing natural drainage ways will be used to convey stormwater to more closely mimic the natural hydrologic and hydraulic cycle. Some of the drainage ways will be used to convey water to the ponds and others will receive water from the ponds and in both scenarios will provide additional water quality benefits.

On site practices for the homes, schools, churches, and other buildings should use means such that impervious areas drain across pervious area to allow for infiltration during the minor events. This would include discharge of the gutters onto landscape areas vs. directly connecting to storm sewer and as discussed above as well using natural ditches and swales where it is logical and makes sense to convey stormwater in lieu of storm sewer piping.

c. Permitting Requirements

When work infringes upon the wetlands or floodplain a 404 Permit will be required. If the work within the waterways is minimal, it will likely be covered under a nationwide 404 permit; it is however possible that an individual permits will be required.

The Colorado Department of Public Health and Environment will require permits for any disturbance that exceed 1 acre of land. Should groundwater be encountered, a dewatering permit will also be required.

El Paso County will require an Erosion and Stormwater Quality Control Permit and any other construction permits required to complete the construction of the site.

Should development occur which effects the floodplain, FEMA will require a permit for work withing the floodplain prior to the commencement of any construction or development within any special flood hazard area (SFHA). If the infrastructure is to be installed within the channel the designer shall route the design through the proper FEMA channels whether that be with a no rise certification or via the CLOMR/LOMR process should a more major improvement within the floodplain be proposed. At this time the project does not propose any direct development within the floodplain however storm infrastructure will discharge into the existing FEMA channel.

d. 4-Step Process

In accordance with the Engineering Criteria Manual I.7.2.A and DCM V2, this site has implemented the four-step process to minimize adverse impacts of urbanization. The four-step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume, and considering the need for Industrial Commercial BMPs.

Step 1 – Reducing Runoff Volumes: The development of the project site includes a variety of land uses including open and vegetated areas interspersed to help disconnect imperious areas and reduce runoff volumes.

Step 2 – Stabilize Drainageways: Altered drainage ways will be designed in a manner that provides water quality benefits through infiltration and the removal of pollutants via phytoremediation. Vegetation will also be selected to stabilize the drainage ways by reducing the velocity of flows and decreasing any scour. Should the final drainage ways require, grade control structures may be implemented to further reduce flow velocities and protect against erosion. These improvements will help stabilize drainageways.

Step 3 – Provide WQCV: Runoff from this development is treated through capture and slow release of the WQCV via detention ponds that are designed per current El Paso County DCM V2.

Step 4 – Consider the need for Industrial and Commercial BMP's: A site specific storm water quality and erosion control plan and narrative will be prepared with subsequent land use approvals prepared in conjunction with the report prior to any construction. Site specific temporary source control BMPs as well as permanent BMPs are detailed in this plan and narrative. Guidelines detailed in the El Paso DCM V2 4.2 pertaining to the covering and storage handline and spill containment and control shall be followed as necessary.

VI. Alternatives Evaluation

The current selected plan for drainage follows the DPBS for the Black Squirrel Basin and will not require an evaluation of alternatives.

VII. Selected Plan

a. Plan Hydrology

This MDDP schematically addressed on-site and off-site drainage patterns using the existing topography and proposed land use plan for the overall drainage design. Individual preliminary and final drainage reports will better define the planning areas as the site is developed.

The overall site is divided into several separate major basins. Basin sizes range from 35 acres to 181 acres in size. Basins A through V2 drain and eventually discharge into an unnamed tributary of the Arkansas River. Basins AA through LL drain towards unnamed tributaries of Black Squirrel Creek.

The sub-basins are described in additional detail above.

b. System Improvements

The site plans propose the construction of 15 separate full spectrum detention facilities and utilize the capacity of 2 existing full spectrum detention facilities. The ponds are preliminarily sized to ensure that the 5-year and 100-year release rates are equal to or less than the historic rates. For the PDR and FDR, the consultant will need to use a routing software to accurately model the routed hydrographs for ponds upstream of the irrigation pond. The irrigation pond has a 12 hr drain time for WQCV. All drains times must be within 72 hours for the 5-year storm or within 120 hours for storm events greater than the 5-year storm per Senate Bill 15-212.

- Pond 1 is located in the northwest corner of the site and discharges into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 1.97 ac-ft during the 100-year event and have a peak outflow of 81.7 cfs which is slightly below the predevelopment peak outflow of 81.0 cfs. The 5-year storage volume is 1.03 ac-ft with a peak outflow of 24.9 cfs.

- Pond 2 is located to the east of Pond 1 and and discharges into another unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 8.8 ac-ft during the 100-year event and have a peak outflow of 74.6 cfs which is slightly below the predevelopment peak outflow of 81.0 cfs. The 5-year storage volume is 6.56 ac-ft with a peak outflow of 27.8 cfs.

- Pond 3 is located on the eastern portion of the site and south of Pond 1. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 6.37 ac-ft during the 100-year event and have a peak outflow of 46.1 cfs which is slightly below the predevelopment peak outflow of 48.5 cfs. The 5-year storage volume is 3.79 ac-ft with a peak outflow of 22.7 cfs.

- Pond 4 is located near the eastern portion of the site adjacent to Black Forest Rd. The pond discharges into a natural drainage way, which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 7.35 ac-ft during the 100-year event and have a peak outflow of 198.8 cfs which is slightly below the predevelopment peak flow rate of 231.6 cfs. The 5-year storage volume is 7.12 ac-ft with a peak outflow of 70.6 cfs.

- Pond 5 is located in the northwest portion of the site. The pond discharges natural drainageway, which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 2.5 ac-ft during the 100-year event and have a peak outflow of 103.1 cfs which is greater than the predevelopment peak outflow of 116.9 cfs. The 5-year storage volume is 1.86 ac-ft with a peak outflow of 39.4 cfs.

- Pond 6 is located near the northwest corner of the site and upstream of Pond 5. The pond discharges into a natural drainageway which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 2.93 ac-ft during the 100-year event and have a peak outflow of 48.2 cfs which is greater than the predevelopment peak outflow of 47.5 cfs. The 5-year storage volume is 1.77 ac-ft with a peak outflow of 12.2 cfs.

- Pond 7 is located in the central portion of site. The pond discharges into a natural drainageway that eventually outlets to an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 12.59 ac-ft during the 100-year event and have a peak outflow of 172.2 cfs which is slightly lower than the predevelopment peak outflow of 191.6 cfs. The 5-year storage volume is 8.38 ac-ft with a peak outflow of 65.4 cfs.

- Pond 8 is located near the central portion of the site and downstream of Pond 7. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 0.94 ac-ft during the 100-year event and have a peak outflow of 28.9 cfs which lower than the predevelopment peak outflow of 32.7. The 5-year storage volume is 0.84 ac-ft with a peak outflow of 11.4 cfs.

- Pond 9 is located near the southeast corner of the site just and adjacent to Black Forest Road. The pond discharges into a natural drainageway and flows under Black Forest Rd. via culvert. The natural drainageway is southeast of the existing property and eventually drains northeast to East Cherry Creek. The pond is planned to store a maximum of 10.31 ac-ft during the 100-year

event and have a peak outflow of 220.7 cfs which is lower than the predevelopment peak outflow of 282.3 cfs. The 5-year storage volume is 6.28 ac-ft with a peak outflow of 94.8 cfs.

- Pond 10 is located on the north central portion of the site and north of Stagecoach Road. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 0.94 ac-ft during the 100-year event and have a peak outflow of 33.9 cfs which is lower than the predevelopment peak outflow of 39.2 cfs. The 5-year storage volume is 0.68 ac-ft with a peak outflow of 13.6 cfs.

- Pond 11 is located near the central portion of the site. The pond discharges into a natural drainageway which eventually discharges into the Irrigation Pond. The pond is planned to store a maximum of 6.83 ac-ft during the 100-year event and have a peak outflow of 230.0 cfs which is above than the predevelopment peak outflow of 221.3 cfs. The 5-year storage volume is 3.66 ac-ft with a peak outflow of 98.4 cfs.

- Existing Pond 12 is designed in the Classic Homes Filing No. 1 FDR and located near the northwest corner of the site and north of Stagecoach Road. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to have a peak outflow of 45.0 cfs.

- Pond 13 is located central portion of the site and just west of the major ridgeline between the two basins. The pond discharges into a natural drainageway to an existing pond of Filing No. 1, which ultimately outlets to Black Squirrel Creek. The pond is planned to store a maximum of 1.8 ac-ft during the 100-year event and have a peak outflow of 54.2 cfs which lower than the predevelopment peak outflow of 55.0. The 5-year storage volume is 1.3 ac-ft with a peak outflow of 17.2 cfs.

- Pond 14 is located near the southwest corner of the site just east of the Black Squirrel Creek. The pond discharges into a natural drainageway of Black Squirrel Creek. The pond is planned to store a maximum of 3.99 ac-ft during the 100-year event and have a peak outflow of 152.3 cfs which is slightly lower than the predevelopment peak outflow of 173.0 cfs. The 5-year storage volume is 1.06 ac-ft with a peak outflow of 59.0 cfs.

- Pond 15 is near the central portion of the site. The pond discharges into a natural drainageway which eventually discharges into the existing Irrigation Pond. The pond is planned to store a maximum of 3.23 ac-ft during the 100- year event and have a peak outflow of 68.4 cfs which is slightly above the predevelopment peak of 67.8 cfs. The 5-year storage volume is 1.94 ac-ft with a peak outflow of 30.9 cfs.

- Pond 16 is near the central portion of the site. The pond discharges into a culvert and goes under Stagecoach Road, which eventually discharges into an existing drainageway of East Cherry Creek. The pond is planned to store a maximum of 5.40 ac-ft during the 100-year event and have a peak outflow of 63.8 cfs which is slightly below the predevelopment peak of 71.2 cfs. The 5 year storage volume is 4.66 ac-ft with a peak outflow of 24.3 cfs.

- Pond 17 is near near the central portion of the site. The pond discharges into a natural drainageway which eventually discharges into an existing drainageway of Black Squirrel Creek. The pond is planned to store a maximum of 1.23 ac-ft during the 100 year event and have a peak outflow of 49.6 cfs which is slightly below the predevelopment peak of 49.9 cfs. The 5 year storage volume is 1.09 ac-ft with a peak outflow of 16.8 cfs..

- The existing Irrigation Pond is in the central portion of site and just south of existing Stagecoach Road. The pond discharges towards an unnamed tributary of East Cherry Creek. The irrigation pond was design and subsequently built as part of the Filing 1 project. Storage Volumes for the pond assumed different upstream development conditions and therefore the pond will receive a higher volume of water during the storm events however the rate into the pond will be reduced. The irrigation pond will store 35.92 ac-ft during the 100-year event with a peak outflow of 274.73 cfs and the 5 year storage volume is 19.67 ac-ft with a peak outflow of 114.0 cfs.

The site plans propose the construction of 2 culverts in the southwest corner of site that navigates flow under roads to proposed Detention Pond 14. Analyses were completed by flow master and calculations can be found in Appendix E.

- Culvert 1 carries flow from Subbasin II3 to Subbasin II2 in the southwest corner of site. Each of the basins consist of the Flying Horse Golf Course and 2.5-acre estate lots. The culvert is 36" RCP at a 1% slope and designed for the 100-year event. The culvert will have a peak outflow of 58.65 cfs, where the pipe is 72% full.

- Culvert 2 carries flow from Subbasin II2 to Subbasin II1 in the southwest corner of site. Each of the basins consist of the Flying Horse Golf Course and 2.5-acre estate lots. The culvert is 42" RCP at a 2% slope and designed for the 100-year event. The culvert will have a peak outflow of 116.62 cfs, where the pipe is 68% full.

The culverts sizes should be refined in the PDR and FDR. Energy dissipation calcs can also be performed later within the design.

Overall runoff from the site will by and large match or be less than predevelopment peak flows sans those for outfall 5 which is slightly greater than predevelopment flows. The volume of water will increase however as the drainage channels are designs, continuous simulation models will be done to see the effects of prolonged runoff rates. Predevelopment and post development flows for the 5-year and 100-year events are summarized in the following table for the 5 site outfalls.

OUTFALL	Predevelopment		Postdevelopment*	
	5 year	100 year	5 year	100 year
1	320.31	725.59	183.76	705.93
2	145.46	311.00	80.36	242.18
3	167.76	361.56	70.06	271.49
4	346.26	733.92	230.07	646.46
5	24.12	50.88	16.85	45.91

*Values to be refined with Preliminary and Final Drainage Reports for each filing

VIII. Drawings

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

IX. Summary

Flying Horse North is a large master planned community consisting of various densities of dwelling units to include single family homes, multifamily homes, parks, institutional sites, and commercial areas. Due to development increased runoff will occur. To mitigate downstream impacts, 16 large full spectrum detention facilities will be built to reduce the runoff rate to near historic levels. These detention facilities will provide water quality enhancements to account for the increased urbanization of the upstream catchment areas. The ponds are preliminarily sized to ensure that the 5-year and 100-year release rates are equal to or less than the historic rates. For the PDR and FDR, the consultant will need to use a routing software to accurately model the routed hydrographs for ponds upstream of the irrigation pond. The irrigation pond has a 12 hour drain time for WQCV. All drains times must be within 72 hours for the 5-year storm or within 120 hours for storm events greater than the 5-year storm per Senate Bill 15-212.

Additional analysis will be required and completed to review the hydraulics of the proposed major drainage channels and be included in future submittals. The proposed design, as described in this report, is not anticipated to cause any adverse impact to downstream properties however as noted previously due to the increased volume of water, downstream tributaries will see increases in the volume of flow. It is advised that low impact design be considered when designing and developing each filing. This shall include those items listed in the four-step process above and any additional measures that are within reason to disconnect impervious areas and increase infiltration. This will alleviate the additional volume of water due to development. Although the rate will remain at or below historic levels, the amount of time the channels will see water will increase which may cause more channel movement than historic. Downstream planning efforts should allow for the natural migration and movement of the channel by continuing to provide large floodplain areas to allow movement of the channel.

X. References

El Paso County – Drainage Criteria Manual, 2014

City of Colorado Springs – Drainage Criteria Manual, May 2014

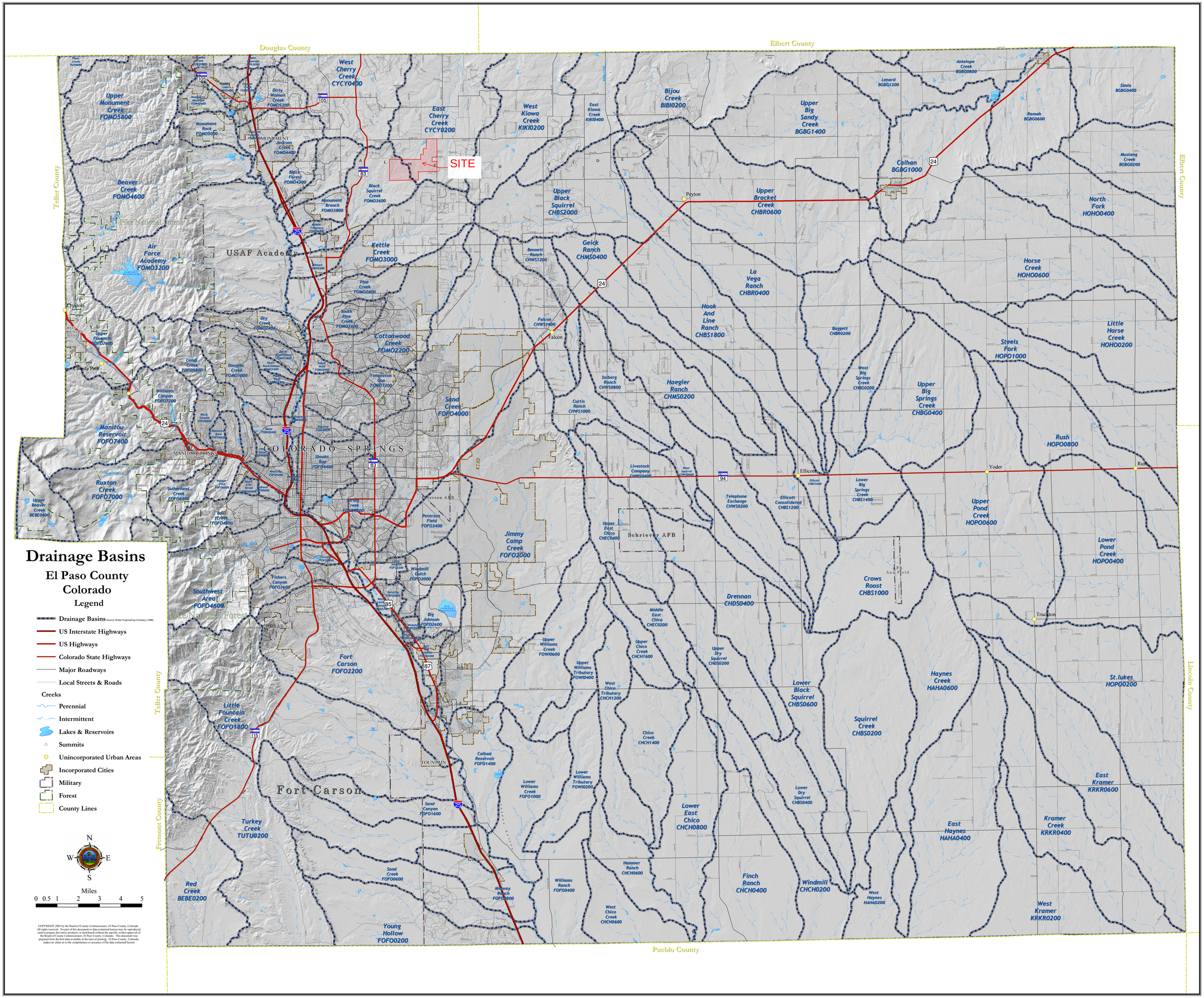
Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018

Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1, Classic Consulting Engineers and Surveyors, November 2017

Flying Horse North Irrigation Reservoir Embankment Design Report, Classic Consulting Engineers and Surveyors, August 2018

Black Squirrel Drainage Basin Planning Study (DBPS), URS Consultants, January 1989

Appendix A


Douglas County
Elbert County
Teller County
Lincoln County
Pueblo County
Fremont County
SITE
USAF Academy
Pike National Forest
COLORADO SPRINGS
Fort Carson
Schriever AFB
Peterson AFB
Drainage Basins
El Paso County
Colorado
Legend
Drainage Basins Source: Muller Engineering Company (1998)
US Interstate Highways
US Highways
Colorado State Highways
Major Roadways
Local Streets & Roads
Creeks
Perennial
Intermittent
Lakes & Reservoirs
Summits
Unincorporated Urban Areas
Incorporated Cities
Military
Forest
County Lines
N
W
E
S
Miles
0 0.5 1 2 3 4 5
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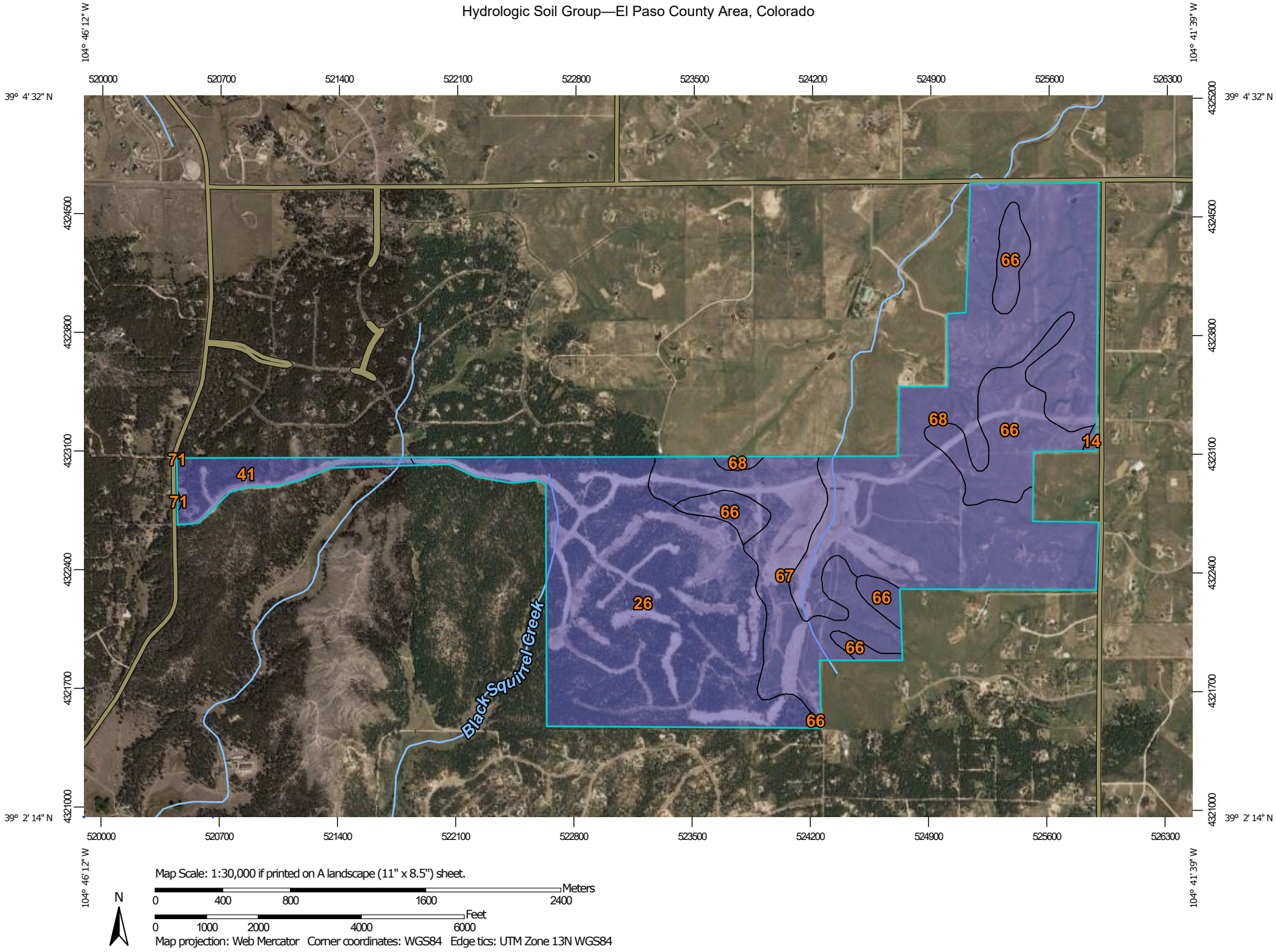
Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 19, 2018—May 26, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
14	Brussett loam, 1 to 3 percent slopes	B	1.9	0.1%
26	Elbeth sandy loam, 8 to 15 percent slopes	B	474.2	33.7%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	53.4	3.8%
66	Peyton sandy loam, 1 to 5 percent slopes	B	160.9	11.4%
67	Peyton sandy loam, 5 to 9 percent slopes	B	182.8	13.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	533.4	37.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	0.6	0.0%
Totals for Area of Interest			**1,407.3**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

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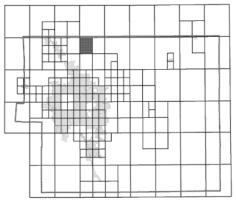
El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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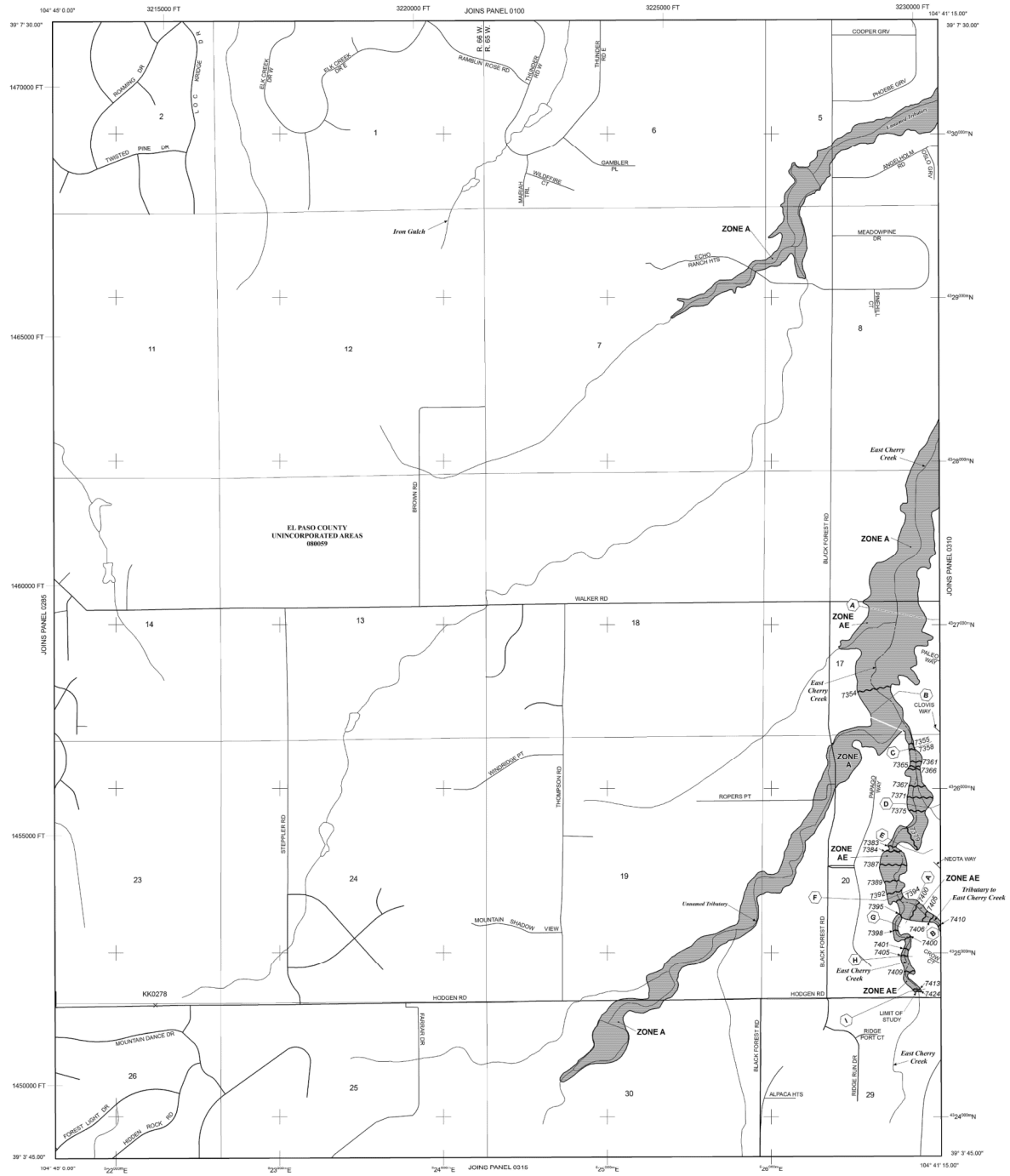

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 11 SOUTH, RANGE 65 WEST, AND TOWNSHIP 11 SOUTH, RANGE 66 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 - - - 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
4000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0305G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 305 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0305	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0305G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

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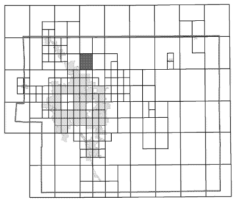
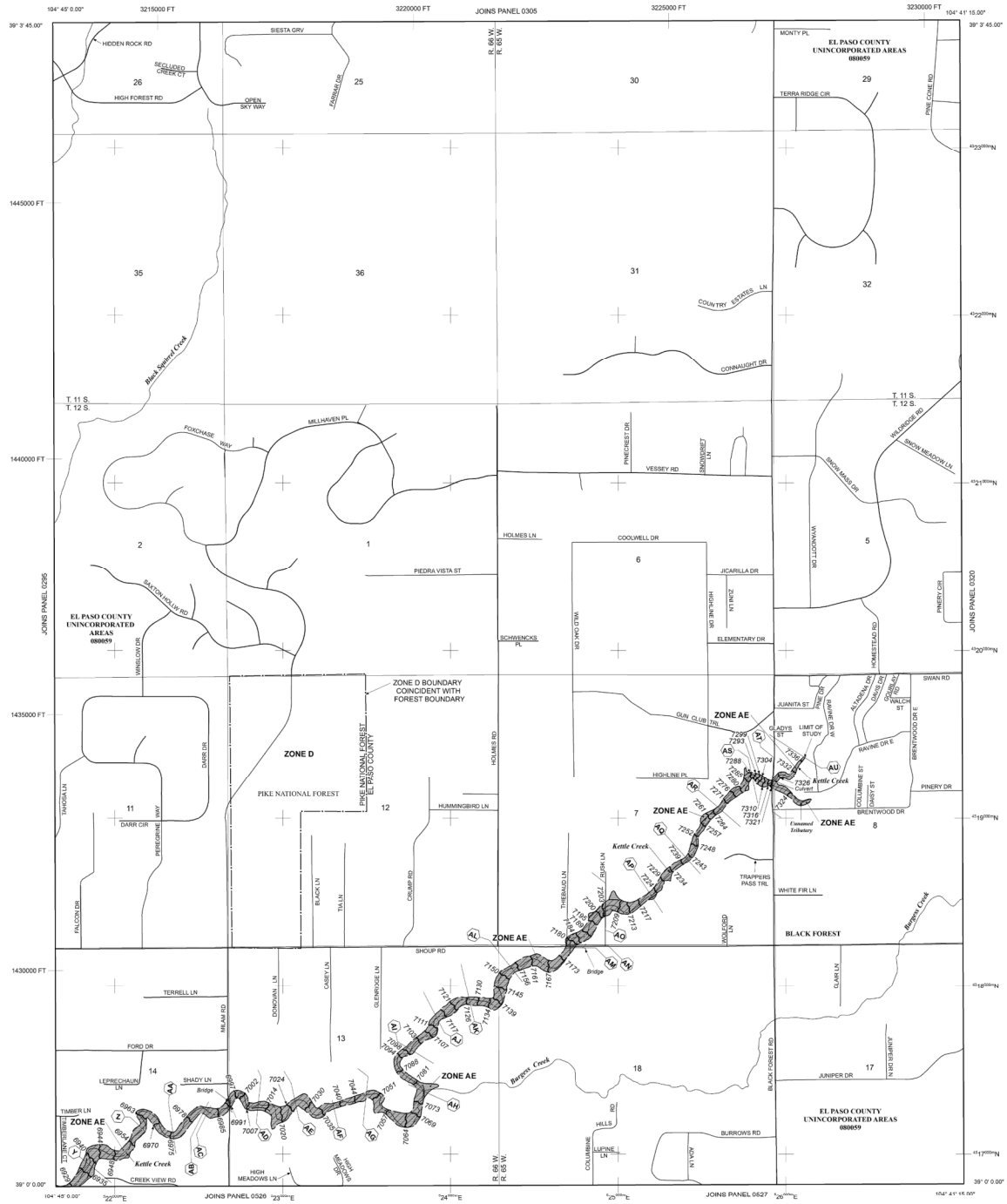


This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

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



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A Cross section line

23 - - - - - 23 Transect line

97° 07' 30.00"
32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4279000N 1000-meter Universal Transverse Mercator grid ticks, zone 13

4000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0315G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 315 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0315	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0315G

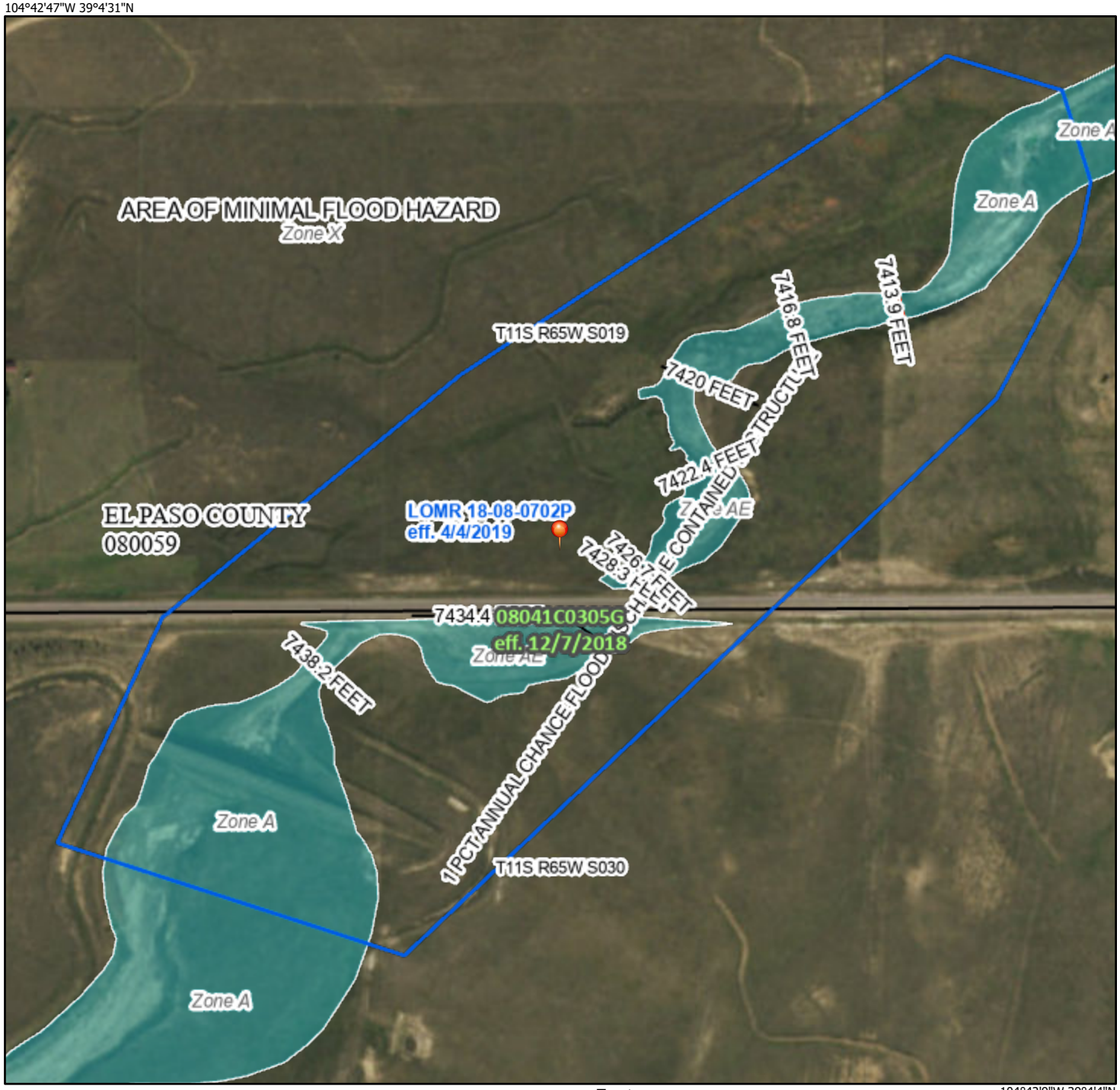
MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

104°42'47"W 39°4'31"N



104°42'9"W 39°4'4"N

Feet 1:6,000

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/9/2022 at 3:00 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Dam Safety - Dams (/Tools/DamSafety/Dams)

Dam Overview

Dam Name	FRANKTOWN PARKER FPE-2 (080130)
Administration Type	Jurisdictional Dam
NID ID	CO00274
WDID	
Physical Status	Active
Hazard Class	Low
Stream	EAST CHERRY CR
Last Inspection Result	Conditionally Satisfactory (04/11/2018)

Location

Division	1
Water District	8
County	EL PASO
Downstream Town	FRANKTOWN
Town Distance	25

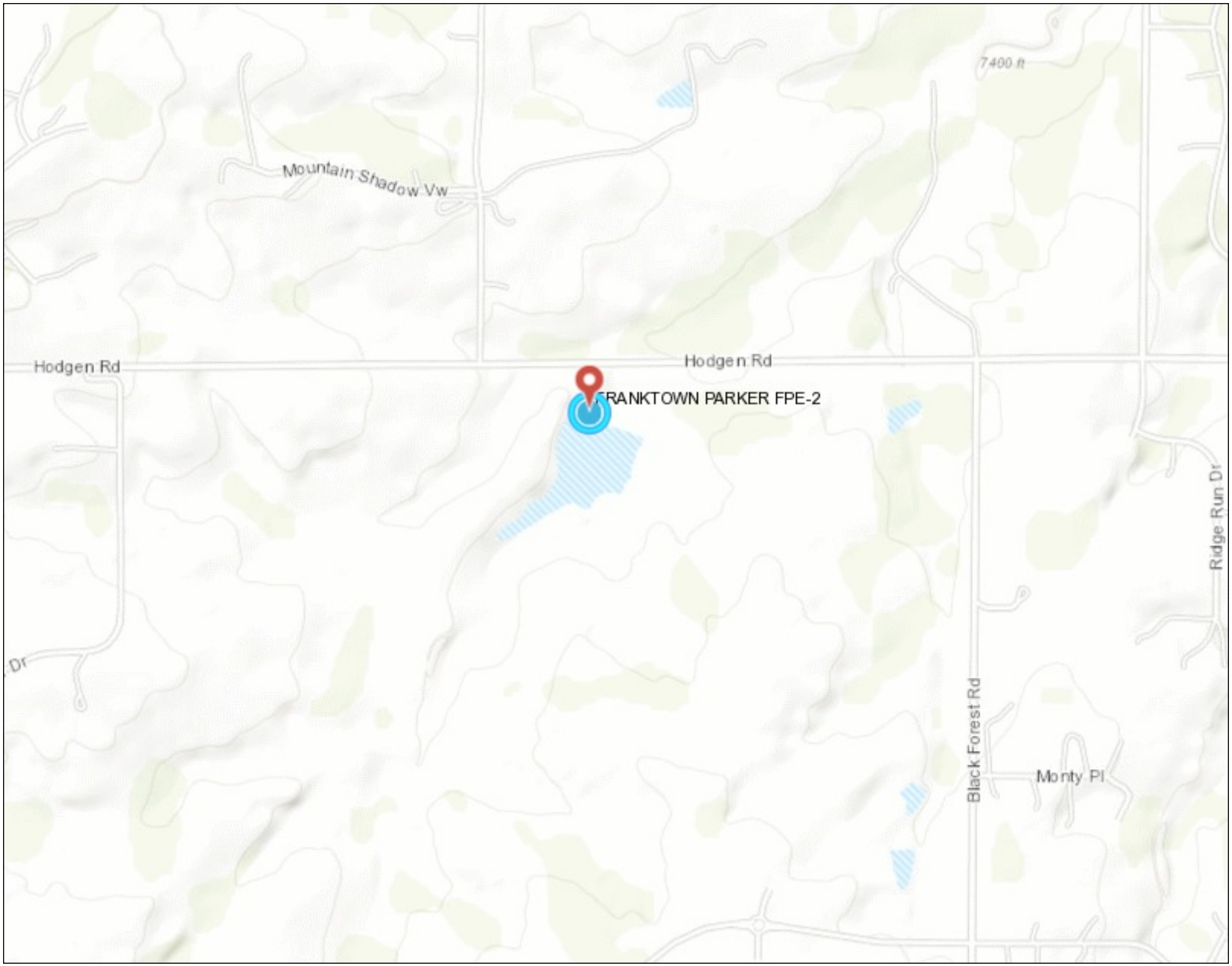
Q40	Q160	Section	Township	Range	PM	UTM X	UTM Y	Latitude	Longitude	Location Accuracy
NE	NW	30	11.0 S	65.0 W	S	524990.8	4324584.3	39.070004	-104.711118	GPS

Dam Details

Primary Name	EL PASO COUNTY
EAP	Not Required
EAP Date	
Primary Contact	STEVE JACOBSEN
EAP Inundation Map	No
Inundation Map Date	

COLORADO'S
Decision Support Systems
CWCB / DWR

Map Viewer



Legend

Jurisdictional Dam
- High
- Significant
- Low
- NPH

Non Jurisdicational Dam

County

Location

Notes

2,339 0 1,169 2,339 Feet

1: 14,032

This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

Date Prepared: 9/22/2021 11:42:36 AM

Appendix B

Basin Description	Park/Open Space	5 Acre	2.5 Acre	Low Density	Med Density	Commercial	Total Impervious	Total Acreage	Composite Percent Impervious	Predominant Soil Group	5 Year C Factor	100 Year C Factor
Impervious Percentage	10%	10%	15%	45%	55%	75%						
P	15.55	14.78	0.00	13.38	0.00	0.00	9.05	43.71	20.71%	B	0.15	0.41
						Pond 1		**43.71**	**20.71%**			
X1	38.32	3.30	0.00	25.66	0.00	9.10	22.53	76.38	29.50%	B	0.24	0.47
						Pond 2		**76.38**	**29.50%**			
O	13.17	0.00	10.72	28.63	0.00	0.00	15.81	52.52	30.10%	B	0.19	0.44
						Pond 3		**52.52**	**30.10%**			
X2	12.11	0.00	0.00	24.22	0.00	0.00	12.11	36.33	33.33%	B	0.19	0.44
X3	38.88	16.85	0.00	6.26	0.00	0.00	8.39	61.99	13.53%	B	0.13	0.40
V2	0.00	0.00	15.34	0.00	0.00	0.00	2.30	15.34	15.00%	B		
V1	2.11	0.00	0.00	9.46	0.00	0.00	4.47	11.57	38.62%	B	0.20	0.45
						Pond 4		**125.23**	**20.85%**			
N	10.44	11.52	0.00	6.77	12.84	0.00	12.30	41.57	29.60%	B	0.19	0.46
						Pond 5		**41.57**	**29.60%**			
M	14.55	0.00	0.00	1.24	6.94	4.10	8.91	26.83	33.19%	B	0.28	0.52
						Pond 6		**26.83**	**33.19%**			
K	26.45	2.93	0.00	61.89	23.46	0.00	43.69	114.73	38.08%	B	0.21	0.47
						Pond 7		**114.73**	**38.08%**			
L	6.93	5.54	0.00	0.00	2.72	0.00	2.74	15.19	18.06%	B	0.15	0.42
						Pond 8		**15.19**	**18.06%**			
S	2.31	0.24	0.00	19.12	0	0.00	8.86	21.67	40.88%	**B**	0.21	0.45
R	26.63	16.11	0.00	21.77	0.00	0.00	14.07	64.51	21.81%	B	0.15	0.41
						Pond 9		**86.18**	**21.81%**			
H	17.65	4.31	0.00	0.00	0.00	0.00	2.20	21.96	10.00%	B	0.12	0.39
						Pond 10		**21.96**	**10.00%**			
B2	7.20	4.48	0.00	8.31	0.00	0.00	4.91	19.99	24.55%	B	0.16	0.42
B1	12.86	13.03	0.00	33.85	0.00	0.00	17.82	59.74	29.83%	B	0.18	0.43
						Pond 11		**79.73**	**28.51%**			
J	28.07	0.00	0.00	0.00	0.00	0.00	2.81	28.07	10.00%	B	0.12	0.39
						Exisiting Pond 12						
I	17.99	0.00	0.00	0.00	0.00	11.00	10.05	28.99	34.66%	B	0.38	0.58
						Pond 16		**57.06**	**22.53%**			
EE2	0.00	0.00	0.00	0.00	0.00	16.36	12.27	16.36	75.00%	B	0.81	0.88
EE3	0.00	0.00	0.00	0.00	6.67	0.00	3.67	6.67	55.00%	B	0.30	0.58
						Pond 13		**23.03**	**69.21%**			
II2	0.00	23.13	0.00	0.00	0.00	0.00	2.31	23.13	10.00%	B	0.12	0.39
II3	0.00	23.97	0.00	0.00	0.00	0.00	2.40	23.97	10.00%	B	0.12	0.39
II1	15.77	34.66	0.00	0.00	0.00	0.00	5.04	50.43	10.00%	B	0.12	0.39
						Pond 14		**97.53**	**10.00%**			
D	4.41	4.70	0.00	31.76	0.00	0.00	15.20	40.87	37.20%	B	0.20	0.44
						Pond 15		**40.87**	**37.20%**			
E	99.63	8.80	0.00	1.72	0.00	6.90	16.79	117.05	14.35%	B	0.16	0.42
G	25.81	3.41	0.00	2.23	0.00	0.00	3.93	31.45	12.48%	B	0.13	0.39
						Irrigation Pond		**148.50**	**13.95%**			
JJ	1.86	4.32	0.00	2.72	0.00	0.00	1.84	8.90	20.70%	B	0.15	0.41
LL	4.39	1.44	0.00	0.37	0.00	0.00	0.75	6.20	12.09%	B	0.13	0.39
						Pond 17		**15.10**	**17.16%**			
KK	5.98	2.42	0.00	0.00	0.00	0.00	0.84	8.40	10.00%	B	0.12	0.39
AA	0.00	33.88	0.00	0.00	0.00	0.00	3.39	33.88	10.00%	B	0.12	0.39
BB	0.00	37.15	0.00	0.00	0.00	0.00	3.72	37.15	10.00%	B	0.12	0.39
CC	0.00	6.33	0.00	0.00	0.00	0.00	0.63	6.33	10.00%	B	0.12	0.39
DD	0.00	69.5	0.00	0.00	0.00	0.00	6.95	69.50	10.00%	B	0.12	0.39
FF	0.00	18.1	0.00	0.00	0.00	0.00	1.81	18.10	10.00%	B	0.12	0.39
GG	0.00	16.35	0.00	0.00	0.00	0.00	1.64	16.35	10.00%	B	0.12	0.39
HH	0.00	12.7	0.00	0.00	0.00	0.00	1.27	12.70	10.00%	B	0.12	0.39

*2% imperviousness for all, and runoff coefficients are .09 and .36 for 5 and 100 yr respectively

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1	P	0.156	0.139	37.1	5.47	19.3	3.87	9.1	55	158,994	1.36	215,685	40.0	39	215,259	0.89
2	X	0.156	0.249	50.8	11.22	26.4	7.93	18.7	176	692,894	1.36	939,952	50.0	139	939,989	0.73
3	O	0.156	0.108	34.9	4.39	18.2	3.10	7.3	33	89,879	1.36	121,926	40.0	23	121,661	0.92
4	N	0.156	0.147	25.7	4.39	13.4	3.10	7.3	89	177,870	1.36	241,291	35.0	57	240,676	1.16
5	W	0.156	0.046	33.7	2.70	17.5	1.90	4.5	5	13,649	1.36	18,515	35.0	3	18,246	0.92
6	M	0.156	0.083	40.0	4.05	20.8	2.86	6.7	16	50,348	1.36	68,300	40.0	11	68,114	0.83
7	V	0.156	0.132	45.0	6.05	23.4	4.27	10.1	40	140,009	1.36	189,931	45.0	30	189,854	0.77
8	U	0.156	0.055	44.5	3.37	23.2	2.38	5.6	6	19,892	1.36	26,985	40.0	4	26,889	0.76
9	L	0.156	0.090	32.6	3.74	17.0	2.64	6.2	24	59,496	1.36	80,709	35.0	16	80,352	0.96
10	K	0.156	0.196	32.6	6.40	17.0	4.52	10.7	134	338,098	1.36	458,650	40.0	92	458,862	0.99
11	S	0.156	0.107	28.6	3.85	14.9	2.72	6.4	40	88,427	1.36	119,956	35.0	26	119,542	1.07
12	R	0.156	0.154	42.5	6.54	22.1	4.62	10.9	61	199,577	1.36	270,738	45.0	44	270,785	0.80
13	G	0.156	0.151	29.3	4.89	15.2	3.46	8.2	83	189,450	1.36	257,000	35.0	55	256,005	1.05
14	D	0.156	0.132	41.6	5.71	21.6	4.04	9.5	44	140,989	1.36	191,260	40.0	32	191,160	0.81
15	B	0.156	0.160	40.3	6.46	20.9	4.56	10.8	70	216,856	1.36	294,178	40.0	50	294,255	0.84
16	E	0.156	0.221	50.4	10.04	26.2	7.10	16.7	119	464,132	1.36	629,622	50.0	93	629,347	0.73
17	H	0.156	0.099	35.7	4.22	18.6	2.98	7.0	27	74,887	1.36	101,588	40.0	19	101,348	0.90
18	J	0.156	0.115	42.2	5.22	21.9	3.69	8.7	32	103,346	1.36	140,195	40.0	23	139,959	0.80
19	I	0.156	0.121	28.1	4.11	14.6	2.90	6.8	53	115,906	1.36	157,233	35.0	35	156,699	1.08
20	JJ	0.156	0.067	26.0	2.84	13.5	2.01	4.7	16	31,654	1.36	42,940	35.0	10	42,323	1.12
21	LL	0.156	0.057	25.2	2.61	13.1	1.84	4.4	11	22,143	1.36	30,038	35.0	7	29,402	1.13
22	KK	0.156	0.065	33.9	3.20	17.6	2.26	5.3	11	29,476	1.36	39,985	35.0	8	39,724	0.92
23	EE	0.126	0.142	26.2	4.37	13.6	3.09	7.3	124	252,176	1.37	346,639	35.0	81	345,618	1.17
24	DD	0.126	0.143	41.4	6.04	21.5	4.27	10.1	79	254,318	1.37	349,583	40.0	58	349,629	0.83
25	CC	0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	1.37	31,585	35.0	7	31,056	1.03
26	AA	0.126	0.102	26.1	3.55	13.6	2.51	5.9	60	121,569	1.37	167,107	35.0	39	166,376	1.16
27	BB	0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	1.37	185,370	35.0	41	184,724	1.09
28	FF	0.156	0.092	26.9	3.41	14.0	2.41	5.7	31	63,961	1.36	86,766	35.0	20	86,304	1.11
29	II	0.156	0.200	40.7	7.75	21.2	5.48	12.9	112	354,034	1.36	480,268	45.0	82	479,975	0.84
30	HH	0.156	0.080	29.6	3.31	15.4	2.34	5.5	20	45,774	1.36	62,096	35.0	13	61,731	1.03
31	GG	0.156	0.089	34.8	3.89	18.1	2.75	6.5	22	59,351	1.36	80,512	40.0	15	80,308	0.91
(OS1) 32	A	0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	1.36	93,513	35.0	21	93,026	1.10
(OS2) 33	C	0.156	0.126	32.9	4.68	17.1	3.31	7.8	50	126,578	1.36	171,711	40.0	33	171,254	0.96
(OS3) 34	F	0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	1.36	124,339	35.0	24	123,917	0.96
(OS4) 35	Q	0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	1.36	355,978	40.0	65	355,849	0.89
(OS5) 36	T	0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	1.36	25,803	40.0	4	25,686	0.77

Printouts for Storm Hydrographs

flow in cfs

time in minutes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	(OS1) 32	(OS2) 33	(OS3) 34	(OS4) 35	(OS5) 36
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.29	0.14	0.03	0.16	0.15	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
20	2.82	3.48	2.02	5.45	0.37	1.04	1.85	0.40	1.58	5.79	2.64	2.56	4.68	2.14	2.98	2.78	1.69	1.68	3.39	1.11	0.80	0.79	10.09	4.91	0.93	5.44	5.37	2.13	3.81	1.40	1.45	2.24	2.89	2.27	3.89	0.39
25	18.80	27.13	13.04	35.04	2.31	6.66	12.64	2.53	9.97	40.01	16.73	17.76	30.60	14.43	20.61	21.20	10.87	11.12	21.63	6.95	5.00	4.96	51.39	26.67	4.61	27.07	26.92	13.35	27.49	8.77	9.19	14.08	18.75	14.54	26.98	2.48
30	32.20	67.65	20.11	53.34	3.24	10.00	22.93	3.63	14.51	74.95	24.38	33.73	49.31	25.32	38.86	50.45	16.51	18.62	32.22	9.54	6.81	7.00	76.33	46.83	6.28	37.57	38.42	18.76	57.40	12.34	13.56	19.93	29.68	22.03	50.95	3.55
35	37.59	103.16	22.47	56.97	3.45	11.18	27.54	4.01	15.71	89.75	25.99	41.20	54.90	29.98	47.20	73.62	18.37	21.73	34.58	9.74	6.88	7.51	81.16	55.57	6.53	38.76	40.62	19.51	74.33	13.01	14.88	20.84	33.29	24.27	61.71	3.91
40	38.83	124.37	22.69	54.61	3.41	11.48	29.34	4.15	15.53	92.05	25.21	43.97	53.65	31.56	50.01	85.68	18.59	22.78	33.51	9.35	6.59	7.45	77.77	58.42	6.34	37.09	39.28	18.79	80.97	12.66	14.93	20.11	33.36	24.13	64.68	4.04
45	37.82	134.83	22.01	51.22	3.31	11.24	29.63	4.12	15.02	88.60	24.01	44.21	51.36	31.41	49.79	91.24	18.06	22.66	31.84	8.81	6.19	7.22	72.99	58.09	6.07	34.82	37.29	17.75	81.77	12.11	14.48	19.03	32.21	23.30	63.33	3.99
50	36.92	138.66	21.39	48.22	3.22	11.07	29.11	4.08	14.53	85.11	22.86	43.25	49.03	30.77	48.59	92.81	17.59	22.25	30.23	8.36	5.87	7.02	68.67	56.74	5.80	32.88	35.42	16.82	79.60	11.60	14.09	18.03	31.10	22.51	61.61	3.95
55	35.74	137.39	20.54	45.47	3.08	10.79	28.60	4.00	13.83	81.17	21.71	42.31	46.51	30.07	47.34	91.29	16.94	21.76	28.69	7.89	5.53	6.72	64.77	55.32	5.52	31.00	33.58	15.93	77.56	11.03	13.52	17.10	29.67	21.44	59.64	3.87
60	34.38	134.37	19.77	42.83	2.98	10.46	28.03	3.92	13.34	77.66	20.74	41.24	44.46	29.23	45.88	89.61	16.31	21.20	27.35	7.45	5.20	6.49	61.11	53.67	5.29	29.23	32.01	15.13	75.26	10.57	13.03	16.27	28.53	20.65	57.32	3.79
65	33.42	132.08	19.22	40.10	2.90	10.20	27.40	3.84	12.93	74.96	19.77	40.09	42.52	28.38	44.42	88.22	15.87	20.61	26.02	6.99	4.85	6.30	57.32	52.02	5.07	27.41	30.44	14.29	72.80	10.13	12.67	15.41	27.63	19.99	55.57	3.70
70	32.67	129.88	18.71	37.41	2.81	10.01	26.80	3.77	12.51	72.41	18.77	39.24	40.53	27.84	43.51	86.72	15.48	20.23	24.62	6.54	4.51	6.12	53.59	50.94	4.83	25.62	28.81	13.44	71.13	9.67	12.33	14.52	26.74	19.34	54.26	3.64
75	31.65	127.10	17.97	35.03	2.68	9.74	26.26	3.69	11.89	69.15	17.47	38.39	37.93	27.21	42.48	84.83	14.90	19.78	22.87	6.12	4.25	5.85	49.95	49.74	4.51	23.92	26.77	12.49	69.50	9.04	11.83	13.46	25.49	18.39	52.62	3.56
80	30.26	123.94	17.01	32.95	2.52	9.38	25.58	3.59	11.12	64.89	16.30	37.25	35.20	26.33	41.03	82.83	14.15	19.16	21.39	5.76	4.00	5.50	46.93	48.09	4.19	22.48	24.99	11.74	67.30	8.39	11.18	12.65	23.91	17.21	50.36	3.45
85	28.72	121.14	16.00	31.11	2.36	8.99	24.82	3.48	10.38	60.44	15.46	35.96	33.28	25.36	39.37	80.95	13.35	18.48	20.30	5.45	3.78	5.16	44.35	46.24	3.97	21.26	23.69	11.14	64.70	7.96	10.51	12.01	22.31	16.05	47.81	3.34
90	27.15	118.36	15.07	29.45	2.25	8.59	24.03	3.36	9.91	57.34	14.78	34.60	31.83	24.34	37.64	79.04	12.58	17.77	19.38	5.18	3.58	4.90	42.04	44.32	3.81	20.16	22.63	10.60	61.93	7.63	9.92	11.45	21.23	15.32	45.18	3.22
95	25.76	115.47	14.48	27.89	2.17	8.19	23.21	3.25	9.57	55.17	14.17	33.22	30.55	23.30	35.88	77.07	12.06	17.04	18.54	4.91	3.38	4.72	39.89	42.36	3.66	19.13	21.66	10.11	59.10	7.33	9.55	10.93	20.47	14.78	42.76	3.10
100	24.47	111.99	13.76	25.59	2.05	7.68	22.11	3.07	9.04	52.49	13.19	31.42	28.66	21.96	33.75	74.65	11.44	16.07	17.25	4.50	3.08	4.47	36.69	39.91	3.42	17.53	20.14	9.32	55.77	6.85	9.05	10.11	19.39	13.98	40.69	2.92
105	23.25	107.68	13.03	23.18	1.94	7.29	20.84	2.89	8.52	49.42	12.22	29.45	26.63	20.67	31.92	71.64	10.86	15.10	15.93	4.09	2.78	4.22	33.37	37.57	3.18	15.93	18.62	8.54	52.60	6.38	8.58	9.29	18.28	13.17	38.65	2.75
110	22.13	102.88	12.36	20.87	1.84	6.96	19.64	2.74	8.03	46.45	11.29	28.01	24.69	19.70	30.45	68.33	10.32	14.39	14.66	3.70	2.49	4.00	30.18	35.79	2.96	14.41	17.17	7.80	50.08	5.93	8.13	8.51	17.23	12.40	36.77	2.62
115	21.09	97.87	11.73	18.77	1.74	6.68	18.78	2.63	7.57	43.67	10.42	26.86	22.88	18.89	29.15	64.92	9.81	13.81	13.48	3.34	2.23	3.79	27.20	34.30	2.75	13.00	15.81	7.10	47.91	5.51	7.72	7.77	16.25	11.69	35.02	2.51
120	20.02	92.74	11.06	16.98	1.63	6.37	18.02	2.52	7.07	40.83	9.47	25.73	20.95	18.08	27.85	61.47	9.27	13.22	12.20	3.00	2.04	3.55	24.35	32.80	2.52	11.64	14.33	6.36	45.79	5.05	7.27	6.99	15.20	10.92	33.25	2.41
125	18.19	87.18	9.84	14.26	1.43	5.79	16.80	2.31	6.15	36.37	7.85	23.93	17.76	16.70	25.74	57.84	8.28	12.19	10.08	2.47	1.68	3.11	20.41	30.34	2.11	9.65	11.84	5.22	42.65	4.23	6.44	5.71	13.37	9.54	30.40	2.20
130	16.10	81.27	8.57	11.64	1.23	5.20	15.35	2.11	5.23	31.03	6.35	21.72	14.40	15.09	23.17	53.82	7.25	11.04	8.20	2.02	1.37	2.69	16.72	27.41	1.72	7.90	9.59	4.27	38.62	3.44	5.60	4.67	11.43	8.12	26.93	2.00
135	14.09	75.08	7.37	9.43	1.04	4.64	13.95	1.92	4.38	25.87	5.19	19.58	11.69	13.55	20.67	49.59	6.28	9.94	6.71	1.65	1.11	2.29	13.59	24.59	1.39	6.43	7.85	3.50	34.54	2.79	4.81	3.83	9.59	6.79	23.57	1.82
140	12.23	68.95	6.26	7.64	0.88	4.11	12.63	1.74	3.59	21.12	4.29	17.55	9.66	12.10	18.33	45.49	5.39	8.91	5.53	1.34	0.90	1.92	11.07	21.94	1.15	5.24	6.48	2.87	30.66	2.30	4.08	3.15	7.89	5.57	20.43	1.64
145	10.54	63.10	5.24	6.18	0.72	3.63	11.41	1.57	2.92	17.15	3.54	15.68	7.99	10.77	16.17	41.61	4.56	7.96	4.55	1.09	0.73	1.58	8.98	19.50	0.96	4.26	5.35	2.34	27.08	1.91	3.41	2.58	6.38	4.52	17.57	1.48
150	8.94	57.66	4.29	4.97	0.59	3.19	10.29	1.42	2.42	14.19	2.92	13.96	6.61	9.54	14.19	38.02	3.79	7.08	3.74	0.88	0.58	1.29	7.27	17.24	0.80	3.44	4.41	1.91	23.82	1.59	2.79	2.11	5.28	3.75	14.90	1.32
155	7.45	52.70	3.52	3.94	0.49	2.76	9.24	1.27	2.03	11.87	2.39	12.36	5.44	8.39	12.32	34.76	3.08	6.25	3.05	0.70	0.46	1.07	5.80	15.13	0.66	2.75	3.60	1.54	20.77	1.31	2.29	1.71	4.43	3.14	12.39	1.18
160	6.09	48.12	2.95	3.08	0.41	2.37	8.26	1.13	1.70	9.93	1.94	10.85	4.44	7.30	10.57	31.71	2.56	5.48	2.46	0.55	0.36	0.90	4.57	13.14	0.54	2.16	2.91	1.22	17.90	1.07	1.92	1.36	3.71	2.63	10.11	1.05
165	5.05	43.81	2.48	2.39	0.35	1.99	7.34	1.01	1.41	8.24	1.55	9.43	3.58	6.28	8.92	28.85	2.16	4.75	1.96	0.43	0.28	0.76	3.56	11.27	0.44	1.69	2.33	0.96	15.20	0.87	1.62	1.08	3.09	2.19	8.40	0.92
170	4.26	39.79	2.08	1.87	0.29	1.63	6.46	0.88	1.17	6.78	1.24	8.08	2.86	5.30	7.36	26.17	1.81	4.05	1.55	0.34	0.22	0.63	2.79	9.47	0.35	1.32	1.85	0.76	12.62	0.70	1.35	0.85	2.55	1.80	7.08	0.80
175	3.59	36.02	1.73	1.43	0.24	1.35	5.62	0.76	0.96	5.55	0.99	6.77	2.29	4.38	6.07	23.66	1.52	3.37	1.23	0.26	0.16	0.52	2.17	7.80	0.28	1.03	1.48	0.60	10.32	0.56	1.13	0.67	2.10	1.48	5.96	0.69
180	3.01	32.46	1.44	1.06	0.20	1.14	4.81	0.65	0.78	4.52	0.78	5.56	1.83	3.61	5.10	21.27	1.26	2.76	0.97	0.20	0.12	0.43	1.63	6.45	0.23	0.77	1.17	0.46	8.65	0.45	0.93	0.52	1.72	1.21	5.00	0.57
185	2.52	29.02	1.19	0.76	0.16	0.97	4.04	0.54	0.64	3.68	0.60	4.63	1.43	3.04	4.32	18.97	1.05	2.31	0.74	0.14	0.08	0.35	1.18	5.44	0.18	0.56	0.90	0.34	7.32	0.35	0.77	0.39	1.40	0.99	4.17	0.47
190	2.10	25.71	0.98	0.51	0.13	0.82	3.31	0.44	0.52	2.97	0.45	3.92	1.09	2.58	3.65	16.75	0.88	1.96	0.54	0.10	0.06	0.29	0.81	4.61	0.14	0.38	0.67	0.24	6.20	0.27	0.64	0.28	1.14	0.80	3.49	0.39
195	1.76	22.53	0.80	0.32	0.11	0.69	2.77	0.37	0.41	2.35	0.32	3.33	0.80	2.19	3.09	14.62	0.72	1.67	0.38	0.06	0.03	0.23	0.53	3.92	0.10	0.25	0.48	0.16	5.25	0.20	0.52	0.19	0.90	0.63	2.91	0.33
200	1.45	19.47	0.64	0.18	0.08	0.59	2.36	0.32	0.32	1.81	0.22	2.84	0.56	1.87	2.62	12.56	0.58	1.42	0.26	0.04	0.02	0.19	0.31	3.33	0.07	0.14	0.33	0.10	4.44	0.14	0.42	0.12	0.70	0.49	2.39	0.29
205	1.17	16.49	0.51	0.08	0.06	0.49	2.02	0.28	0.24	1.36	0.14	2.42	0.38	1.58	2.19	10.56	0.46	1.21	0.16	0.02	0.01	0.14	0.15	2.82	0.05	0.07	0.21	0.06	3.74	0.10	0.33	0.07	0.53	0.37	1.94	0.25
210	0.94	13.67	0.39	0.02	0.05	0.41	1.74	0.24	0.17	0.97	0.08	2.05	0.23	1.33	1.82	8.69	0.36	1.02	0.09	0.00	0.00	0.11	0.05	2.36	0.03	0.02	0.12	0.02	3.11	0.06	0.25	0.03	0.38	0.26	1.55	0.21
215	0.73	11.40	0.29	0.00	0.03	0.33	1.48	0.20	0.12	0.67	0.04	1.71	0.12	1.10	1.48	7.33	0.27	0.85	0.03	0.00	0.00	0.08	0.00	1.95	0.02	0.00	0.05	0.01	2.55	0.03	0.19	0.01	0.27	0.18	1.21	0.18
220	0.56	9.77	0.21	0.00	0.02	0.26	1.25	0.17	0.08	0.43	0.01	1.41	0.05	0.90	1.19	6.32	0.20	0.70	0.01	0.00	0.00	0.05	0.00	1.59	0.01	0.00	0.01	0.00	2.06	0.01	0.13	0.00	0.18	0.12	0.92	0.15
225	0.41	8.45	0.14	0.00	0.02	0.21	1.05	0.14	0.04	0.25	0.00	1.15	0.01	0.72	0.94	5.46	0.14	0.57	0.00	0.00	0.00	0.03	0.00	1.28	0.00	0.00	0.00	0.00	1.63	0.00	0.09	0.00	0.10	0.07	0.67	0.12
230	0.29	7.27	0.09	0.00	0.01	0.16	0.86	0.12	0.02	0.11	0.00	0.92	0.00	0.57	0.72	4.69	0.09	0.45	0.00	0.00	0.00	0.02	0.00	1.01	0.00	0.00	0.00	0.00	1.27	0.00	0.06	0.00	0.05	0.03	0.47	0.10
235	0.19	6.22	0.05	0.00	0.00	0.12	0.70	0.09	0.01	0.03	0.00	0.72	0.00	0.44	0.54	4.00	0.06	0.35	0.00	0.00	0.00	0.01	0.00	0.77	0.00	0.00	0.00	0.00	0.95	0.00	0.03	0.00	0.02	0.01	0.31	0.08
240	0.12	5.27	0.02	0.00	0.00	0.08	0.56	0.07	0.00	0.00	0.00	0.55	0.00	0.32	0.38	3.38	0.03	0.26	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.69	0.00	0.01	0.00	0.00	0.00	0.19	0.06
245	0.06	4.42	0.01	0.00	0.00	0.06	0.44	0.06	0.00	0.00	0.00	0.40	0.00	0.23	0.26	2.82	0.01	0.19	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.10	0.05
250	0.02	3.65	0.00	0.00	0.00	0.03	0.33	0.04	0.00	0.00	0.00	0.28	0.00	0.16	0.17	2.32	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.04	0.03
255	0.00	2.98	0.00	0.00	0.00	0.02	0.24	0.03	0.00	0.00	0.00	0.19	0.00	0.10	0.09	1.88	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.02
260	0.00	2.39	0.00	0.00	0.00	0.01	0.17	0.02	0.00	0.00	0.00	0.12	0.00	0.06	0.04	1.50	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.02
265	0.00	1.88	0.00	0.00	0.00	0.00	0.11	0.01	0.00	0.00	0.00	0.06	0.00	0.02	0.01	1.17	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01
270	0.00	1.44	0.00	0.00	0.00	0.00	0.07	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.89	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
275	0.00	1.07	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
280	0.00	0.76	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
285	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
290	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
295	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
305	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Printouts for Unit Hydrographs

flow in cfs

time in minutes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	(OS1) 32	(OS2) 33	(OS3) 34	(OS4) 35	(OS5) 36
5	39.76	49.06	28.60	76.96	5.22	14.75	26.15	5.67	22.26	81.67	37.29	36.07	66.04	30.25	41.99	39.19	23.94	23.71	47.89	15.74	11.33	11.17	107.22	51.61	9.97	58.05	57.18	30.05	53.69	19.76	20.44	31.63	40.75	32.05	54.93	5.58
10	55.25	123.67	32.97	87.90	5.06	16.13	40.17	5.70	23.14	133.15	39.11	60.03	82.91	43.80	69.03	92.20	26.85	31.61	52.30	14.92	10.63	10.97	122.04	79.24	9.54	58.05	59.91	29.61	104.26	19.40	21.75	31.56	49.33	35.88	90.59	5.57
15	53.29	166.57	31.07	76.87	4.64	15.40	39.51	5.47	21.34	129.81	34.97	59.77	76.40	42.74	68.35	117.24	25.32	30.70	46.81	12.61	8.81	10.12	107.50	77.64	8.45	50.00	53.49	25.72	111.71	17.35	20.34	27.62	46.27	33.34	89.42	5.33
20	48.43	175.94	27.34	62.15	3.94	14.04	37.47	5.08	18.11	115.02	28.83	56.50	62.48	39.91	63.98	118.16	22.40	28.61	38.38	10.53	7.41	8.67	87.14	72.71	7.11	41.14	44.08	21.25	106.50	14.45	17.76	22.80	39.96	28.49	82.36	4.92
25	41.10	171.04	23.52	52.03	3.51	12.12	34.06	4.51	15.87	95.79	24.86	50.76	54.23	35.31	56.39	113.46	19.30	25.33	32.96	8.84	6.16	7.64	73.43	64.46	6.18	34.61	37.96	18.04	95.61	12.56	15.40	19.43	34.32	24.71	70.05	4.34
30	36.83	159.70	20.83	43.09	3.08	11.00	29.73	4.07	13.84	83.65	20.88	44.14	45.98	31.11	49.29	104.67	17.17	22.44	27.54	7.44	5.22	6.72	60.70	56.54	5.26	28.89	31.84	15.03	81.93	10.67	13.63	16.15	30.02	21.56	62.04	3.93
35	32.57	141.91	18.15	37.24	2.66	9.87	27.20	3.72	11.82	71.50	18.19	40.04	39.41	28.12	44.31	91.79	15.04	20.33	24.00	6.44	4.48	5.80	52.76	51.07	4.60	25.06	27.75	13.14	73.81	9.27	11.86	14.17	25.72	18.42	54.87	3.58
40	28.31	126.24	15.94	31.38	2.39	8.74	24.66	3.36	10.61	62.60	15.86	35.94	34.63	25.12	39.33	83.42	13.17	18.21	20.83	5.44	3.73	5.18	44.82	45.60	4.05	21.24	24.17	11.25	65.70	8.16	10.47	12.19	22.83	16.46	47.71	3.23
45	25.55	115.80	14.36	25.53	2.13	7.82	22.13	3.01	9.41	55.65	13.53	31.85	29.86	22.12	34.52	76.41	11.91	16.10	17.67	4.44	2.99	4.64	36.88	40.14	3.50	17.41	20.58	9.36	57.58	7.04	9.42	10.21	20.32	14.61	42.69	2.87
50	23.06	105.35	12.78	19.68	1.88	7.15	19.80	2.75	8.22	48.70	11.20	28.82	25.08	20.28	31.63	69.40	10.66	14.74	14.50	3.43	2.26	4.09	28.94	36.73	2.95	13.58	16.99	7.47	52.30	5.92	8.37	8.23	17.81	12.76	38.56	2.64
55	20.58	94.91	11.20	16.53	1.62	6.48	18.32	2.54	7.03	41.75	8.87	26.43	20.30	18.52	28.74	62.39	9.40	13.49	11.34	2.91	2.01	3.55	23.55	33.54	2.40	11.26	13.40	5.95	47.64	4.80	7.32	6.43	15.29	10.91	34.42	2.43
60	18.09	86.04	9.62	14.58	1.37	5.81	16.83	2.32	5.83	34.80	7.51	24.05	16.30	16.77	25.84	57.15	8.14	12.25	9.83	2.58	1.77	3.00	20.90	30.35	1.95	9.99	11.44	5.32	42.99	3.89	6.28	5.77	12.78	9.06	30.28	2.22
65	15.60	80.12	8.04	12.63	1.12	5.14	15.34	2.11	4.69	27.85	6.73	21.66	14.71	15.01	22.95	53.14	6.88	11.00	8.77	2.24	1.52	2.45	18.26	27.16	1.76	8.71	10.25	4.69	38.33	3.52	5.23	5.11	10.26	7.24	26.15	2.00
70	13.12	74.21	6.58	10.68	0.98	4.47	13.86	1.90	4.29	24.82	5.96	19.28	13.11	13.26	20.06	49.14	5.63	9.76	7.72	1.91	1.27	2.13	15.61	23.96	1.58	7.43	9.05	4.06	33.68	3.15	4.33	4.45	9.20	6.63	22.01	1.79
75	10.92	68.30	6.06	8.73	0.90	3.80	12.37	1.69	3.89	22.50	5.18	16.90	11.52	11.50	17.17	45.13	5.07	8.51	6.66	1.57	1.02	1.95	12.96	20.77	1.39	6.16	7.85	3.43	29.02	2.77	3.98	3.79	8.36	6.01	18.13	1.58
80	10.09	62.38	5.53	6.78	0.81	3.21	10.89	1.48	3.49	20.18	4.40	14.51	9.93	9.75	14.28	41.13	4.65	7.27	5.61	1.24	0.78	1.77	10.32	17.58	1.21	4.88	6.66	2.80	24.37	2.40	3.63	3.13	7.53	5.39	16.75	1.37
85	9.26	56.47	5.01	4.83	0.73	2.99	9.40	1.26	3.09	17.87	3.63	12.13	8.34	8.50	13.06	37.12	4.23	6.23	4.55	0.91	0.53	1.59	7.67	15.36	1.03	3.61	5.46	2.17	21.53	2.03	3.28	2.47	6.69	4.78	15.37	1.16
90	8.43	50.56	4.48	2.88	0.65	2.76	8.00	1.12	2.70	15.55	2.85	11.33	6.75	7.92	12.10	33.12	3.81	5.81	3.50	0.57	0.28	1.41	5.02	14.30	0.84	2.33	4.27	1.54	19.98	1.66	2.93	1.81	5.85	4.16	13.99	1.07
95	7.60	44.64	3.95	0.93	0.56	2.54	7.50	1.05	2.30	13.23	2.07	10.53	5.15	7.33	11.14	29.11	3.39	5.40	2.44	0.24	0.03	1.22	2.38	13.24	0.66	1.05	3.07	0.91	18.43	1.28	2.59	1.15	5.01	3.55	12.61	1.00
100	6.77	38.73	3.43	0.00	0.48	2.32	7.01	0.98	1.90	10.92	1.30	9.74	3.56	6.75	10.17	25.10	2.97	4.98	1.39	0.00	0.00	1.04	0.00	12.17	0.48	0.00	1.87	0.28	16.88	0.91	2.24	0.49	4.17	2.93	11.23	0.93
105	5.94	34.43	2.90		0.39	2.09	6.51	0.91	1.50	8.60	0.52	8.94	1.97	6.16	9.21	22.90	2.55	4.57	0.33			0.86		11.11	0.29		0.68	0.00	15.33	0.54	1.89	0.00	3.34	2.31	9.85	0.85
110	5.11	32.46	2.37		0.31	1.87	6.02	0.84	1.10	6.28	0.00	8.15	0.38	5.58	8.24	21.57	2.14	4.15	0.00			0.68		10.04	0.11		0.00		13.78	0.17	1.54		2.50	1.70	8.48	0.78
115	4.29	30.48	1.85		0.22	1.64	5.52	0.77	0.70	3.97		7.36	0.00	4.99	7.28	20.23	1.72	3.74				0.50		8.98	0.00				12.22	0.00	1.19		1.66	1.08	7.10	0.71
120	3.46	28.51	1.32		0.14	1.42	5.03	0.70	0.31	1.65		6.56		4.41	6.32	18.90	1.30	3.32				0.32		7.92					10.67		0.84		0.82	0.47	5.72	0.64
125	2.63	26.54	0.79		0.05	1.20	4.53	0.62	0.00	0.00		5.77		3.82	5.35	17.56	0.88	2.91				0.13		6.85					9.12		0.49		0.00	0.00	4.34	0.57
130	1.80	24.57	0.27		0.00	0.97	4.04	0.55				4.97		3.24	4.39	16.23	0.46	2.49				0.00		5.79					7.57		0.14				2.96	0.50
135	0.97	22.60	0.00			0.75	3.54	0.48				4.18		2.65	3.43	14.89	0.04	2.08						4.72					6.02		0.00				1.58	0.43
140	0.14	20.63				0.53	3.05	0.41				3.38		2.07	2.46	13.56	0.00	1.66						3.66					4.47						0.20	0.36
145	0.00	18.66				0.30	2.55	0.34				2.59		1.48	1.50	12.22		1.25						2.60					2.92						0.00	0.29
150		16.69				0.08	2.06	0.27				1.79		0.90	0.53	10.89		0.83						1.53					1.36							0.22
155		14.72				0.00	1.56	0.20				1.00		0.31	0.00	9.55		0.42						0.47					0.00							0.15
160		12.74					1.07	0.13				0.20		0.00		8.22		0.00						0.00												0.08
165		10.77					0.57	0.06				0.00				6.88		0.00																		0.01
170		8.80					0.08	0.00								5.54																				0.00
175		6.83					0.00									4.21																				
180		4.86														2.87																				
185		2.89														1.54																				
190		0.92														0.20																				
195		0.00														0.00																				

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
1	P	0.156	0.139	37.5	5.52	19.5	3.90	9.2	55	158,994	2.54	403,480	45.0	82	402,649	1.88
2	X	0.156	0.249	50.8	11.22	26.4	7.93	18.7	176	692,894	2.54	1,758,362	55.0	299	1,758,430	1.56
3	O	0.156	0.108	34.9	4.39	18.2	3.10	7.3	33	89,879	2.54	228,086	45.0	49	227,590	1.96
4	N	0.156	0.147	25.7	4.39	13.4	3.10	7.3	89	177,870	2.54	451,382	40.0	119	450,230	2.43
5	W	0.156	0.046	33.7	2.70	17.5	1.90	4.5	5	13,649	2.54	34,637	45.0	7	34,132	1.95
6	M	0.156	0.083	40.0	4.05	20.8	2.86	6.7	16	50,348	2.54	127,769	45.0	25	127,421	1.77
7	V	0.156	0.132	45.0	6.05	23.4	4.27	10.1	40	140,009	2.54	355,302	50.0	64	355,159	1.66
8	U	0.156	0.055	44.5	3.37	23.2	2.38	5.6	6	19,892	2.54	50,481	50.0	9	50,301	1.63
9	L	0.156	0.090	32.6	3.74	17.0	2.64	6.2	24	59,496	2.54	150,983	45.0	33	150,313	2.03
10	K	0.156	0.196	32.6	6.40	17.0	4.52	10.7	134	338,098	2.54	857,993	45.0	195	858,390	2.10
11	S	0.156	0.107	28.6	3.85	14.9	2.72	6.4	40	88,427	2.54	224,401	40.0	55	223,627	2.24
12	R	0.156	0.154	42.5	6.54	22.1	4.62	10.9	61	199,577	2.54	506,469	50.0	95	506,557	1.73
13	G	0.156	0.151	29.3	4.89	15.2	3.46	8.2	83	189,450	2.54	480,767	40.0	115	478,906	2.21
14	D	0.156	0.132	41.6	5.71	21.6	4.04	9.5	44	140,989	2.54	357,789	50.0	68	357,603	1.75
15	B	0.156	0.160	40.3	6.46	20.9	4.56	10.8	70	216,856	2.54	550,317	50.0	107	550,461	1.80
16	E	0.156	0.221	50.4	10.04	26.2	7.10	16.7	119	464,132	2.54	1,177,830	55.0	200	1,177,315	1.56
17	H	0.156	0.099	35.7	4.22	18.6	2.98	7.0	27	74,887	2.54	190,041	45.0	40	189,591	1.93
18	J	0.156	0.115	42.2	5.22	21.9	3.69	8.7	32	103,346	2.54	262,262	50.0	49	261,821	1.72
19	I	0.156	0.121	28.1	4.11	14.6	2.90	6.8	53	115,906	2.54	294,135	40.0	73	293,135	2.27
20	JJ	0.156	0.067	26.0	2.84	13.5	2.01	4.7	16	31,654	2.54	80,327	40.0	20	79,174	2.35
21	LL	0.156	0.057	25.2	2.61	13.1	1.84	4.4	11	22,143	2.54	56,192	40.0	14	55,003	2.37
22	KK	0.156	0.065	33.9	3.20	17.6	2.26	5.3	11	29,476	2.54	74,800	45.0	16	74,311	1.97
23	EE	0.126	0.142	26.2	4.37	13.6	3.09	7.3	124	252,176	2.55	643,212	40.0	167	641,316	2.41
24	DD	0.126	0.143	41.4	6.04	21.5	4.27	10.1	79	254,318	2.55	648,674	50.0	124	648,759	1.77
25	CC	0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	2.55	58,608	40.0	14	57,626	2.14
26	AA	0.126	0.102	26.1	3.55	13.6	2.51	5.9	60	121,569	2.55	310,079	40.0	80	308,721	2.40
27	BB	0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	2.55	343,966	40.0	84	342,767	2.27
28	FF	0.156	0.092	26.9	3.41	14.0	2.41	5.7	31	63,961	2.54	162,313	40.0	41	161,448	2.33
29	II	0.156	0.200	40.7	7.75	21.2	5.48	12.9	112	354,034	2.54	898,434	50.0	176	897,885	1.80
30	HH	0.156	0.080	29.6	3.31	15.4	2.34	5.5	20	45,774	2.54	116,162	40.0	27	115,480	2.17
31	GG	0.156	0.089	34.8	3.89	18.1	2.75	6.5	22	59,351	2.54	150,614	45.0	32	150,232	1.96
(OS1) 32	A	0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	2.54	174,933	40.0	44	174,023	2.31
(OS2) 33	C	0.156	0.126	32.9	4.68	17.1	3.31	7.8	50	126,578	2.54	321,218	45.0	71	320,363	2.04
(OS3) 34	F	0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	2.54	232,600	45.0	52	231,811	2.04
(OS4) 35	Q	0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	2.54	665,926	45.0	138	665,685	1.91
(OS5) 36	T	0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	2.54	48,270	45.0	9	48,050	1.66

Printouts for Storm Hydrographs

flow in cfs

time in minutes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	(OS1) 32	(OS2) 33	(OS3) 34	(OS4) 35	(OS5) 36
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.03	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.30	0.15	0.03	0.16	0.16	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
20	1.89	2.38	1.38	3.72	0.25	0.71	1.27	0.27	1.08	3.95	1.80	1.75	3.19	1.46	2.03	1.90	1.16	1.15	2.32	0.76	0.55	0.54	7.65	3.74	0.71	4.12	4.06	1.45	2.60	0.96	0.99	1.53	1.97	1.55	2.66	0.27
25	16.40	23.27	11.67	31.36	2.09	5.97	11.15	2.27	8.96	35.21	15.03	15.61	27.27	12.78	18.13	18.26	9.73	9.88	19.40	6.27	4.51	4.47	46.24	23.73	4.17	24.47	24.30	12.02	23.96	7.90	8.25	12.67	16.74	13.02	23.73	2.23
30	46.39	82.49	31.11	83.11	5.29	15.71	32.52	5.84	23.19	104.57	38.93	46.73	74.46	36.53	54.05	62.80	25.75	27.54	50.82	15.77	11.30	11.39	117.59	65.65	10.19	60.28	60.63	30.58	75.91	20.11	21.51	32.35	45.26	34.42	70.80	5.73
35	69.09	162.29	43.09	112.51	6.85	21.45	50.22	7.76	30.80	163.84	51.46	74.27	105.37	55.21	85.40	118.83	35.33	40.44	68.13	19.89	14.14	14.83	157.98	100.15	12.94	77.20	79.49	39.31	129.02	25.98	28.91	41.83	63.63	46.99	111.84	7.58
40	79.29	228.50	47.69	119.24	7.31	23.88	59.12	8.60	33.21	190.17	54.65	88.38	115.21	64.18	101.04	161.25	39.04	46.53	72.63	20.50	14.48	15.91	167.45	116.87	13.57	80.22	84.15	41.02	159.97	27.42	31.57	43.83	70.43	51.30	131.63	8.38
45	82.17	269.90	48.54	116.29	7.33	24.61	63.10	8.94	33.30	195.43	53.91	94.33	114.54	67.65	107.03	185.35	39.78	48.88	71.58	20.00	14.10	15.99	163.51	123.33	13.42	78.17	82.85	40.16	173.37	27.13	31.99	42.98	71.27	51.63	137.80	8.68
50	81.25	291.70	47.63	110.46	7.19	24.40	63.92	8.95	32.51	190.88	51.86	95.25	110.85	67.84	107.33	197.23	39.11	48.99	68.72	19.05	13.40	15.66	155.55	123.69	12.96	74.34	79.58	38.34	175.60	26.20	31.38	41.09	69.62	50.40	136.63	8.66
55	79.05	298.70	45.92	103.36	6.90	23.83	62.86	8.79	31.10	182.94	48.99	93.36	105.15	66.39	104.83	199.80	37.78	47.99	64.82	17.87	12.55	15.04	145.67	120.92	12.30	69.64	75.09	36.02	171.77	24.83	30.22	38.64	66.70	48.22	132.78	8.50
60	76.42	295.79	44.16	97.30	6.64	23.21	61.68	8.64	29.77	174.34	46.62	91.15	99.88	64.72	101.85	196.92	36.40	46.87	61.58	16.89	11.83	14.46	137.37	117.73	11.75	65.74	71.38	34.16	167.01	23.70	29.07	36.69	63.80	46.12	128.07	8.34
65	73.96	290.36	42.71	91.72	6.44	22.60	60.50	8.47	28.80	167.42	44.59	88.91	95.63	63.02	98.84	193.71	35.23	45.71	58.78	15.97	11.13	14.01	129.80	114.52	11.29	62.13	68.18	32.47	162.06	22.77	28.15	34.94	61.58	44.56	123.64	8.17
70	70.19	283.34	40.17	82.29	6.01	21.38	57.96	8.04	26.84	157.83	40.73	84.99	88.34	60.00	94.15	188.90	33.18	43.50	53.61	14.24	9.85	13.09	116.95	109.09	10.34	55.61	62.18	29.24	154.87	20.87	26.41	31.58	57.69	41.62	117.58	7.74
75	66.02	272.60	37.49	72.93	5.58	20.23	54.96	7.65	24.81	145.94	36.70	80.47	80.03	56.82	89.00	181.26	31.05	41.23	48.13	12.66	8.73	12.16	103.92	103.23	9.39	49.45	55.95	26.09	146.57	18.94	24.64	28.21	53.39	38.46	110.47	7.36
80	61.15	258.84	34.27	64.19	5.06	18.83	51.86	7.19	22.34	132.25	32.32	75.67	70.77	53.28	83.31	171.84	28.47	38.69	42.31	11.16	7.71	11.03	91.36	96.80	8.31	43.49	49.24	22.91	137.53	16.73	22.47	24.76	48.29	34.68	102.36	6.91
85	56.07	244.43	31.03	57.10	4.55	17.44	48.66	6.74	19.98	117.95	28.79	70.59	62.77	49.58	77.20	162.34	25.89	36.06	37.72	9.96	6.88	9.94	81.33	89.99	7.40	38.78	43.89	20.47	127.70	14.89	20.34	22.13	43.20	30.98	93.67	6.47
90	51.21	230.90	27.97	51.11	4.10	16.12	45.60	6.32	17.94	105.45	26.03	65.68	56.63	46.02	71.30	153.30	23.42	33.55	34.07	8.96	6.17	8.95	72.97	83.45	6.71	34.85	39.67	18.46	118.03	13.48	18.34	19.98	38.74	27.79	85.33	6.05
95	46.51	218.06	25.37	45.94	3.75	14.82	42.70	5.92	16.43	95.87	23.76	60.99	51.70	42.59	65.61	144.76	21.25	31.13	31.03	8.08	5.53	8.17	65.81	77.15	6.15	31.43	36.18	16.75	108.79	12.35	16.67	18.16	35.37	25.43	77.34	5.64
100	42.49	206.00	23.45	41.20	3.48	13.60	39.86	5.52	15.23	88.43	21.73	56.41	47.40	39.25	60.11	136.79	19.60	28.77	28.31	7.28	4.95	7.58	59.27	71.05	5.66	28.31	33.06	15.18	99.82	11.35	15.42	16.51	32.72	23.55	70.60	5.25
105	39.54	194.57	21.89	36.78	3.25	12.57	37.10	5.13	14.16	82.02	19.88	52.00	43.50	36.19	55.32	129.13	18.31	26.54	25.82	6.53	4.40	7.07	53.18	65.47	5.21	25.40	30.21	13.74	91.76	10.45	14.40	14.99	30.42	21.89	65.62	4.86
110	37.14	183.51	20.51	32.57	3.04	11.80	34.43	4.77	13.20	76.26	18.14	48.19	39.87	33.71	51.72	121.71	17.18	24.69	23.47	5.81	3.87	6.61	47.39	60.98	4.80	22.62	27.51	12.36	85.40	9.60	13.49	13.54	28.36	20.39	61.56	4.52
115	35.03	172.69	19.25	28.63	2.84	11.17	32.16	4.48	12.30	70.94	16.49	45.38	36.42	31.81	48.83	114.41	16.16	23.30	21.24	5.13	3.39	6.19	41.92	57.52	4.40	20.01	24.95	11.05	80.46	8.80	12.66	12.16	26.44	19.00	57.98	4.26
120	33.10	162.09	18.08	25.18	2.66	10.60	30.46	4.26	11.45	65.89	14.92	43.10	33.15	30.21	46.31	107.29	15.21	22.14	19.12	4.52	2.98	5.79	36.87	54.60	4.02	17.61	22.53	9.82	76.26	8.04	11.89	10.85	24.63	17.67	54.71	4.06
125	30.13	150.76	16.11	20.40	2.33	9.64	28.28	3.90	9.97	58.65	12.28	39.99	28.03	27.86	42.76	99.67	13.59	20.39	15.63	3.57	2.38	5.08	29.64	50.43	3.36	13.99	18.48	7.82	70.86	6.71	10.54	8.69	21.68	15.45	50.01	3.71
130	26.78	138.93	14.06	16.20	2.01	8.67	25.84	3.56	8.50	50.11	9.71	36.34	22.47	25.22	38.56	91.83	11.94	18.50	12.29	2.83	1.89	4.40	23.52	45.64	2.72	11.09	14.59	6.15	64.23	5.41	9.19	6.81	18.56	13.18	44.39	3.37
135	23.58	127.73	12.12	12.81	1.71	7.75	23.52	3.24	7.10	41.73	7.59	32.83	17.56	22.70	34.49	84.33	10.37	16.69	9.66	2.26	1.50	3.74	18.65	41.04	2.15	8.82	11.43	4.88	57.58	4.25	7.91	5.40	15.56	11.00	38.96	3.06
140	20.61	117.21	10.30	10.14	1.43	6.90	21.35	2.94	5.80	33.86	6.06	29.50	13.92	20.32	30.66	77.35	8.91	14.99	7.72	1.79	1.19	3.14	14.82	36.71	1.69	7.01	9.12	3.90	51.26	3.36	6.71	4.32	12.76	8.97	33.88	2.77
145	17.86	107.39	8.60	8.00	1.16	6.12	19.33	2.67	4.60	26.82	4.85	26.43	11.14	18.15	27.16	70.84	7.54	13.43	6.17	1.42	0.93	2.56	11.73	32.74	1.35	5.55	7.30	3.10	45.44	2.69	5.59	3.44	10.15	7.11	29.18	2.50
150	15.24	98.30	6.97	6.29	0.92	5.38	17.49	2.41	3.61	21.07	3.89	23.65	8.94	16.14	23.90	64.85	6.22	12.00	4.94	1.12	0.73	2.03	9.27	29.08	1.09	4.38	5.85	2.47	40.11	2.16	4.52	2.74	7.95	5.59	24.73	2.26
155	12.73	90.01	5.52	4.88	0.73	4.67	15.78	2.17	2.90	16.90	3.10	21.00	7.15	14.23	20.80	59.40	4.98	10.63	3.92	0.87	0.57	1.60	7.23	25.59	0.87	3.42	4.66	1.94	35.05	1.73	3.57	2.16	6.37	4.49	20.46	2.02
160	10.34	82.42	4.37	3.80	0.59	3.99	14.16	1.95	2.34	13.64	2.44	18.48	5.68	12.40	17.82	54.36	3.92	9.33	3.08	0.68	0.44	1.29	5.61	22.26	0.70	2.66	3.67	1.51	30.20	1.38	2.83	1.69	5.14	3.62	16.42	1.80
165	8.18	75.36	3.51	2.97	0.47	3.33	12.61	1.73	1.88	10.95	1.92	16.06	4.46	10.65	14.97	49.68	3.13	8.08	2.40	0.53	0.35	1.04	4.41	19.05	0.55	2.09	2.87	1.18	25.55	1.09	2.28	1.32	4.14	2.91	12.91	1.58
170	6.47	68.75	2.83	2.36	0.38	2.69	11.12	1.52	1.50	8.75	1.51	13.71	3.51	8.93	12.19	45.26	2.52	6.86	1.90	0.43	0.28	0.84	3.49	15.93	0.43	1.66	2.27	0.94	21.03	0.86	1.84	1.05	3.31	2.33	10.30	1.37
175	5.21	62.48	2.28	1.86	0.30	2.12	9.65	1.31	1.20	6.96	1.22	11.41	2.80	7.26	9.64	41.07	2.04	5.67	1.53	0.34	0.22	0.67	2.79	12.90	0.35	1.32	1.83	0.76	16.73	0.69	1.48	0.85	2.64	1.85	8.31	1.17
180	4.21	56.46	1.83	1.43	0.24	1.68	8.22	1.11	0.96	5.54	0.98	9.18	2.28	5.74	7.61	37.01	1.64	4.51	1.23	0.26	0.16	0.54	2.16	10.18	0.28	1.02	1.47	0.60	13.12	0.56	1.19	0.67	2.11	1.48	6.71	0.97
185	3.40	50.55	1.48	1.05	0.20	1.36	6.82	0.91	0.78	4.49	0.78	7.22	1.83	4.54	6.13	33.03	1.33	3.53	0.97	0.19	0.12	0.43	1.62	8.07	0.23	0.76	1.17	0.46	10.53	0.45	0.96	0.52	1.71	1.20	5.42	0.77
190	2.76	44.77	1.20	0.73	0.16	1.11	5.47	0.72	0.64	3.66	0.60	5.75	1.43	3.66	4.98	29.14	1.08	2.84	0.74	0.14	0.08	0.35	1.15	6.52	0.18	0.54	0.89	0.33	8.55	0.35	0.78	0.39	1.40	0.98	4.39	0.61
195	2.26	39.11	0.98	0.46	0.13	0.90	4.29	0.57	0.51	2.95	0.44	4.66	1.08	2.99	4.06	25.32	0.88	2.31	0.54	0.09	0.05	0.29	0.76	5.31	0.14	0.36	0.66	0.23	6.96	0.27	0.64	0.27	1.13	0.79	3.59	0.49
200	1.84	33.56	0.80	0.26	0.11	0.74	3.44	0.46	0.41	2.35	0.31	3.82	0.79	2.45	3.34	21.59	0.72	1.90	0.37	0.05	0.03	0.23	0.45	4.36	0.10	0.21	0.46	0.15	5.71	0.20	0.52	0.18	0.90	0.63	2.91	0.40
205	1.50	28.13	0.64	0.11	0.08	0.61	2.82	0.38	0.32	1.81	0.20	3.15	0.54	2.02	2.73	17.93	0.58	1.56	0.23	0.02	0.01	0.19	0.22	3.59	0.07	0.10	0.30	0.08	4.68	0.14	0.42	0.10	0.70	0.49	2.38	0.33
210	1.22	22.87	0.51	0.03	0.06	0.49	2.33	0.31	0.23	1.34	0.12	2.59	0.33	1.65	2.22	14.41	0.46	1.28	0.13	0.01	0.00	0.14	0.07	2.93	0.05	0.03	0.17	0.04	3.82	0.09	0.33	0.05	0.53	0.36	1.93	0.27
215	0.98	18.15	0.39	0.00	0.05	0.40	1.92	0.26	0.17	0.94	0.05	2.12	0.18	1.34	1.81	11.38	0.36	1.05	0.05	0.00	0.00	0.11	0.00	2.39	0.03	0.00	0.08	0.01	3.10	0.05	0.25	0.01	0.38	0.26	1.55	0.22
220	0.78	14.53	0.29	0.00	0.03	0.33	1.58	0.21	0.11	0.62	0.02	1.72	0.07	1.10	1.48	9.21	0.27	0.85	0.01	0.00	0.00	0.07	0.00	1.95	0.01	0.00	0.02	0.00	2.54	0.02	0.18	0.00	0.25	0.17	1.21	0.18
225	0.59	11.93	0.20	0.00	0.02	0.26	1.29	0.17	0.06	0.36	0.00	1.41	0.01	0.89	1.19	7.60	0.20	0.70	0.00	0.00	0.00	0.05	0.00	1.58	0.00	0.00	0.00	0.00	2.05	0.00	0.13	0.00	0.15	0.10	0.91	0.15
230	0.43	9.86	0.13	0.00	0.01	0.21	1.05	0.14	0.03	0.17	0.00	1.14	0.00	0.72	0.94	6.28	0.13	0.56	0.00	0.00	0.00	0.03	0.00	1.27	0.00	0.00	0.00	0.00	1.63	0.00	0.08	0.00	0.07	0.05	0.66	0.12
235	0.30	8.15	0.07	0.00	0.01	0.16	0.86	0.11	0.01	0.05	0.00	0.92	0.00	0.57	0.72	5.18	0.08	0.45	0.00	0.00	0.00	0.01	0.00	1.00	0.00	0.00	0.00	0.00	1.27	0.00	0.04	0.00	0.02	0.01	0.44	0.10
240	0.19	6.70	0.03	0.00	0.00	0.12	0.69	0.09	0.00	0.00	0.00	0.72	0.00	0.44	0.53	4.26	0.04	0.35	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.95	0.00	0.02	0.00	0.00	0.00	0.27	0.08
245	0.11	5.48	0.01	0.00	0.00	0.08	0.56	0.07	0.00	0.00	0.00	0.54	0.00	0.32	0.37	3.48	0.02	0.26	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.14	0.06
250	0.05	4.46	0.00	0.00	0.00	0.05	0.43	0.06	0.00	0.00	0.00	0.40	0.00	0.22	0.24	2.83	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.05	0.05
255	0.01	3.64	0.00	0.00	0.00	0.03	0.33	0.04	0.00	0.00	0.00	0.27	0.00	0.14	0.14	2.31	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.01	0.03
260	0.00	2.96	0.00	0.00	0.00	0.01	0.24	0.03	0.00	0.00	0.00	0.17	0.00	0.08	0.06	1.87	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.02
265	0.00	2.38	0.00	0.00	0.00	0.00	0.16	0.02	0.00	0.00	0.00	0.09	0.00	0.04	0.02	1.50	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.01
270	0.00	1.88	0.00	0.00	0.00	0.00	0.10	0.01	0.00	0.00	0.00	0.04	0.00	0.01	0.00	1.17	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
275	0.00	1.44	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
280	0.00	1.05	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
285	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
290	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
295	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
305	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Printouts for Unit Hydrographs

flow in cfs

time in minutes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	(OS1) 32	(OS2) 33	(OS3) 34	(OS4) 35	(OS5) 36
5	39.06	49.06	28.60	76.96	5.22	14.75	26.15	5.67	22.26	81.67	37.29	36.07	66.04	30.25	41.99	39.19	23.94	23.71	47.89	15.74	11.33	11.17	107.22	51.61	9.97	58.05	57.18	30.05	53.69	19.76	20.44	31.63	40.75	32.05	54.93	5.58
10	54.67	123.67	32.97	87.90	5.06	16.13	40.17	5.70	23.14	133.15	39.11	60.03	82.91	43.80	69.03	92.20	26.85	31.61	52.30	14.92	10.63	10.97	122.04	79.24	9.54	58.05	59.91	29.61	104.26	19.40	21.75	31.56	49.33	35.88	90.59	5.57
15	52.81	166.57	31.07	76.87	4.64	15.40	39.51	5.47	21.34	129.81	34.97	59.77	76.40	42.74	68.35	117.24	25.32	30.70	46.81	12.61	8.81	10.12	107.50	77.64	8.45	50.00	53.49	25.72	111.71	17.35	20.34	27.62	46.27	33.34	89.42	5.33
20	48.16	175.94	27.34	62.15	3.94	14.04	37.47	5.08	18.11	115.02	28.83	56.50	62.48	39.91	63.98	118.16	22.40	28.61	38.38	10.53	7.41	8.67	87.14	72.71	7.11	41.14	44.08	21.25	106.50	14.45	17.76	22.80	39.96	28.49	82.36	4.92
25	40.87	171.04	23.52	52.03	3.51	12.12	34.06	4.51	15.87	95.79	24.86	50.76	54.23	35.31	56.39	113.46	19.30	25.33	32.96	8.84	6.16	7.64	73.43	64.46	6.18	34.61	37.96	18.04	95.61	12.56	15.40	19.43	34.32	24.71	70.05	4.34
30	36.70	159.70	20.83	43.09	3.08	11.00	29.73	4.07	13.84	83.65	20.88	44.14	45.98	31.11	49.29	104.67	17.17	22.44	27.54	7.44	5.22	6.72	60.70	56.54	5.26	28.89	31.84	15.03	81.93	10.67	13.63	16.15	30.02	21.56	62.04	3.93
35	32.53	141.91	18.15	37.24	2.66	9.87	27.20	3.72	11.82	71.50	18.19	40.04	39.41	28.12	44.31	91.79	15.04	20.33	24.00	6.44	4.48	5.80	52.76	51.07	4.60	25.06	27.75	13.14	73.81	9.27	11.86	14.17	25.72	18.42	54.87	3.58
40	28.36	126.24	15.94	31.38	2.39	8.74	24.66	3.36	10.61	62.60	15.86	35.94	34.63	25.12	39.33	83.42	13.17	18.21	20.83	5.44	3.73	5.18	44.82	45.60	4.05	21.24	24.17	11.25	65.70	8.16	10.47	12.19	22.83	16.46	47.71	3.23
45	25.51	115.80	14.36	25.53	2.13	7.82	22.13	3.01	9.41	55.65	13.53	31.85	29.86	22.12	34.52	76.41	11.91	16.10	17.67	4.44	2.99	4.64	36.88	40.14	3.50	17.41	20.58	9.36	57.58	7.04	9.42	10.21	20.32	14.61	42.69	2.87
50	23.07	105.35	12.78	19.68	1.88	7.15	19.80	2.75	8.22	48.70	11.20	28.82	25.08	20.28	31.63	69.40	10.66	14.74	14.50	3.43	2.26	4.09	28.94	36.73	2.95	13.58	16.99	7.47	52.30	5.92	8.37	8.23	17.81	12.76	38.56	2.64
55	20.64	94.91	11.20	16.53	1.62	6.48	18.32	2.54	7.03	41.75	8.87	26.43	20.30	18.52	28.74	62.39	9.40	13.49	11.34	2.91	2.01	3.55	23.55	33.54	2.40	11.26	13.40	5.95	47.64	4.80	7.32	6.43	15.29	10.91	34.42	2.43
60	18.21	86.04	9.62	14.58	1.37	5.81	16.83	2.32	5.83	34.80	7.51	24.05	16.30	16.77	25.84	57.15	8.14	12.25	9.83	2.58	1.77	3.00	20.90	30.35	1.95	9.99	11.44	5.32	42.99	3.89	6.28	5.77	12.78	9.06	30.28	2.22
65	15.77	80.12	8.04	12.63	1.12	5.14	15.34	2.11	4.69	27.85	6.73	21.66	14.71	15.01	22.95	53.14	6.88	11.00	8.77	2.24	1.52	2.45	18.26	27.16	1.76	8.71	10.25	4.69	38.33	3.52	5.23	5.11	10.26	7.24	26.15	2.00
70	13.34	74.21	6.58	10.68	0.98	4.47	13.86	1.90	4.29	24.82	5.96	19.28	13.11	13.26	20.06	49.14	5.63	9.76	7.72	1.91	1.27	2.13	15.61	23.96	1.58	7.43	9.05	4.06	33.68	3.15	4.33	4.45	9.20	6.63	22.01	1.79
75	10.93	68.30	6.06	8.73	0.90	3.80	12.37	1.69	3.89	22.50	5.18	16.90	11.52	11.50	17.17	45.13	5.07	8.51	6.66	1.57	1.02	1.95	12.96	20.77	1.39	6.16	7.85	3.43	29.02	2.77	3.98	3.79	8.36	6.01	18.13	1.58
80	10.12	62.38	5.53	6.78	0.81	3.21	10.89	1.48	3.49	20.18	4.40	14.51	9.93	9.75	14.28	41.13	4.65	7.27	5.61	1.24	0.78	1.77	10.32	17.58	1.21	4.88	6.66	2.80	24.37	2.40	3.63	3.13	7.53	5.39	16.75	1.37
85	9.31	56.47	5.01	4.83	0.73	2.99	9.40	1.26	3.09	17.87	3.63	12.13	8.34	8.50	13.06	37.12	4.23	6.23	4.55	0.91	0.53	1.59	7.67	15.36	1.03	3.61	5.46	2.17	21.53	2.03	3.28	2.47	6.69	4.78	15.37	1.16
90	8.50	50.56	4.48	2.88	0.65	2.76	8.00	1.12	2.70	15.55	2.85	11.33	6.75	7.92	12.10	33.12	3.81	5.81	3.50	0.57	0.28	1.41	5.02	14.30	0.84	2.33	4.27	1.54	19.98	1.66	2.93	1.81	5.85	4.16	13.99	1.07
95	7.68	44.64	3.95	0.93	0.56	2.54	7.50	1.05	2.30	13.23	2.07	10.53	5.15	7.33	11.14	29.11	3.39	5.40	2.44	0.24	0.03	1.22	2.38	13.24	0.66	1.05	3.07	0.91	18.43	1.28	2.59	1.15	5.01	3.55	12.61	1.00
100	6.87	38.73	3.43	0.00	0.48	2.32	7.01	0.98	1.90	10.92	1.30	9.74	3.56	6.75	10.17	25.10	2.97	4.98	1.39	0.00	0.00	1.04	0.00	12.17	0.48	0.00	1.87	0.28	16.88	0.91	2.24	0.49	4.17	2.93	11.23	0.93
105	6.06	34.43	2.90		0.39	2.09	6.51	0.91	1.50	8.60	0.52	8.94	1.97	6.16	9.21	22.90	2.55	4.57	0.33			0.86		11.11	0.29		0.68	0.00	15.33	0.54	1.89	0.00	3.34	2.31	9.85	0.85
110	5.25	32.46	2.37		0.31	1.87	6.02	0.84	1.10	6.28	0.00	8.15	0.38	5.58	8.24	21.57	2.14	4.15	0.00			0.68		10.04	0.11		0.00		13.78	0.17	1.54		2.50	1.70	8.48	0.78
115	4.44	30.48	1.85		0.22	1.64	5.52	0.77	0.70	3.97		7.36	0.00	4.99	7.28	20.23	1.72	3.74				0.50		8.98	0.00				12.22	0.00	1.19		1.66	1.08	7.10	0.71
120	3.63	28.51	1.32		0.14	1.42	5.03	0.70	0.31	1.65		6.56		4.41	6.32	18.90	1.30	3.32				0.32		7.92					10.67		0.84		0.82	0.47	5.72	0.64
125	2.82	26.54	0.79		0.05	1.20	4.53	0.62	0.00	0.00		5.77		3.82	5.35	17.56	0.88	2.91				0.13		6.85					9.12		0.49		0.00	0.00	4.34	0.57
130	2.01	24.57	0.27		0.00	0.97	4.04	0.55				4.97		3.24	4.39	16.23	0.46	2.49				0.00		5.79					7.57		0.14				2.96	0.50
135	1.19	22.60	0.00			0.75	3.54	0.48				4.18		2.65	3.43	14.89	0.04	2.08						4.72					6.02		0.00				1.58	0.43
140	0.38	20.63				0.53	3.05	0.41				3.38		2.07	2.46	13.56	0.00	1.66						3.66					4.47						0.20	0.36
145	0.00	18.66				0.30	2.55	0.34				2.59		1.48	1.50	12.22		1.25						2.60					2.92						0.00	0.29
150		16.69				0.08	2.06	0.27				1.79		0.90	0.53	10.89		0.83						1.53					1.36							0.22
155		14.72				0.00	1.56	0.20				1.00		0.31	0.00	9.55		0.42						0.47					0.00							0.15
160		12.74					1.07	0.13				0.20		0.00		8.22		0.00						0.00												0.08
165		10.77					0.57	0.06				0.00				6.88		0.00																		0.01
170		8.80					0.08	0.00								5.54																				0.00
175		6.83					0.00									4.21																				
180		4.86														2.87																				
185		2.89														1.54																				
190		0.92														0.20																				
195		0.00														0.00																				

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
C1	P	0.109	0.109	37.4	4.63	19.5	3.27	7.7	55	158,667	1.40	221,934	40.0	40	221,363	0.92
C2	X1	0.100	0.155	31.9	5.30	16.6	3.75	8.8	112	277,259	1.42	393,306	35.0	81	392,534	1.06
C3	O	0.099	0.133	26.4	4.19	13.7	2.96	7.0	93	190,648	1.42	270,701	35.0	64	269,846	1.22
C4	X2	0.097	0.119	29.1	4.16	15.1	2.94	6.9	59	131,878	1.43	188,214	35.0	41	187,567	1.14
C5	X3	0.120	0.131	46.9	6.23	24.4	4.40	10.4	62	225,024	1.38	311,107	45.0	48	311,075	0.77
C6	N	0.100	0.118	15.2	2.87	7.9	2.03	4.8	129	150,899	1.42	214,092	30.0	73	208,706	1.77
C7	V2	0.118	0.069	30.0	3.10	15.6	2.19	5.2	24	55,684	1.39	77,171	35.0	16	76,523	1.05
C8	U	0.156	0.056	40.0	3.23	20.8	2.28	5.4	7	21,272	1.36	28,856	40.0	5	28,711	0.82
C9	M	0.097	0.104	15.7	2.75	8.2	1.94	4.6	80	97,393	1.43	138,967	30.0	47	135,178	1.73
C10	V1	0.094	0.078	26.5	3.09	13.8	2.18	5.1	20	41,999	1.44	60,441	35.0	14	59,892	1.21
C11	L	0.105	0.069	32.9	3.24	17.1	2.29	5.4	23	57,681	1.41	81,214	35.0	16	80,597	1.01
C12	K	0.094	0.217	16.6	4.26	8.6	3.01	7.1	324	416,470	1.44	598,839	30.0	201	596,187	1.75
C13	R	0.108	0.122	33.0	4.58	17.1	3.23	7.6	80	203,861	1.40	285,653	35.0	57	284,875	1.01
C14	H	0.126	0.085	42.1	4.24	21.9	3.00	7.1	24	79,715	1.37	109,575	40.0	18	109,307	0.81
C15	J	0.126	0.095	38.9	4.33	20.2	3.06	7.2	34	101,894	1.37	140,063	40.0	24	139,728	0.86
C16	I	0.096	0.110	22.0	3.36	11.4	2.38	5.6	62	105,234	1.43	150,503	30.0	40	149,058	1.39
C17	E	0.119	0.167	54.0	8.41	28.1	5.95	14.0	92	386,704	1.38	535,352	50.0	75	534,977	0.70
C18	G	0.122	0.098	39.3	4.44	20.4	3.14	7.4	38	114,164	1.38	157,567	40.0	27	157,168	0.86
C19	D	0.095	0.134	20.3	3.59	10.5	2.54	6.0	94	148,358	1.44	213,029	30.0	61	211,555	1.50
C20	B2	0.105	0.076	38.3	3.74	19.9	2.65	6.2	24	72,564	1.41	102,126	40.0	18	101,809	0.90
C21	B1	0.100	0.140	29.6	4.67	15.4	3.30	7.8	95	216,856	1.42	307,783	35.0	67	306,584	1.12
C22	W	0.156	0.046	33.7	2.70	17.5	1.90	4.5	5	13,649	1.36	18,515	35.0	3	18,246	0.92
C23	S	0.093	0.107	21.8	3.29	11.3	2.32	5.5	47	78,662	1.44	113,604	30.0	31	112,488	1.42
B1	JJ	0.109	0.053	22.5	2.42	11.7	1.71	4.0	19	32,307	1.40	45,188	30.0	11	43,903	1.29
B2	LL	0.122	0.047	24.1	2.37	12.5	1.68	4.0	12	22,506	1.38	31,043	30.0	7	30,181	1.19
B3	KK	0.126	0.055	32.6	2.87	16.9	2.03	4.8	12	30,492	1.37	41,914	35.0	8	41,402	0.97
B4	EE1	0.126	0.124	30.2	4.37	15.7	3.09	7.3	79	184,658	1.37	253,830	35.0	53	252,727	1.05
B5	DD	0.126	0.142	41.6	6.04	21.6	4.27	10.1	78	252,285	1.37	346,789	40.0	58	346,842	0.83
B6	II3	0.126	0.088	25.0	3.19	13.0	2.25	5.3	45	87,011	1.37	119,605	35.0	28	118,504	1.18
B7	II2	0.126	0.087	23.9	3.09	12.4	2.18	5.1	45	83,962	1.37	115,413	30.0	28	114,044	1.21
B8	II1	0.126	0.123	53.3	6.54	27.7	4.62	10.9	44	183,061	1.37	251,634	50.0	35	251,692	0.69
B9	CC	0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	1.37	31,585	35.0	7	31,056	1.03
B10	AA	0.126	0.103	26.0	3.55	13.5	2.51	5.9	61	122,694	1.37	168,654	35.0	39	167,923	1.16
B11	BB	0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	1.37	185,370	35.0	41	184,724	1.09
B12	FF	0.126	0.078	26.0	3.05	13.5	2.15	5.1	33	65,703	1.37	90,315	35.0	21	89,406	1.15
B13	GG	0.126	0.074	33.9	3.43	17.6	2.43	5.7	23	59,351	1.37	81,583	35.0	15	81,214	0.95
B14	HH	0.126	0.066	28.7	2.96	14.9	2.09	4.9	21	46,101	1.37	63,370	35.0	14	62,681	1.07
B15	EE2	0.078	0.121	11.6	2.58	6.0	1.83	4.3	66	59,387	1.52	90,334	30.0	36	86,502	2.18
B16	EE3	0.086	0.073	19.8	2.61	10.3	1.84	4.3	16	24,212	1.48	35,738	30.0	10	34,826	1.56
OS1	A	0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	1.36	93,513	35.0	21	93,026	1.10
OS2	C	0.156	0.128	32.3	4.68	16.8	3.31	7.8	53	132,096	1.36	179,196	35.0	35	178,684	0.97
OS3	F	0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	1.36	124,339	35.0	24	123,917	0.96
OS4	Q	0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	1.36	355,978	40.0	65	355,849	0.89
OS5	T	0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	1.36	25,803	40.0	4	25,686	0.77

Printouts for Storm Hydrographs

flow in cfs

time in minutes	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	OS1	OS2	OS3	OS4	OS5
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.04	0.14	0.15	0.12	0.01	0.22	0.01	0.00	0.18	0.06	0.03	0.82	0.06	0.00	0.01	0.15	0.02	0.01	0.25	0.03	0.14	0.00	0.15	0.02	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.46	0.08	0.00	0.00	0.00	0.00	0.00
15	0.53	1.98	2.02	1.57	0.20	2.97	0.14	0.00	2.33	0.81	0.37	11.11	0.86	0.06	0.08	1.95	0.24	0.14	3.36	0.37	1.88	0.00	2.02	0.21	0.05	0.03	0.18	0.14	0.12	0.12	0.07	0.03	0.16	0.15	0.09	0.06	0.06	5.97	1.01	0.00	0.00	0.00	0.01	0.00
20	5.75	13.08	12.70	8.54	4.17	18.63	2.59	0.48	12.34	3.55	3.05	50.05	8.66	2.03	2.76	9.90	4.43	3.25	15.47	3.15	12.08	0.37	8.27	2.28	1.19	1.13	6.42	4.86	4.19	4.24	2.53	0.93	5.51	5.37	3.06	2.07	1.94	16.28	3.39	2.24	3.07	2.27	3.89	0.39
25	23.57	47.21	44.05	28.34	20.98	62.23	11.41	3.03	39.37	10.82	11.28	153.84	34.76	10.31	14.10	31.59	23.44	15.70	47.85	11.82	42.64	2.31	24.48	8.93	5.58	5.61	32.75	26.37	20.71	20.92	13.99	4.61	27.43	26.92	15.09	10.31	9.58	34.65	8.67	14.08	19.95	14.54	26.98	2.48
30	35.36	72.71	61.35	39.37	36.95	73.48	15.50	4.31	46.54	13.91	15.20	200.94	51.58	15.43	21.22	40.37	47.93	23.70	61.12	16.47	62.19	3.24	30.83	11.49	7.36	7.71	49.02	46.29	28.02	28.04	25.66	6.28	38.06	38.42	20.42	14.46	13.08	35.71	10.38	19.93	31.56	22.03	50.95	3.55
35	39.44	80.91	63.86	41.46	44.18	66.38	16.15	4.71	42.30	13.99	15.97	187.58	56.59	17.31	23.73	39.19	63.28	26.57	58.68	17.86	66.93	3.45	29.77	11.21	7.29	8.14	53.25	54.94	28.32	27.96	31.23	6.53	39.23	40.62	20.78	15.49	13.56	29.45	9.76	20.84	35.31	24.27	61.71	3.91
40	40.00	80.19	60.81	39.93	47.04	58.03	15.67	4.81	37.16	13.30	15.63	163.94	56.16	17.86	24.25	36.40	70.51	27.18	53.69	17.99	64.79	3.41	27.56	10.50	6.94	7.98	51.95	57.78	26.98	26.51	33.75	6.34	37.52	39.28	19.88	15.35	13.12	23.84	8.85	20.11	35.24	24.13	64.68	4.04
45	38.81	76.57	56.84	37.81	47.59	49.93	14.96	4.71	32.27	12.44	15.05	143.78	53.94	17.61	23.65	33.28	73.81	26.52	48.63	17.48	61.60	3.31	25.15	9.69	6.46	7.71	49.78	57.49	25.20	24.62	34.82	6.07	35.21	37.29	18.67	14.85	12.48	19.13	7.99	19.03	33.98	23.30	63.33	3.99
50	37.78	73.05	53.34	35.84	46.80	43.06	14.31	4.64	28.08	11.71	14.50	126.14	51.84	17.32	23.18	30.92	74.68	25.99	44.53	17.05	58.51	3.22	23.30	9.08	6.11	7.46	47.64	56.16	23.79	23.22	34.94	5.80	33.24	35.42	17.67	14.40	11.89	16.17	7.25	18.03	32.74	22.51	61.61	3.95
55	36.42	69.15	50.13	33.84	45.96	37.83	13.59	4.52	24.59	10.99	13.78	109.53	49.30	16.91	22.49	28.25	73.70	25.23	39.95	16.45	55.28	3.08	21.22	8.36	5.71	7.10	45.19	54.77	22.32	21.67	34.39	5.52	31.33	33.58	16.65	13.75	11.29	13.28	6.44	17.10	31.16	21.44	59.64	3.87
60	34.99	66.08	47.12	32.15	45.09	34.14	13.01	4.39	22.23	10.32	13.26	98.62	47.28	16.45	21.73	25.63	72.52	24.39	35.74	15.85	52.60	2.98	19.21	7.63	5.31	6.85	43.26	53.16	20.89	20.10	33.96	5.29	29.52	32.01	15.68	13.26	10.79	10.92	5.76	16.27	29.97	20.65	57.32	3.79
65	33.99	63.45	44.06	30.50	44.13	30.86	12.45	4.28	20.24	9.64	12.81	90.47	45.61	16.00	21.14	23.47	71.62	23.71	33.07	15.41	50.06	2.90	17.60	7.00	4.91	6.63	41.47	51.55	19.41	18.56	33.60	5.07	27.66	30.44	14.69	12.86	10.28	9.28	5.34	15.41	28.98	19.99	55.57	3.70
70	33.16	60.82	41.11	28.83	43.15	27.69	11.87	4.21	18.32	9.00	12.35	82.86	43.98	15.71	20.71	22.17	70.70	23.22	31.24	15.06	47.47	2.81	16.62	6.63	4.60	6.40	39.63	50.47	18.07	17.41	33.18	4.83	25.84	28.81	13.72	12.48	9.74	8.61	5.03	14.52	27.99	19.34	54.26	3.64
75	32.01	57.46	38.23	26.81	42.22	23.81	11.09	4.09	15.86	8.37	11.69	73.26	41.76	15.33	20.09	20.77	69.35	22.53	28.96	14.54	44.27	2.68	15.54	6.24	4.33	6.06	37.15	49.28	16.99	16.39	32.51	4.51	24.14	26.77	12.83	11.90	9.06	7.91	4.62	13.46	26.61	18.39	52.62	3.56
80	30.52	53.48	35.86	24.90	41.16	20.63	10.27	3.93	13.52	7.85	10.90	62.89	39.04	14.82	19.27	19.16	67.57	21.63	26.30	13.88	40.99	2.52	14.30	5.79	4.06	5.66	34.37	47.67	15.98	15.34	31.73	4.19	22.68	24.99	12.06	11.18	8.45	7.20	4.15	12.65	24.88	17.21	50.36	3.45
85	28.91	49.88	33.84	23.53	40.01	18.89	9.73	3.77	12.27	7.41	10.17	55.41	36.41	14.28	18.39	17.65	66.08	20.65	23.74	13.19	38.70	2.36	13.13	5.37	3.81	5.30	32.47	45.85	15.06	14.38	31.05	3.97	21.45	23.69	11.41	10.48	8.02	6.74	3.71	12.01	23.21	16.05	47.81	3.34
90	27.30	47.47	32.03	22.45	38.82	17.87	9.32	3.61	11.58	7.02	9.70	51.49	34.60	13.71	17.48	16.21	64.72	19.65	21.37	12.49	36.94	2.25	12.02	4.97	3.58	5.06	31.08	43.96	14.21	13.49	30.41	3.81	20.33	22.63	10.82	9.94	7.67	6.44	3.30	11.45	22.14	15.32	45.18	3.22
95	25.90	45.63	30.33	21.46	37.60	17.18	8.96	3.44	11.12	6.65	9.36	49.19	33.32	13.14	16.61	14.83	63.36	18.68	19.28	11.85	35.38	2.17	10.96	4.59	3.36	4.89	29.88	42.04	13.40	12.63	29.77	3.66	19.28	21.66	10.26	9.58	7.36	6.27	2.97	10.93	21.36	14.78	42.76	3.10
100	24.54	43.13	27.84	20.00	35.96	15.40	8.37	3.22	9.99	6.08	8.82	44.71	31.52	12.35	15.64	12.92	61.56	17.57	16.97	11.18	33.11	2.05	9.54	4.02	3.01	4.61	28.05	39.62	12.15	11.31	28.83	3.42	17.65	20.14	9.37	9.05	6.84	5.49	2.64	10.11	20.21	13.98	40.69	2.92
105	23.32	40.44	25.29	18.50	34.04	14.04	7.80	3.06	9.11	5.52	8.31	40.58	29.68	11.63	14.86	11.36	59.31	16.68	15.34	10.63	30.73	1.94	8.42	3.51	2.68	4.34	26.16	37.28	10.91	10.01	27.71	3.18	16.03	18.62	8.51	8.56	6.34	4.96	2.41	9.29	19.02	13.17	38.65	2.75
110	22.19	37.85	22.83	17.07	32.14	13.05	7.26	2.93	8.47	4.99	7.83	37.65	27.93	11.09	14.18	10.40	56.92	15.92	14.23	10.13	28.44	1.84	7.72	3.19	2.38	4.09	24.36	35.51	9.74	8.88	26.57	2.96	14.48	17.17	7.69	8.09	5.86	4.61	2.24	8.51	17.88	12.40	36.77	2.62
115	21.16	35.43	20.55	15.72	30.49	12.31	6.75	2.81	7.99	4.50	7.37	35.51	26.30	10.64	13.57	9.75	54.48	15.24	13.39	9.68	26.30	1.74	7.24	2.98	2.17	3.85	22.69	34.02	8.74	8.15	25.40	2.75	13.05	15.81	6.93	7.66	5.41	4.40	2.11	7.77	16.82	11.69	35.02	2.51
120	20.06	32.88	18.35	14.27	29.19	11.39	6.19	2.68	7.40	4.02	6.88	33.00	24.55	10.19	12.92	9.08	51.90	14.52	12.47	9.19	24.01	1.63	6.74	2.78	2.00	3.59	20.87	32.55	8.01	7.55	24.16	2.52	11.72	14.33	6.22	7.19	4.92	4.09	1.96	6.99	15.69	10.92	33.25	2.41
125	18.12	28.75	15.32	11.89	27.29	8.30	5.19	2.42	5.44	3.30	5.96	25.50	21.55	9.33	11.72	7.35	48.52	13.19	9.95	8.28	20.28	1.43	5.45	2.25	1.64	3.10	17.77	30.12	6.62	6.20	22.42	2.11	9.71	11.84	5.13	6.30	4.05	2.64	1.54	5.71	13.73	9.54	30.40	2.20
130	16.05	24.18	12.56	9.59	25.05	5.88	4.24	2.18	3.91	2.71	5.08	18.34	18.38	8.45	10.47	5.79	44.72	11.81	7.66	7.37	16.48	1.23	4.28	1.78	1.33	2.64	14.57	27.23	5.38	4.99	20.65	1.72	7.94	9.59	4.20	5.44	3.27	1.66	1.18	4.67	11.65	8.12	26.93	2.00
135	14.07	19.84	10.23	7.82	22.89	4.12	3.43	1.94	2.78	2.21	4.25	13.22	15.37	7.60	9.28	4.56	41.26	10.48	5.91	6.50	13.34	1.04	3.37	1.42	1.07	2.20	11.72	24.44	4.36	4.00	19.07	1.39	6.47	7.85	3.42	4.62	2.68	1.02	0.91	3.83	9.68	6.79	23.57	1.82
140	12.24	16.05	8.34	6.48	20.84	2.80	2.83	1.73	1.93	1.81	3.50	9.43	12.62	6.82	8.17	3.57	38.10	9.25	4.52	5.70	11.01	0.88	2.63	1.12	0.86	1.81	9.65	21.82	3.51	3.20	17.60	1.15	5.26	6.48	2.79	3.87	2.22	0.61	0.69	3.15	7.89	5.57	20.43	1.64
145	10.56	13.16	6.78	5.36	18.94	1.86	2.35	1.53	1.30	1.48	2.83	6.49	10.21	6.09	7.16	2.78	35.14	8.12	3.42	4.96	9.12	0.72	2.04	0.88	0.69	1.47	8.01	19.41	2.83	2.55	16.23	0.96	4.27	5.35	2.26	3.18	1.83	0.35	0.52	2.58	6.44	4.52	17.57	1.48
150	8.97	10.95	5.51	4.43	17.20	1.25	1.95	1.34	0.87	1.20	2.34	4.40	8.44	5.42	6.21	2.12	32.40	7.06	2.53	4.26	7.55	0.59	1.55	0.67	0.54	1.22	6.66	17.18	2.26	2.01	14.97	0.80	3.45	4.41	1.83	2.59	1.52	0.17	0.38	2.11	5.35	3.75	14.90	1.32
155	7.49	9.16	4.40	3.64	15.57	0.79	1.62	1.16	0.57	0.96	1.97	3.00	7.08	4.78	5.31	1.60	29.91	6.07	1.85	3.61	6.24	0.49	1.17	0.51	0.42	1.02	5.53	15.10	1.77	1.55	13.81	0.66	2.75	3.60	1.46	2.16	1.24	0.05	0.28	1.71	4.48	3.14	12.39	1.18
160	6.14	7.64	3.47	2.96	14.04	0.44	1.33	1.00	0.34	0.76	1.65	1.91	5.94	4.19	4.47	1.20	27.58	5.13	1.36	2.99	5.10	0.41	0.87	0.39	0.33	0.86	4.54	13.13	1.37	1.19	12.72	0.54	2.16	2.91	1.14	1.82	1.01	0.00	0.20	1.36	3.74	2.63	10.11	1.05
165	5.07	6.31	2.72	2.38	12.60	0.19	1.08	0.84	0.16	0.60	1.38	1.07	4.95	3.63	3.68	0.89	25.38	4.24	0.96	2.44	4.13	0.35	0.65	0.29	0.25	0.71	3.70	11.28	1.06	0.91	11.70	0.44	1.69	2.33	0.89	1.52	0.81	0.00	0.14	1.08	3.10	2.19	8.40	0.92
170	4.26	5.17	2.13	1.90	11.24	0.04	0.87	0.69	0.05	0.47	1.14	0.47	4.09	3.08	3.03	0.64	23.31	3.47	0.65	2.04	3.31	0.29	0.46	0.21	0.19	0.59	2.98	9.51	0.83	0.69	10.73	0.35	1.32	1.85	0.70	1.27	0.65	0.00	0.09	0.85	2.55	1.80	7.08	0.80
175	3.59	4.21	1.66	1.52	9.94	0.00	0.70	0.57	0.00	0.37	0.94	0.12	3.36	2.56	2.55	0.44	21.37	2.91	0.41	1.72	2.65	0.24	0.31	0.15	0.14	0.48	2.40	7.84	0.62	0.51	9.83	0.28	1.02	1.48	0.54	1.05	0.52	0.00	0.05	0.67	2.08	1.48	5.96	0.69
180	3.02	3.42	1.26	1.21	8.69	0.00	0.57	0.48	0.00	0.28	0.77	0.00	2.75	2.09	2.15	0.28	19.55	2.46	0.22	1.45	2.13	0.20	0.20	0.10	0.10	0.40	1.93	6.47	0.45	0.35	8.97	0.23	0.76	1.17	0.40	0.87	0.41	0.00	0.03	0.52	1.70	1.21	5.00	0.57
185	2.53	2.77	0.91	0.94	7.49	0.00	0.45	0.41	0.00	0.20	0.63	0.00	2.25	1.76	1.82	0.16	17.80	2.08	0.09	1.22	1.67	0.16	0.11	0.06	0.07	0.32	1.54	5.45	0.31	0.24	8.14	0.18	0.55	0.90	0.29	0.72	0.32	0.00	0.01	0.39	1.38	0.99	4.17	0.47
190	2.12	2.22	0.64	0.71	6.33	0.00	0.35	0.35	0.00	0.14	0.51	0.00	1.82	1.49	1.53	0.07	16.10	1.76	0.02	1.03	1.28	0.13	0.05	0.03	0.04	0.26	1.19	4.62	0.21	0.14	7.34	0.14	0.38	0.67	0.20	0.59	0.24	0.00	0.00	0.28	1.11	0.80	3.49	0.39
195	1.78	1.73	0.42	0.52	5.23	0.00	0.26	0.29	0.00	0.10	0.41	0.00	1.45	1.27	1.29	0.02	14.47	1.48	0.00	0.87	0.95	0.11	0.01	0.01	0.02	0.21	0.90	3.93	0.12	0.07	6.57	0.10	0.24	0.48	0.13	0.47	0.17	0.00	0.00	0.19	0.88	0.63	2.91	0.33
200	1.47	1.32	0.25	0.36	4.33	0.00	0.19	0.25	0.00	0.06	0.32	0.00	1.13	1.09	1.09	0.00	12.91	1.25	0.00	0.72	0.67	0.08	0.00	0.00	0.01	0.16	0.65	3.34	0.06	0.03	5.84	0.07	0.14	0.33	0.07	0.37	0.12	0.00	0.00	0.12	0.67	0.49	2.39	0.29
205	1.20	0.97	0.13	0.24	3.68	0.00	0.13	0.21	0.00	0.03	0.24	0.00	0.85	0.92	0.90	0.00	11.39	1.04	0.00	0.59	0.46	0.06	0.00	0.00	0.00	0.12	0.45	2.83	0.02	0.00	5.12	0.05	0.07	0.21	0.03	0.29	0.08	0.00	0.00	0.07	0.50	0.37	1.94	0.25
210	0.96	0.68	0.04	0.14	3.17	0.00	0.08	0.17	0.00	0.01	0.17	0.00	0.62	0.78	0.73	0.00	9.92	0.85	0.00	0.48	0.29	0.05	0.00	0.00	0.00	0.09	0.29	2.38	0.00	0.00	4.42	0.03	0.02	0.12	0.01	0.22	0.05	0.00	0.00	0.03	0.36	0.26	1.55	0.21
215	0.75	0.45	0.00	0.07	2.73	0.00	0.05	0.14	0.00	0.00	0.12	0.00	0.43	0.65	0.59	0.00	8.50	0.69	0.00	0.38	0.16	0.03	0.00	0.00	0.00	0.06	0.17	1.97	0.00	0.00	3.75	0.02	0.00	0.05	0.00	0.16	0.02	0.00	0.00	0.01	0.24	0.18	1.21	0.18
220	0.58	0.28	0.00	0.02	2.34	0.00	0.02	0.11	0.00	0.00	0.08	0.00	0.28	0.53	0.47	0.00	7.12	0.54	0.00	0.30	0.07	0.02	0.00	0.00	0.00	0.04	0.08	1.61	0.00	0.00	3.12	0.01	0.00	0.01	0.00	0.11	0.01	0.00	0.00	0.00	0.15	0.12	0.92	0.15
225	0.43	0.14	0.00	0.00	1.98	0.00	0.01	0.09	0.00	0.00	0.05	0.00	0.17	0.43	0.36	0.00	5.90	0.42	0.00	0.23	0.02	0.02	0.00	0.00	0.00	0.02	0.03	1.29	0.00	0.00	2.63	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.08	0.07	0.67	0.12
230	0.30	0.05	0.00	0.00	1.66	0.00	0.00	0.07	0.00	0.00	0.02	0.00	0.08	0.34	0.27	0.00	5.04	0.32	0.00	0.17	0.00	0.01	0.00	0.00	0.00	0.01	0.00	1.02	0.00	0.00	2.26	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.04	0.03	0.47	0.10
235	0.21	0.01	0.00	0.00	1.38	0.00	0.00	0.05	0.00	0.00	0.01	0.00	0.03	0.27	0.19	0.00	4.36	0.23	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	1.95	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.31	0.08
240	0.13	0.00	0.00	0.00	1.12	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.20	0.13	0.00	3.77	0.16	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	1.68	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.06
245	0.07	0.00	0.00	0.00	0.90	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.15	0.08	0.00	3.23	0.10	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.00	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.05
250	0.03	0.00	0.00	0.00	0.71	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.10	0.05	0.00	2.75	0.06	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.03
255	0.01	0.00	0.00	0.00	0.55	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.07	0.02	0.00	2.32	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
260	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	1.93	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
265	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
270	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
275	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
280	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
285	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
290	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
295	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
320	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Printouts for Unit Hydrographs

flow in cfs

time in minutes	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	OS1	OS2	OS3	OS4	OS5
5	45.34	82.91	82.65	52.25	39.08	128.52	23.97	6.81	80.02	20.40	22.44	284.52	66.66	21.54	29.37	60.88	39.45	32.05	90.88	23.13	77.75	5.22	46.13	18.51	12.02	12.10	68.24	51.02	44.80	45.37	26.45	9.97	58.83	57.18	32.68	22.09	20.71	65.48	15.79	31.63	43.36	32.05	54.93	5.58
10	54.47	111.91	91.29	57.68	61.90	103.08	23.22	6.76	64.93	19.54	22.07	302.60	79.27	24.30	33.58	58.21	81.91	37.34	88.53	24.18	93.85	5.06	43.70	16.90	11.11	11.73	78.07	78.33	42.87	42.87	43.98	9.54	58.81	59.91	31.15	22.14	19.91	44.42	14.04	31.56	52.46	35.88	90.59	5.57
15	51.97	105.69	80.26	52.17	61.19	74.64	20.77	6.40	47.60	16.76	20.25	215.59	74.24	23.37	32.06	45.83	92.45	35.73	68.11	22.89	86.21	4.64	34.34	13.46	8.99	10.68	71.58	76.75	35.84	34.89	44.04	8.45	50.57	53.49	26.44	20.49	17.54	29.78	10.86	27.62	49.05	33.34	89.42	5.33
20	46.86	90.99	65.31	42.92	58.42	55.89	17.36	5.80	35.82	13.93	17.14	158.26	64.06	21.58	29.12	37.74	90.81	32.56	54.51	20.58	70.75	3.94	28.20	11.16	7.60	9.01	59.07	71.92	29.73	29.09	42.66	7.11	41.60	44.08	21.99	17.62	14.65	20.12	8.59	22.80	42.01	28.49	82.36	4.92
25	40.16	77.37	55.15	37.17	53.70	41.56	15.13	5.04	27.23	11.77	15.15	124.60	55.11	18.94	25.06	30.19	86.81	27.99	43.59	17.82	61.53	3.51	22.58	9.03	6.22	7.98	51.60	63.84	24.63	23.71	40.24	6.18	34.95	37.96	18.45	15.44	12.65	12.27	6.98	19.43	36.14	24.71	70.05	4.34
30	36.04	67.19	45.65	31.41	47.04	27.23	12.90	4.58	18.65	9.86	13.25	90.94	48.22	17.04	22.63	25.47	80.44	25.31	35.74	16.05	52.31	3.08	19.01	7.67	5.32	6.96	44.13	55.98	20.76	20.14	36.78	5.26	29.19	31.84	15.50	13.59	10.64	9.05	5.65	16.15	31.47	21.56	62.04	3.93
35	31.91	57.01	39.75	27.17	43.02	21.44	11.21	4.11	14.03	8.59	11.34	62.31	41.33	15.42	20.21	20.76	71.71	22.64	27.90	14.28	44.86	2.66	15.43	6.30	4.49	5.98	37.83	50.60	17.77	16.98	32.81	4.60	25.29	27.75	13.42	11.74	9.34	5.83	4.32	14.17	26.80	18.42	54.87	3.58
40	27.79	50.72	33.86	23.81	39.27	16.66	9.89	3.64	11.17	7.31	10.20	51.09	36.71	13.81	17.78	16.05	65.58	19.96	20.06	12.51	39.51	2.39	11.85	4.94	3.67	5.37	33.47	45.21	14.77	13.81	30.46	4.05	21.40	24.17	11.33	10.46	8.15	2.61	3.10	12.19	23.91	16.46	47.71	3.23
45	25.19	44.82	27.96	20.45	35.52	11.88	8.57	3.27	8.31	6.04	9.07	39.87	32.68	12.21	15.99	12.03	60.64	17.90	16.67	11.35	34.15	2.13	8.97	3.67	2.85	4.76	29.10	39.83	11.78	10.65	28.11	3.50	17.50	20.58	9.25	9.37	6.96	0.00	2.66	10.21	21.18	14.61	42.69	2.87
50	22.77	38.93	22.06	17.08	31.76	7.11	7.25	2.99	5.45	4.76	7.94	28.65	28.64	11.25	14.55	10.46	55.71	16.31	14.05	10.30	28.79	1.88	7.78	3.21	2.28	4.15	24.74	36.41	8.93	8.55	25.77	2.95	13.61	16.99	7.16	8.27	5.77		2.22	8.23	18.45	12.76	38.56	2.64
55	20.34	33.03	17.80	13.72	29.25	2.33	5.93	2.71	2.59	3.89	6.80	17.43	24.61	10.30	13.11	8.89	50.78	14.73	11.44	9.24	23.44	1.62	6.59	2.76	2.01	3.54	20.37	33.27	7.93	7.50	23.42	2.40	11.36	13.40	6.05	7.17	4.58		1.77	6.43	15.72	10.91	34.42	2.43
60	17.91	27.14	15.84	11.27	27.05	0.00	4.74	2.43	0.00	3.46	5.67	6.21	20.58	9.34	11.68	7.32	46.02	13.15	8.82	8.19	18.65	1.37	5.40	2.30	1.73	2.93	16.01	30.13	6.93	6.45	21.53	1.95	10.06	11.44	5.36	6.07	3.89		1.33	5.77	12.99	9.06	30.28	2.22
65	15.49	22.03	13.87	10.14	24.85		4.29	2.15		3.04	4.54	0.00	16.54	8.38	10.24	5.75	43.15	11.57	6.21	7.14	16.86	1.12	4.20	1.85	1.46	2.39	14.41	26.98	5.93	5.39	20.15	1.76	8.76	10.25	4.66	4.97	3.50		0.89	5.11	10.46	7.24	26.15	2.00
70	13.06	20.07	11.90	9.02	22.65		3.85	1.87		2.61	4.15		14.82	7.43	8.81	4.18	40.28	9.99	3.60	6.09	15.07	0.98	3.01	1.39	1.19	2.18	12.96	23.84	4.94	4.34	18.77	1.58	7.46	9.05	3.97	4.30	3.10		0.44	4.45	9.55	6.63	22.01	1.79
75	10.84	18.10	9.94	7.90	20.45		3.41	1.59		2.19	3.78		13.47	6.47	7.37	2.61	37.41	8.40	0.98	5.03	13.29	0.90	1.82	0.94	0.91	1.98	11.50	20.70	3.94	3.28	17.39	1.39	6.16	7.85	3.27	3.94	2.71		0.00	3.79	8.64	6.01	18.13	1.58
80	10.04	16.14	7.97	6.78	18.24		2.97	1.35		1.76	3.40		12.13	5.51	6.49	1.04	34.55	7.28	0.00	4.59	11.50	0.81	0.62	0.49	0.64	1.78	10.05	17.55	2.94	2.23	16.00	1.21	4.86	6.66	2.57	3.57	2.31		0.00	3.13	7.73	5.39	16.75	1.37
85	9.23	14.17	6.01	5.66	16.04		2.53	1.26		1.34	3.02		10.78	4.78	6.01	0.00	31.68	6.75		4.24	9.72	0.73	0.00	0.03	0.36	1.57	8.59	15.25	1.94	1.18	14.62	1.03	3.56	5.46	1.88	3.21	1.91			2.47	6.83	4.78	15.37	1.16
90	8.42	12.21	4.04	4.54	13.84		2.09	1.16		0.92	2.64		9.44	4.46	5.53		28.81	6.23		3.89	7.93	0.65		0.00	0.09	1.37	7.14	14.20	0.94	0.12	13.24	0.84	2.26	4.27	1.18	2.84	1.52			1.81	5.92	4.16	13.99	1.07
95	7.61	10.24	2.07	3.42	12.15		1.65	1.07		0.49	2.27		8.09	4.14	5.05		25.94	5.70		3.54	6.15	0.56			0.00	1.17	5.68	13.15	0.00	0.00	11.86	0.66	0.97	3.07	0.49	2.47	1.12			1.15	5.01	3.55	12.61	1.00
100	6.80	8.28	0.11	2.30	11.42		1.21	0.98		0.07	1.89		6.75	3.82	4.57		23.08	5.17		3.19	4.36	0.48				0.96	4.23	12.10			10.48	0.48	0.00	1.87	0.00	2.11	0.72			0.49	4.10	2.93	11.23	0.93
105	5.99	6.31	0.00	1.17	10.68		0.77	0.88		0.00	1.51		5.40	3.50	4.09		20.21	4.64		2.84	2.58	0.39				0.76	2.77	11.06			9.09	0.29		0.68		1.74	0.33			0.00	3.19	2.31	9.85	0.85
110	5.18	4.35		0.05	9.95		0.33	0.79			1.14		4.06	3.18	3.62		18.11	4.12		2.49	0.79	0.31				0.55	1.32	10.01			8.49	0.11		0.00		1.38	0.00				2.28	1.70	8.48	0.78
115	4.37	2.38		0.00	9.21		0.00	0.69			0.76		2.71	2.86	3.14		17.16	3.59		2.13	0.00	0.22				0.35	0.00	8.96			8.03	0.00				1.01					1.37	1.08	7.10	0.71
120	3.56	0.42			8.48			0.60			0.38		1.37	2.54	2.66		16.20	3.06		1.78		0.14				0.15		7.91			7.57					0.65					0.46	0.47	5.72	0.64
125	2.76	0.00			7.75			0.51			0.00		0.02	2.23	2.18		15.25	2.54		1.43		0.05				0.00		6.87			7.11					0.28					0.00	0.00	4.34	0.57
130	1.95				7.01			0.41			0.00		0.00	1.91	1.70		14.29	2.01		1.08		0.00						5.82			6.65					0.00							2.96	0.50
135	1.14				6.28			0.32						1.59	1.22		13.33	1.48		0.73								4.77			6.18												1.58	0.43
140	0.33				5.55			0.23						1.27	0.75		12.38	0.95		0.38								3.72			5.72												0.20	0.36
145	0.00				4.81			0.13						0.95	0.27		11.42	0.43		0.03								2.68			5.26												0.00	0.29
150					4.08			0.04						0.63	0.00		10.47	0.00		0.00								1.63			4.80													0.22
155					3.34			0.00						0.31			9.51											0.58			4.34													0.15
160					2.61									0.00			8.55											0.00			3.88													0.08
165					1.88												7.60														3.42													0.01
170					1.14												6.64														2.96													0.00
175					0.41												5.69														2.50													
180					0.00												4.73														2.04													
185																	3.77														1.58													
190																	2.82														1.12													
195																	1.86														0.66													
200																	0.91														0.19													
205																	0.00														0.00													

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
C1	P	0.109	0.109	37.4	4.63	19.5	3.27	7.7	55	158,667	2.57	407,452	45.0	83	406,404	1.90
C2	X1	0.100	0.155	31.9	5.30	16.6	3.75	8.8	112	277,259	2.58	715,935	45.0	163	714,529	2.14
C3	O	0.099	0.133	26.4	4.19	13.7	2.96	7.0	93	190,648	2.58	492,472	40.0	127	490,916	2.43
C4	X2	0.097	0.119	29.1	4.16	15.1	2.94	6.9	59	131,878	2.59	341,350	40.0	82	340,177	2.27
C5	X3	0.120	0.131	46.9	6.23	24.4	4.40	10.4	62	225,024	2.56	575,240	50.0	101	575,182	1.62
C6	N	0.100	0.118	15.2	2.87	7.9	2.03	4.8	129	150,899	2.58	389,674	35.0	141	379,871	3.40
C7	V2	0.118	0.069	30.0	3.10	15.6	2.19	5.2	24	55,684	2.56	142,481	40.0	33	141,285	2.17
C8	U	0.126	0.047	39.1	2.90	20.3	2.05	4.8	7	21,272	2.55	54,257	45.0	11	53,777	1.79
C9	M	0.097	0.104	15.7	2.75	8.2	1.94	4.6	80	97,393	2.59	252,068	35.0	89	245,194	3.32
C10	V1	0.094	0.078	26.5	3.09	13.8	2.18	5.1	20	41,999	2.60	109,069	40.0	28	108,078	2.39
C11	L	0.105	0.069	32.9	3.24	17.1	2.29	5.4	23	57,681	2.57	148,506	40.0	32	147,376	2.04
C12	K	0.094	0.217	16.6	4.26	8.6	3.01	7.1	324	416,470	2.60	1,081,182	35.0	382	1,076,395	3.33
C13	R	0.108	0.122	33.0	4.58	17.1	3.23	7.6	80	203,861	2.57	523,871	45.0	116	522,444	2.07
C14	H	0.126	0.085	42.1	4.24	21.9	3.00	7.1	24	79,715	2.55	203,324	45.0	38	202,827	1.72
C15	J	0.126	0.095	38.9	4.33	20.2	3.06	7.2	34	101,894	2.55	259,896	45.0	51	259,274	1.82
C16	I	0.096	0.110	22.0	3.36	11.4	2.38	5.6	62	105,234	2.59	272,611	35.0	78	269,994	2.69
C17	E	0.119	0.167	54.0	8.41	28.1	5.95	14.0	92	386,704	2.56	989,065	55.0	158	988,371	1.48
C18	G	0.122	0.098	39.3	4.44	20.4	3.14	7.4	38	114,164	2.55	291,648	45.0	57	290,911	1.82
C19	D	0.095	0.134	20.3	3.59	10.5	2.54	6.0	94	148,358	2.59	384,936	35.0	117	382,272	2.87
C20	B2	0.105	0.076	38.3	3.74	19.9	2.65	6.2	24	72,564	2.57	186,792	45.0	37	186,213	1.86
C21	B1	0.100	0.140	29.6	4.67	15.4	3.30	7.8	95	216,856	2.58	560,078	40.0	134	557,898	2.24
C22	W	0.126	0.038	32.9	2.47	17.1	1.74	4.1	5	13,649	2.55	34,813	40.0	7	34,153	1.98
C23	S	0.093	0.107	21.8	3.29	11.3	2.32	5.5	47	78,662	2.60	204,568	35.0	59	202,558	2.72
B1	JJ	0.109	0.053	22.5	2.42	11.7	1.71	4.0	19	32,307	2.57	82,963	35.0	23	80,603	2.56
B2	LL	0.122	0.047	24.1	2.37	12.5	1.68	4.0	12	22,506	2.55	57,481	40.0	15	55,886	2.43
B3	KK	0.126	0.055	32.6	2.87	16.9	2.03	4.8	12	30,492	2.55	77,774	40.0	17	76,823	2.02
B4	EE1	0.126	0.124	30.2	4.37	15.7	3.09	7.3	79	184,658	2.55	470,997	40.0	110	468,951	2.17
B5	DD	0.126	0.142	41.6	6.04	21.6	4.27	10.1	78	252,285	2.55	643,489	50.0	122	643,587	1.76
B6	II3	0.126	0.088	25.0	3.19	13.0	2.25	5.3	45	87,011	2.55	221,934	40.0	59	219,892	2.45
B7	II2	0.126	0.087	23.9	3.09	12.4	2.18	5.1	45	83,962	2.55	214,157	40.0	58	211,616	2.50
B8	II1	0.126	0.123	53.3	6.54	27.7	4.62	10.9	44	183,061	2.55	466,923	50.0	74	467,031	1.48
B9	CC	0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	2.55	58,608	40.0	14	57,626	2.14
B10	AA	0.126	0.103	26.0	3.55	13.5	2.51	5.9	61	122,694	2.55	312,949	40.0	81	311,592	2.40
B11	BB	0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	2.55	343,966	40.0	84	342,767	2.27
B12	FF	0.126	0.078	26.0	3.05	13.5	2.15	5.1	33	65,703	2.55	167,585	40.0	43	165,899	2.38
B13	GG	0.126	0.074	33.9	3.43	17.6	2.43	5.7	23	59,351	2.55	151,382	45.0	32	150,699	1.99
B14	HH	0.126	0.066	28.7	2.96	14.9	2.09	4.9	21	46,101	2.55	117,587	40.0	28	116,310	2.22
B15	EE2	0.078	0.121	11.6	2.58	6.0	1.83	4.3	66	59,387	2.66	157,718	35.0	64	151,027	3.89
B16	EE3	0.086	0.073	19.8	2.61	10.3	1.84	4.3	16	24,212	2.62	63,519	35.0	19	61,897	2.90
OS1	A	0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	2.54	174,933	40.0	44	174,023	2.31
OS2	C	0.156	0.128	32.3	4.68	16.8	3.31	7.8	53	132,096	2.54	335,220	45.0	75	334,263	2.07
OS3	F	0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	2.54	232,600	45.0	52	231,811	2.04
OS4	Q	0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	2.54	665,926	45.0	138	665,685	1.91
OS5	T	0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	2.54	48,270	45.0	9	48,050	1.66

Printouts for Storm Hydrographs

flow in cfs

time in minutes	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	OS1	OS2	OS3	OS4	OS5
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.10	0.35	0.37	0.28	0.04	0.55	0.03	0.00	0.43	0.15	0.07	2.02	0.16	0.01	0.01	0.36	0.04	0.02	0.62	0.07	0.34	0.00	0.37	0.04	0.01	0.01	0.03	0.03	0.02	0.02	0.01	0.00	0.03	0.03	0.02	0.01	0.01	1.12	0.19	0.00	0.00	0.00	0.00	0.00
15	0.54	2.07	2.05	1.59	0.21	2.92	0.14	0.02	2.29	0.81	0.37	11.24	0.88	0.06	0.08	1.95	0.26	0.14	3.37	0.38	1.93	0.01	2.02	0.21	0.05	0.03	0.19	0.15	0.12	0.12	0.08	0.03	0.16	0.16	0.09	0.06	0.06	5.79	1.00	0.00	0.00	0.00	0.01	0.00
20	4.70	11.12	10.74	7.30	3.28	15.55	2.04	0.50	10.40	3.05	2.53	42.94	7.12	1.54	2.10	8.42	3.53	2.52	13.24	2.61	10.24	0.38	7.13	1.85	0.92	0.86	4.87	3.70	3.17	3.21	1.93	0.71	4.17	4.06	2.31	1.57	1.47	14.49	2.99	1.53	2.10	1.55	2.66	0.27
25	21.31	42.74	40.06	25.82	18.70	56.95	10.35	2.96	36.06	9.90	10.27	140.21	31.45	9.28	12.69	28.86	20.70	14.14	43.72	10.74	38.70	2.24	22.40	8.13	5.06	5.07	29.47	23.46	18.74	18.94	12.40	4.17	24.80	24.30	13.66	9.32	8.67	32.03	7.97	12.67	17.81	13.02	23.73	2.23
30	52.47	103.29	92.85	59.21	51.07	124.52	24.86	7.28	78.20	21.78	23.88	310.50	76.79	23.68	32.46	64.01	61.04	35.92	96.34	25.34	91.41	5.49	48.69	18.77	12.10	12.45	75.21	64.89	45.65	45.93	35.13	10.19	61.07	60.63	33.27	23.06	21.20	61.35	16.48	32.35	48.13	34.42	70.80	5.73
35	72.59	146.12	121.30	77.62	78.55	141.24	31.64	9.48	89.08	26.94	30.50	382.30	105.10	32.51	44.66	78.06	104.95	49.65	117.38	33.33	123.94	7.04	58.96	22.80	14.90	15.98	102.16	99.00	57.26	57.08	55.32	12.94	78.18	79.49	41.82	30.07	26.93	63.62	19.33	41.83	67.59	46.99	111.84	7.58
40	80.82	162.05	127.40	82.46	92.56	131.97	33.25	10.30	83.73	27.67	32.40	366.16	115.19	36.41	49.76	77.75	133.37	55.45	115.70	36.41	133.69	7.46	58.53	22.77	15.07	16.95	110.30	115.56	58.65	57.88	66.15	13.57	81.18	84.15	43.07	32.31	28.16	55.45	18.79	43.83	74.62	51.30	131.63	8.38
45	82.83	163.27	124.06	81.19	99.03	118.58	32.86	10.51	75.69	26.90	32.31	331.39	116.06	37.80	51.19	73.99	148.70	57.12	108.75	37.14	132.27	7.45	55.58	21.80	14.58	16.91	109.61	121.99	56.87	55.86	71.83	13.42	79.07	82.85	41.95	32.48	27.73	46.89	17.55	42.98	75.28	51.63	137.80	8.68
50	81.58	158.49	117.90	78.07	100.73	103.87	31.74	10.39	66.89	25.57	31.49	296.19	113.09	37.67	50.61	68.88	156.30	56.51	100.27	36.58	127.67	7.28	51.66	20.42	13.79	16.51	106.25	122.41	53.86	52.66	74.39	12.96	75.17	79.58	39.90	31.77	26.66	38.88	16.13	41.09	73.42	50.40	136.63	8.66
55	79.08	151.06	110.28	73.75	99.29	88.87	30.11	10.10	57.66	23.93	30.11	257.83	108.20	36.87	49.29	63.28	157.91	55.08	90.81	35.49	120.95	6.97	47.36	18.87	12.87	15.79	100.97	119.69	50.31	49.03	74.39	12.30	70.40	75.09	37.39	30.50	25.19	32.17	14.52	38.64	70.19	48.22	132.78	8.50
60	76.36	143.64	103.89	69.97	97.55	79.01	28.73	9.82	51.21	22.58	28.83	226.63	103.38	36.02	47.84	58.10	156.12	53.49	82.04	34.36	114.73	6.70	43.41	17.43	12.05	15.14	96.13	116.57	47.26	45.78	73.41	11.75	66.42	71.38	35.30	29.29	24.01	27.17	13.07	36.69	67.02	46.12	128.07	8.34
65	73.88	137.95	98.09	66.79	95.89	71.81	27.60	9.55	46.69	21.33	27.87	206.63	99.64	35.14	46.46	53.38	154.23	51.97	74.74	33.33	109.67	6.49	39.85	16.06	11.24	14.65	92.29	113.43	44.34	42.65	72.72	11.29	62.73	68.18	33.33	28.36	22.99	23.15	11.91	34.94	64.65	44.56	123.64	8.17
70	69.85	128.95	88.33	61.17	92.17	59.02	25.31	9.01	38.85	19.11	25.91	176.87	93.19	33.30	43.95	46.62	150.73	49.19	65.43	31.44	101.09	6.03	34.79	14.03	9.90	13.61	85.32	108.08	39.23	37.53	70.75	10.34	56.10	62.18	29.73	26.49	20.93	17.19	10.39	31.58	60.46	41.62	117.58	7.74
75	65.65	118.52	78.57	55.25	87.52	47.88	23.01	8.51	31.96	17.02	23.95	147.31	86.15	31.60	41.48	41.36	145.00	46.44	57.55	29.61	91.60	5.58	30.84	12.50	8.80	12.56	77.68	102.29	34.74	33.31	67.80	9.39	49.85	55.95	26.42	24.61	18.88	13.84	9.12	28.21	55.78	38.46	110.47	7.36
80	60.62	106.57	69.04	48.77	82.70	36.49	20.36	7.89	24.62	14.97	21.56	117.15	77.82	29.59	38.50	36.02	137.88	43.15	49.26	27.38	81.07	5.03	26.80	10.94	7.76	11.29	68.89	95.94	30.64	29.30	64.36	8.31	43.86	49.24	23.27	22.32	16.64	10.62	7.73	24.76	50.26	34.68	102.36	6.91
85	55.53	94.89	61.48	43.37	77.83	28.41	18.11	7.29	18.99	13.36	19.32	91.21	69.66	27.58	35.51	31.26	130.40	39.84	41.76	25.18	71.91	4.50	23.20	9.58	6.87	10.11	61.12	89.23	27.26	25.90	60.91	7.40	39.10	43.89	20.77	20.11	14.85	8.56	6.49	22.13	44.83	30.98	93.67	6.47
90	50.66	85.03	55.19	39.16	73.19	23.43	16.41	6.70	15.55	12.02	17.36	72.79	62.50	25.67	32.65	27.11	123.69	36.68	35.16	23.07	64.90	4.05	20.06	8.38	6.12	9.10	55.20	82.79	24.37	22.99	57.82	6.71	35.12	39.67	18.66	18.11	13.45	7.33	5.40	19.98	40.19	27.79	85.33	6.05
95	46.06	77.60	49.78	35.73	68.82	20.36	15.04	6.14	13.43	10.86	15.91	61.63	57.05	23.80	29.87	23.29	117.53	33.61	29.19	21.05	59.27	3.72	17.17	7.28	5.43	8.35	50.53	76.58	21.80	20.35	54.96	6.15	31.66	36.18	16.83	16.53	12.29	6.50	4.43	18.16	36.74	25.43	77.34	5.64
100	42.18	71.61	44.85	32.70	64.58	18.22	13.84	5.63	11.98	9.80	14.75	54.59	52.76	22.00	27.37	19.78	111.81	30.81	24.23	19.29	54.34	3.45	14.53	6.25	4.79	7.74	46.50	70.57	19.43	17.90	52.29	5.66	28.49	33.06	15.14	15.31	11.26	5.98	3.67	16.51	33.99	23.55	70.60	5.25
105	39.30	66.29	40.25	29.93	60.44	16.80	12.76	5.24	10.99	8.80	13.72	49.65	49.03	20.32	25.39	16.74	106.34	28.53	20.91	17.96	49.87	3.21	12.29	5.30	4.19	7.20	42.85	65.04	17.19	15.57	49.71	5.21	25.53	30.21	13.56	14.27	10.31	5.67	3.22	14.99	31.55	21.89	65.62	4.86
110	36.92	61.47	35.88	27.33	56.40	15.78	11.74	4.93	10.30	7.86	12.79	46.29	45.68	18.94	23.85	14.52	101.05	26.79	18.83	16.89	45.70	3.00	10.71	4.55	3.63	6.71	39.48	60.54	15.07	13.43	47.20	4.80	22.71	27.51	12.06	13.35	9.42	5.56	2.92	13.54	29.35	20.39	61.56	4.52
115	34.82	56.94	31.76	24.86	52.65	15.10	10.78	4.66	9.81	6.97	11.93	43.86	42.56	17.89	22.54	13.15	95.85	25.32	17.43	15.95	41.74	2.80	9.73	4.08	3.15	6.25	36.28	57.09	13.13	11.68	44.71	4.40	20.06	24.95	10.65	12.50	8.57	5.51	2.72	12.16	27.30	19.00	57.98	4.26
120	32.89	52.63	27.97	22.52	49.54	14.74	9.86	4.42	9.52	6.15	11.10	42.21	39.59	17.01	21.36	12.24	90.71	24.00	16.42	15.10	37.97	2.61	9.07	3.78	2.83	5.81	33.24	54.20	11.57	10.57	42.26	4.02	17.65	22.53	9.37	11.69	7.77	5.51	2.57	10.85	25.34	17.67	54.71	4.06
125	29.73	46.08	22.40	18.73	46.00	10.79	8.27	3.99	7.04	4.86	9.65	32.92	34.79	15.57	19.39	9.77	84.50	21.83	12.99	13.62	32.08	2.27	7.22	3.01	2.27	5.03	28.31	50.08	9.29	8.50	39.07	3.36	14.04	18.48	7.42	10.27	6.37	3.61	2.00	8.69	22.19	15.45	50.01	3.71
130	26.39	38.84	17.75	14.90	42.15	7.68	6.72	3.57	5.06	3.85	8.25	23.63	29.76	14.12	17.36	7.56	77.34	19.57	9.84	12.15	25.86	1.94	5.58	2.35	1.79	4.29	23.12	45.34	7.37	6.70	35.61	2.72	11.14	14.59	5.88	8.88	5.05	2.32	1.51	6.81	18.85	13.18	44.39	3.37
135	23.22	31.84	14.09	11.61	38.53	5.47	5.31	3.18	3.65	3.06	6.91	17.13	24.92	12.73	15.42	5.85	70.70	17.42	7.47	10.75	20.29	1.63	4.31	1.83	1.42	3.57	18.28	40.80	5.83	5.27	32.66	2.15	8.84	11.43	4.68	7.56	3.94	1.45	1.14	5.40	15.62	11.00	38.96	3.06
140	20.27	25.45	11.21	9.24	35.15	3.81	4.17	2.82	2.59	2.44	5.67	12.45	20.41	11.44	13.63	4.49	65.01	15.42	5.68	9.46	16.02	1.34	3.31	1.41	1.11	2.92	14.33	36.52	4.60	4.13	30.07	1.69	7.03	9.12	3.72	6.33	3.15	0.87	0.87	4.32	12.63	8.97	33.88	2.77
145	17.53	19.99	8.89	7.41	32.00	2.57	3.33	2.48	1.78	1.94	4.51	8.77	16.25	10.26	11.98	3.47	59.91	13.60	4.32	8.26	12.81	1.06	2.55	1.09	0.87	2.31	11.43	32.60	3.62	3.22	27.72	1.35	5.56	7.30	2.95	5.17	2.52	0.51	0.66	3.44	9.98	7.11	29.18	2.50
150	14.92	15.88	7.04	5.95	29.14	1.76	2.68	2.16	1.23	1.54	3.53	6.08	12.72	9.17	10.41	2.66	55.25	11.86	3.25	7.12	10.29	0.83	1.95	0.84	0.68	1.82	9.19	28.98	2.82	2.49	25.58	1.09	4.39	5.85	2.32	4.10	2.03	0.25	0.49	2.74	7.87	5.59	24.73	2.26
155	12.42	12.80	5.50	4.75	26.48	1.13	2.16	1.86	0.82	1.20	2.83	4.24	10.19	8.12	8.91	2.02	51.05	10.19	2.42	6.03	8.24	0.67	1.48	0.64	0.52	1.46	7.39	25.54	2.18	1.93	23.64	0.87	3.42	4.66	1.81	3.23	1.62	0.08	0.36	2.16	6.34	4.49	20.46	2.02
160	10.06	10.31	4.27	3.77	23.98	0.63	1.72	1.56	0.48	0.94	2.29	2.73	8.23	7.12	7.47	1.55	47.16	8.59	1.83	4.98	6.55	0.54	1.13	0.50	0.41	1.18	5.90	22.25	1.70	1.49	21.82	0.70	2.66	3.67	1.41	2.60	1.28	0.00	0.27	1.69	5.11	3.62	16.42	1.80
165	7.94	8.25	3.36	2.96	21.61	0.28	1.36	1.27	0.24	0.74	1.84	1.55	6.62	6.16	6.08	1.19	43.52	7.05	1.33	3.98	5.17	0.43	0.87	0.39	0.32	0.95	4.67	19.09	1.33	1.17	20.13	0.55	2.09	2.87	1.11	2.10	1.00	0.00	0.20	1.32	4.10	2.91	12.91	1.58
170	6.30	6.57	2.66	2.32	19.34	0.07	1.07	1.01	0.08	0.59	1.48	0.70	5.30	5.22	4.81	0.88	40.14	5.60	0.92	3.12	4.06	0.35	0.64	0.29	0.25	0.76	3.68	16.01	1.06	0.91	18.55	0.43	1.66	2.27	0.88	1.69	0.79	0.00	0.13	1.05	3.27	2.33	10.30	1.37
175	5.07	5.21	2.13	1.87	17.13	0.00	0.85	0.80	0.00	0.47	1.18	0.18	4.23	4.30	3.80	0.62	36.97	4.40	0.58	2.50	3.24	0.28	0.44	0.21	0.19	0.60	2.92	13.02	0.83	0.69	17.06	0.35	1.32	1.83	0.70	1.35	0.64	0.00	0.08	0.85	2.60	1.85	8.31	1.17
180	4.10	4.16	1.66	1.51	14.97	0.00	0.70	0.64	0.00	0.37	0.94	0.00	3.38	3.43	3.06	0.40	33.96	3.53	0.32	2.02	2.64	0.22	0.29	0.14	0.14	0.48	2.38	10.30	0.62	0.50	15.63	0.28	1.02	1.47	0.54	1.09	0.52	0.00	0.04	0.67	2.08	1.48	6.71	0.97
185	3.32	3.40	1.25	1.21	12.84	0.00	0.56	0.52	0.00	0.28	0.77	0.00	2.74	2.68	2.48	0.23	31.02	2.86	0.14	1.64	2.12	0.18	0.16	0.09	0.10	0.39	1.92	8.13	0.44	0.33	14.23	0.23	0.76	1.17	0.40	0.88	0.41	0.00	0.01	0.52	1.69	1.20	5.42	0.77
190	2.70	2.76	0.89	0.94	10.76	0.00	0.45	0.42	0.00	0.20	0.63	0.00	2.24	2.15	2.02	0.11	28.14	2.33	0.03	1.33	1.67	0.15	0.07	0.04	0.06	0.32	1.54	6.56	0.29	0.20	12.86	0.18	0.53	0.89	0.28	0.71	0.32	0.00	0.00	0.39	1.38	0.98	4.39	0.61
195	2.20	2.21	0.60	0.71	8.76	0.00	0.35	0.35	0.00	0.14	0.51	0.00	1.81	1.76	1.65	0.03	25.32	1.91	0.00	1.09	1.28	0.12	0.02	0.02	0.03	0.26	1.19	5.35	0.17	0.11	11.51	0.14	0.35	0.66	0.18	0.58	0.24	0.00	0.00	0.27	1.11	0.79	3.59	0.49
200	1.79	1.73	0.36	0.51	6.94	0.00	0.26	0.28	0.00	0.08	0.41	0.00	1.45	1.44	1.35	0.00	22.56	1.56	0.00	0.89	0.94	0.10	0.00	0.00	0.01	0.21	0.89	4.39	0.09	0.04	10.20	0.10	0.20	0.46	0.11	0.47	0.17	0.00	0.00	0.18	0.88	0.63	2.91	0.40
205	1.46	1.31	0.18	0.34	5.51	0.00	0.18	0.23	0.00	0.04	0.32	0.00	1.13	1.19	1.10	0.00	19.85	1.27	0.00	0.72	0.65	0.07	0.00	0.00	0.00	0.16	0.63	3.61	0.03	0.00	8.91	0.07	0.10	0.30	0.05	0.37	0.11	0.00	0.00	0.10	0.67	0.49	2.38	0.33
210	1.19	0.95	0.06	0.21	4.49	0.00	0.12	0.19	0.00	0.02	0.24	0.00	0.85	0.98	0.90	0.00	17.20	1.04	0.00	0.59	0.41	0.06	0.00	0.00	0.00	0.12	0.42	2.96	0.00	0.00	7.64	0.05	0.03	0.17	0.01	0.29	0.07	0.00	0.00	0.05	0.49	0.36	1.93	0.27
215	0.96	0.65	0.00	0.10	3.72	0.00	0.07	0.15	0.00	0.00	0.17	0.00	0.61	0.80	0.73	0.00	14.61	0.85	0.00	0.48	0.23	0.04	0.00	0.00	0.00	0.08	0.25	2.41	0.00	0.00	6.41	0.03	0.00	0.08	0.00	0.21	0.03	0.00	0.00	0.01	0.34	0.26	1.55	0.22
220	0.75	0.40	0.00	0.04	3.07	0.00	0.03	0.12	0.00	0.00	0.11	0.00	0.40	0.65	0.59	0.00	12.08	0.68	0.00	0.38	0.10	0.03	0.00	0.00	0.00	0.05	0.12	1.96	0.00	0.00	5.22	0.01	0.00	0.02	0.00	0.15	0.01	0.00	0.00	0.00	0.22	0.17	1.21	0.18
225	0.57	0.21	0.00	0.00	2.53	0.00	0.01	0.10	0.00	0.00	0.07	0.00	0.24	0.53	0.47	0.00	9.70	0.54	0.00	0.30	0.02	0.02	0.00	0.00	0.00	0.03	0.04	1.60	0.00	0.00	4.17	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.12	0.10	0.91	0.15
230	0.42	0.08	0.00	0.00	2.07	0.00	0.00	0.08	0.00	0.00	0.03	0.00	0.12	0.43	0.36	0.00	7.70	0.42	0.00	0.23	0.00	0.01	0.00	0.00	0.00	0.01	0.00	1.29	0.00	0.00	3.35	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.05	0.05	0.66	0.12
235	0.29	0.01	0.00	0.00	1.68	0.00	0.00	0.06	0.00	0.00	0.01	0.00	0.04	0.34	0.26	0.00	6.28	0.31	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00	2.76	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.01	0.44	0.10
240	0.18	0.00	0.00	0.00	1.37	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.27	0.18	0.00	5.19	0.22	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	2.28	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.08
245	0.10	0.00	0.00	0.00	1.12	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.20	0.12	0.00	4.29	0.15	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.06
250	0.04	0.00	0.00	0.00	0.90	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.14	0.07	0.00	3.54	0.09	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
255	0.01	0.00	0.00	0.00	0.71	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.03	0.00	2.91	0.04	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03
260	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00	2.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
265	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	1.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
270	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
275	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
280	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
285	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
290	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
295	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
320	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Printouts for Unit Hydrographs

flow in cfs

time in minutes	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	OS1	OS2	OS3	OS4	OS5
5	45.34	82.91	82.65	52.25	39.08	128.52	23.97	7.03	80.02	20.40	22.44	284.52	66.66	21.54	29.37	60.88	39.45	32.05	90.88	23.13	77.75	5.35	46.13	18.51	12.02	12.10	68.24	51.02	44.80	45.37	26.45	9.97	58.83	57.18	32.68	22.09	20.71	65.48	15.79	31.63	43.36	32.05	54.93	5.58
10	54.47	111.91	91.29	57.68	61.90	103.08	23.22	6.89	64.93	19.54	22.07	302.60	79.27	24.30	33.58	58.21	81.91	37.34	88.53	24.18	93.85	5.16	43.70	16.90	11.11	11.73	78.07	78.33	42.87	42.87	43.98	9.54	58.81	59.91	31.15	22.14	19.91	44.42	14.04	31.56	52.46	35.88	90.59	5.57
15	51.97	105.69	80.26	52.17	61.19	74.64	20.77	6.49	47.60	16.76	20.25	215.59	74.24	23.37	32.06	45.83	92.45	35.73	68.11	22.89	86.21	4.68	34.34	13.46	8.99	10.68	71.58	76.75	35.84	34.89	44.04	8.45	50.57	53.49	26.44	20.49	17.54	29.78	10.86	27.62	49.05	33.34	89.42	5.33
20	46.86	90.99	65.31	42.92	58.42	55.89	17.36	5.82	35.82	13.93	17.14	158.26	64.06	21.58	29.12	37.74	90.81	32.56	54.51	20.58	70.75	3.97	28.20	11.16	7.60	9.01	59.07	71.92	29.73	29.09	42.66	7.11	41.60	44.08	21.99	17.62	14.65	20.12	8.59	22.80	42.01	28.49	82.36	4.92
25	40.16	77.37	55.15	37.17	53.70	41.56	15.13	5.09	27.23	11.77	15.15	124.60	55.11	18.94	25.06	30.19	86.81	27.99	43.59	17.82	61.53	3.53	22.58	9.03	6.22	7.98	51.60	63.84	24.63	23.71	40.24	6.18	34.95	37.96	18.45	15.44	12.65	12.27	6.98	19.43	36.14	24.71	70.05	4.34
30	36.04	67.19	45.65	31.41	47.04	27.23	12.90	4.60	18.65	9.86	13.25	90.94	48.22	17.04	22.63	25.47	80.44	25.31	35.74	16.05	52.31	3.08	19.01	7.67	5.32	6.96	44.13	55.98	20.76	20.14	36.78	5.26	29.19	31.84	15.50	13.59	10.64	9.05	5.65	16.15	31.47	21.56	62.04	3.93
35	31.91	57.01	39.75	27.17	43.02	21.44	11.21	4.11	14.03	8.59	11.34	62.31	41.33	15.42	20.21	20.76	71.71	22.64	27.90	14.28	44.86	2.65	15.43	6.30	4.49	5.98	37.83	50.60	17.77	16.98	32.81	4.60	25.29	27.75	13.42	11.74	9.34	5.83	4.32	14.17	26.80	18.42	54.87	3.58
40	27.79	50.72	33.86	23.81	39.27	16.66	9.89	3.61	11.17	7.31	10.20	51.09	36.71	13.81	17.78	16.05	65.58	19.96	20.06	12.51	39.51	2.39	11.85	4.94	3.67	5.37	33.47	45.21	14.77	13.81	30.46	4.05	21.40	24.17	11.33	10.46	8.15	2.61	3.10	12.19	23.91	16.46	47.71	3.23
45	25.19	44.82	27.96	20.45	35.52	11.88	8.57	3.28	8.31	6.04	9.07	39.87	32.68	12.21	15.99	12.03	60.64	17.90	16.67	11.35	34.15	2.12	8.97	3.67	2.85	4.76	29.10	39.83	11.78	10.65	28.11	3.50	17.50	20.58	9.25	9.37	6.96	0.00	2.66	10.21	21.18	14.61	42.69	2.87
50	22.77	38.93	22.06	17.08	31.76	7.11	7.25	2.99	5.45	4.76	7.94	28.65	28.64	11.25	14.55	10.46	55.71	16.31	14.05	10.30	28.79	1.85	7.78	3.21	2.28	4.15	24.74	36.41	8.93	8.55	25.77	2.95	13.61	16.99	7.16	8.27	5.77		2.22	8.23	18.45	12.76	38.56	2.64
55	20.34	33.03	17.80	13.72	29.25	2.33	5.93	2.69	2.59	3.89	6.80	17.43	24.61	10.30	13.11	8.89	50.78	14.73	11.44	9.24	23.44	1.59	6.59	2.76	2.01	3.54	20.37	33.27	7.93	7.50	23.42	2.40	11.36	13.40	6.05	7.17	4.58		1.77	6.43	15.72	10.91	34.42	2.43
60	17.91	27.14	15.84	11.27	27.05	0.00	4.74	2.40	0.00	3.46	5.67	6.21	20.58	9.34	11.68	7.32	46.02	13.15	8.82	8.19	18.65	1.32	5.40	2.30	1.73	2.93	16.01	30.13	6.93	6.45	21.53	1.95	10.06	11.44	5.36	6.07	3.89		1.33	5.77	12.99	9.06	30.28	2.22
65	15.49	22.03	13.87	10.14	24.85		4.29	2.10		3.04	4.54	0.00	16.54	8.38	10.24	5.75	43.15	11.57	6.21	7.14	16.86	1.07	4.20	1.85	1.46	2.39	14.41	26.98	5.93	5.39	20.15	1.76	8.76	10.25	4.66	4.97	3.50		0.89	5.11	10.46	7.24	26.15	2.00
70	13.06	20.07	11.90	9.02	22.65		3.85	1.81		2.61	4.15		14.82	7.43	8.81	4.18	40.28	9.99	3.60	6.09	15.07	0.98	3.01	1.39	1.19	2.18	12.96	23.84	4.94	4.34	18.77	1.58	7.46	9.05	3.97	4.30	3.10		0.44	4.45	9.55	6.63	22.01	1.79
75	10.84	18.10	9.94	7.90	20.45		3.41	1.51		2.19	3.78		13.47	6.47	7.37	2.61	37.41	8.40	0.98	5.03	13.29	0.89	1.82	0.94	0.91	1.98	11.50	20.70	3.94	3.28	17.39	1.39	6.16	7.85	3.27	3.94	2.71		0.00	3.79	8.64	6.01	18.13	1.58
80	10.04	16.14	7.97	6.78	18.24		2.97	1.34		1.76	3.40		12.13	5.51	6.49	1.04	34.55	7.28	0.00	4.59	11.50	0.80	0.62	0.49	0.64	1.78	10.05	17.55	2.94	2.23	16.00	1.21	4.86	6.66	2.57	3.57	2.31		0.00	3.13	7.73	5.39	16.75	1.37
85	9.23	14.17	6.01	5.66	16.04		2.53	1.25		1.34	3.02		10.78	4.78	6.01	0.00	31.68	6.75		4.24	9.72	0.71	0.00	0.03	0.36	1.57	8.59	15.25	1.94	1.18	14.62	1.03	3.56	5.46	1.88	3.21	1.91			2.47	6.83	4.78	15.37	1.16
90	8.42	12.21	4.04	4.54	13.84		2.09	1.15		0.92	2.64		9.44	4.46	5.53		28.81	6.23		3.89	7.93	0.62		0.00	0.09	1.37	7.14	14.20	0.94	0.12	13.24	0.84	2.26	4.27	1.18	2.84	1.52			1.81	5.92	4.16	13.99	1.07
95	7.61	10.24	2.07	3.42	12.15		1.65	1.05		0.49	2.27		8.09	4.14	5.05		25.94	5.70		3.54	6.15	0.53			0.00	1.17	5.68	13.15	0.00	0.00	11.86	0.66	0.97	3.07	0.49	2.47	1.12			1.15	5.01	3.55	12.61	1.00
100	6.80	8.28	0.11	2.30	11.42		1.21	0.95		0.07	1.89		6.75	3.82	4.57		23.08	5.17		3.19	4.36	0.44				0.96	4.23	12.10			10.48	0.48	0.00	1.87	0.00	2.11	0.72			0.49	4.10	2.93	11.23	0.93
105	5.99	6.31	0.00	1.17	10.68		0.77	0.85		0.00	1.51		5.40	3.50	4.09		20.21	4.64		2.84	2.58	0.36				0.76	2.77	11.06			9.09	0.29		0.68		1.74	0.33			0.00	3.19	2.31	9.85	0.85
110	5.18	4.35		0.05	9.95		0.33	0.75			1.14		4.06	3.18	3.62		18.11	4.12		2.49	0.79	0.27				0.55	1.32	10.01			8.49	0.11		0.00		1.38	0.00				2.28	1.70	8.48	0.78
115	4.37	2.38		0.00	9.21		0.00	0.66			0.76		2.71	2.86	3.14		17.16	3.59		2.13	0.00	0.18				0.35	0.00	8.96			8.03	0.00				1.01					1.37	1.08	7.10	0.71
120	3.56	0.42			8.48			0.56			0.38		1.37	2.54	2.66		16.20	3.06		1.78		0.09				0.15		7.91			7.57					0.65					0.46	0.47	5.72	0.64
125	2.76	0.00			7.75			0.46			0.00		0.02	2.23	2.18		15.25	2.54		1.43		0.00				0.00		6.87			7.11					0.28					0.00	0.00	4.34	0.57
130	1.95				7.01			0.36			0.00		0.00	1.91	1.70		14.29	2.01		1.08		0.00						5.82			6.65					0.00							2.96	0.50
135	1.14				6.28			0.26						1.59	1.22		13.33	1.48		0.73								4.77			6.18												1.58	0.43
140	0.33				5.55			0.16						1.27	0.75		12.38	0.95		0.38								3.72			5.72												0.20	0.36
145	0.00				4.81			0.07						0.95	0.27		11.42	0.43		0.03								2.68			5.26												0.00	0.29
150					4.08			0.00						0.63	0.00		10.47	0.00		0.00								1.63			4.80													0.22
155					3.34									0.31			9.51											0.58			4.34													0.15
160					2.61									0.00			8.55											0.00			3.88													0.08
165					1.88												7.60														3.42													0.01
170					1.14												6.64														2.96													0.00
175					0.41												5.69														2.50													
180					0.00												4.73														2.04													
185																	3.77														1.58													
190																	2.82														1.12													
195																	1.86														0.66													
200																	0.91														0.19													
205																	0.00														0.00													

Appendix C

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EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
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*******************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*******************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2022 00:00:00
Ending Date .............. 01/01/2022 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........       164.959         53.754
External Outflow .........       152.095         49.563
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......        12.843          4.185
Continuity Error (%) .....         0.013


*******************************
Highest Flow Instability Indexes
```

****
Link SP101 (3)
Link SP103 (3)
Link SP102 (2)

****
Routing Time Step Summary
****

```
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
A	JUNCTION	0.00	0.00	7625.00	0 00:00	0.00
AA	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
B	JUNCTION	0.00	0.00	7570.00	0 00:00	0.00
BB	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
BB1	JUNCTION	0.00	0.00	7385.00	0 00:00	0.00
BB2	JUNCTION	0.00	0.00	7365.00	0 00:00	0.00
C	JUNCTION	0.00	0.00	7635.00	0 00:00	0.00
CC	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
D	JUNCTION	0.00	0.00	7575.00	0 00:00	0.00
DD	JUNCTION	0.00	0.00	7500.00	0 00:00	0.00
E	JUNCTION	0.00	0.00	7572.00	0 00:00	0.00
EE	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
F	JUNCTION	0.00	0.00	7633.00	0 00:00	0.00
FF	JUNCTION	0.00	0.00	7430.00	0 00:00	0.00
G	JUNCTION	0.00	0.00	7565.00	0 00:00	0.00
GG	JUNCTION	0.00	0.00	7420.00	0 00:00	0.00
H1	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
HH	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
I	JUNCTION	0.00	0.00	7595.00	0 00:00	0.00
II	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
II1	JUNCTION	0.00	0.00	7375.00	0 00:00	0.00
BB3	JUNCTION	0.00	0.00	7330.00	0 00:00	0.00
J	JUNCTION	0.00	0.00	7560.00	0 00:00	0.00
JJ	JUNCTION	0.00	0.00	7575.00	0 00:00	0.00

K	JUNCTION	0.00	0.00	7585.00	0	00:00	0.00
KK	JUNCTION	0.00	0.00	7590.00	0	00:00	0.00
L	JUNCTION	0.00	0.00	7548.00	0	00:00	0.00
LL	JUNCTION	0.00	0.00	7580.00	0	00:00	0.00
LL1	JUNCTION	0.00	0.00	7525.00	0	00:00	0.00
M	JUNCTION	0.00	0.00	7590.00	0	00:00	0.00
N	JUNCTION	0.00	0.00	7535.00	0	00:00	0.00
O	JUNCTION	0.00	0.00	7525.00	0	00:00	0.00
P	JUNCTION	0.00	0.00	7480.00	0	00:00	0.00
Q	JUNCTION	0.00	0.00	7585.00	0	00:00	0.00
R	JUNCTION	0.00	0.00	7596.00	0	00:00	0.00
S	JUNCTION	0.00	0.00	7598.00	0	00:00	0.00
SP1	JUNCTION	0.00	0.00	7495.00	0	00:00	0.00
SP2	JUNCTION	0.00	0.00	7490.00	0	00:00	0.00
SP3	JUNCTION	0.00	0.00	7435.00	0	00:00	0.00
T	JUNCTION	0.00	0.00	7583.00	0	00:00	0.00
T1	JUNCTION	0.00	0.00	7565.00	0	00:00	0.00
U	JUNCTION	0.00	0.00	7567.00	0	00:00	0.00
T2	JUNCTION	0.00	0.00	7555.00	0	00:00	0.00
V	JUNCTION	0.00	0.00	7577.00	0	00:00	0.00
X	JUNCTION	0.00	0.00	7500.00	0	00:00	0.00
W	JUNCTION	0.00	0.00	7546.00	0	00:00	0.00
H	JUNCTION	0.00	0.00	7560.00	0	00:00	0.00
OF2	OUTFALL	0.00	0.00	7550.00	0	00:00	0.00
OF1	OUTFALL	0.00	0.00	7430.00	0	00:00	0.00
OF3	OUTFALL	0.00	0.00	7435.00	0	00:00	0.00
OF5	OUTFALL	0.00	0.00	7520.00	0	00:00	0.00
OF4	OUTFALL	0.00	0.00	7325.00	0	00:00	0.00
IRR_POND	STORAGE	2.17	3.25	7533.25	0	02:12	3.25

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
A	JUNCTION	20.84	20.84	0 00:35	0.696		

0.696	0.000								
AA		JUNCTION	38.76	38.76	0	00:35	1.24	1.24	0.000
B		JUNCTION	50.01	103.48	0	00:40	2.2	4.18	0.000
BB		JUNCTION	40.62	40.62	0	00:35	1.38	1.38	0.000
BB1		JUNCTION	0.00	242.15	0	00:35	0	8.7	0.000
BB2		JUNCTION	0.00	257.03	0	00:35	0	9.31	0.000
C		JUNCTION	33.36	33.36	0	00:40	1.28	1.28	0.000
CC		JUNCTION	6.53	6.53	0	00:35	0.232	0.232	0.000
D		JUNCTION	31.56	31.56	0	00:40	1.43	1.43	0.000
DD		JUNCTION	58.42	58.42	0	00:40	2.62	2.62	0.000
E		JUNCTION	92.81	223.69	0	00:45	4.71	10.3	0.000
EE		JUNCTION	81.16	81.16	0	00:35	2.59	2.59	0.000
F		JUNCTION	24.27	24.27	0	00:35	0.927	0.927	0.000
FF		JUNCTION	19.51	162.77	0	00:35	0.646	6.08	0.000
G		JUNCTION	54.90	79.17	0	00:35	1.91	2.84	0.000
GG		JUNCTION	14.93	14.93	0	00:40	0.601	0.601	0.000
H1		JUNCTION	0.00	133.51	0	02:08	0	9.72	0.000
HH		JUNCTION	13.01	13.01	0	00:35	0.462	0.462	0.000
I		JUNCTION	34.58	34.58	0	00:35	1.17	1.17	0.000
II		JUNCTION	81.77	81.77	0	00:45	3.59	3.59	0.000
II1		JUNCTION	0.00	81.77	0	00:45	0	3.59	0.000
BB3		JUNCTION	0.00	346.26	0	00:40	0	13.4	0.000
J		JUNCTION	22.78	56.31	0	00:35	1.05	2.22	0.000
JJ		JUNCTION	9.74	9.74	0	00:35	0.317	0.317	0.000
K		JUNCTION	92.05	92.05	0	00:40	3.43	3.43	0.000
KK		JUNCTION	7.51	7.51	0	00:35	0.297		

```
0.297       0.000
  L                    JUNCTION     15.71   107.58     0  00:40       0.601
4.03       0.000
  LL                   JUNCTION      6.88     6.88     0  00:35        0.22
0.22       0.000
  LL1                  JUNCTION      0.00    24.12     0  00:35           0
0.834       0.000
  M                    JUNCTION     11.48    11.48     0  00:40       0.509
0.509       0.000
  N                    JUNCTION     56.97    68.16     0  00:35         1.8
2.31       0.000
  O                    JUNCTION     22.69    22.69     0  00:40        0.91
0.91       0.000
  P                    JUNCTION     38.52    38.52     0  00:40        1.61
1.61       0.000
  Q                    JUNCTION     64.68    64.68     0  00:40        2.66
2.66       0.000
  R                    JUNCTION     44.21   108.65     0  00:40        2.03
4.69       0.000
  S                    JUNCTION     25.99    25.99     0  00:35       0.894
0.894       0.000
  SP1                  JUNCTION      0.00   207.17     0  01:51           0
16       0.000
  SP2                  JUNCTION      0.00   281.79     0  00:40           0
19.2       0.000
  SP3                  JUNCTION      0.00   320.31     0  00:40           0
20.8       0.000
  T                    JUNCTION      4.04     4.04     0  00:40       0.192
0.192       0.000
  T1                   JUNCTION      0.00   137.90     0  00:40           0
5.77       0.000
  U                    JUNCTION      4.15     4.15     0  00:40       0.201
0.201       0.000
  T2                   JUNCTION      0.00   145.46     0  00:40           0
6.11       0.000
  V                    JUNCTION     29.63    29.63     0  00:45        1.42
1.42       0.000
  X                    JUNCTION    138.66   167.76     0  00:50        7.03
8.45       0.000
  W                    JUNCTION      3.45     3.45     0  00:35       0.136
0.136       0.000
  H                    JUNCTION     18.59    18.59     0  00:40       0.758
0.758       0.000
  OF2                  OUTFALL       0.00   145.46     0  00:40           0
6.11       0.000
  OF1                  OUTFALL       0.00   320.31     0  00:40           0
20.8       0.000
  OF3                  OUTFALL       0.00   167.76     0  00:50           0
8.45       0.000
  OF5                  OUTFALL       0.00    24.12     0  00:35           0
```

```
0.834       0.000
  OF4                  OUTFALL       0.00   346.26     0  00:40           0
13.4       0.000
  IRR_POND             STORAGE       0.00   298.49     0  00:40           0
13.2       0.052


  *********************
  Node Flooding Summary
  *********************

  No nodes were flooded.


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------
--------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit          1000 ft3    Full  Loss  Loss      1000 ft3    Full    days
hr:min        CFS

-------------------------------------------------------------------------------
--------------
  IRR_POND               718.772      33     0     0      1098.529      50       0
02:12     126.25


  ***********************
  Outfall Loading Summary
  ***********************

  ----------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
  Outfall Node          Pcnt       CFS       CFS    10^6 gal
  ----------------------------------------------------------
  OF2                  75.42     50.15    145.46       6.111
  OF1                  98.06    131.34    320.31      20.806
  OF3                  83.19     62.87    167.76       8.451
  OF5                  64.44      8.01     24.12       0.834
  OF4                  74.72    110.64    346.26      13.357
  ----------------------------------------------------------
  System               79.17    363.02    989.13      49.559
```

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
A100	DUMMY	20.84	0	00:35			
AA100	DUMMY	38.76	0	00:35			
B100	DUMMY	103.48	0	00:40			
BB100	DUMMY	40.62	0	00:35			
BB101	DUMMY	242.15	0	00:35			
BB102	DUMMY	257.03	0	00:35			
C100	DUMMY	33.36	0	00:40			
CC100	DUMMY	6.53	0	00:35			
D100	DUMMY	31.56	0	00:40			
DD100	DUMMY	58.42	0	00:40			
E100	DUMMY	223.69	0	00:45			
EE100	DUMMY	81.16	0	00:35			
EE101	DUMMY	162.77	0	00:35			
F100	DUMMY	24.27	0	00:35			
G100	DUMMY	79.17	0	00:35			
GG100	DUMMY	14.93	0	00:40			
H101	DUMMY	133.51	0	02:08			
HH100	DUMMY	13.01	0	00:35			
I100	DUMMY	34.58	0	00:35			
II100	DUMMY	81.77	0	00:45			
II101	DUMMY	81.77	0	00:45			
J100	DUMMY	56.31	0	00:35			
JJ100	DUMMY	9.74	0	00:35			
K100	DUMMY	92.05	0	00:40			
KK100	DUMMY	7.51	0	00:35			
L100	DUMMY	107.58	0	00:40			
LL100	DUMMY	6.88	0	00:35			
M100	DUMMY	11.48	0	00:40			
N100	DUMMY	68.16	0	00:35			
O100	DUMMY	22.69	0	00:40			
BB103	DUMMY	346.26	0	00:40			
OF5	DUMMY	24.12	0	00:35			
P100	DUMMY	38.52	0	00:40			
Q100	DUMMY	64.68	0	00:40			
R100	DUMMY	108.65	0	00:40			
S100	DUMMY	25.99	0	00:35			
SP101	DUMMY	207.17	0	01:51			
SP102	DUMMY	281.79	0	00:40			
SP103	DUMMY	320.31	0	00:40			

T100	DUMMY	4.04	0	00:40
T101	DUMMY	137.90	0	00:40
U100	DUMMY	4.15	0	00:40
U101	DUMMY	145.46	0	00:40
V100	DUMMY	29.63	0	00:45
W100	DUMMY	3.45	0	00:35
X100	DUMMY	167.76	0	00:50
H100	DUMMY	18.59	0	00:40
IRR_OUTLET	DUMMY	126.25	0	02:12

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Mon Jul 18 10:52:15 2022
Analysis ended on:  Mon Jul 18 10:52:15 2022
Total elapsed time: < 1 sec
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------


*******************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*******************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2022 00:00:00
Ending Date .............. 01/01/2022 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........       308.214        100.436
External Outflow .........       294.043         95.818
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......        14.142          4.608
Continuity Error (%) .....         0.009


*******************************
Highest Flow Instability Indexes
```

****
All links are stable.

****
Routing Time Step Summary
****

```
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
A	JUNCTION	0.00	0.00	7625.00	0 00:00	0.00
AA	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
B	JUNCTION	0.00	0.00	7570.00	0 00:00	0.00
BB	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
BB1	JUNCTION	0.00	0.00	7385.00	0 00:00	0.00
BB2	JUNCTION	0.00	0.00	7365.00	0 00:00	0.00
C	JUNCTION	0.00	0.00	7635.00	0 00:00	0.00
CC	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
D	JUNCTION	0.00	0.00	7575.00	0 00:00	0.00
DD	JUNCTION	0.00	0.00	7500.00	0 00:00	0.00
E	JUNCTION	0.00	0.00	7572.00	0 00:00	0.00
EE	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
F	JUNCTION	0.00	0.00	7633.00	0 00:00	0.00
FF	JUNCTION	0.00	0.00	7430.00	0 00:00	0.00
G	JUNCTION	0.00	0.00	7565.00	0 00:00	0.00
GG	JUNCTION	0.00	0.00	7420.00	0 00:00	0.00
H1	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
HH	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
I	JUNCTION	0.00	0.00	7595.00	0 00:00	0.00
II	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
II1	JUNCTION	0.00	0.00	7375.00	0 00:00	0.00
BB3	JUNCTION	0.00	0.00	7330.00	0 00:00	0.00
J	JUNCTION	0.00	0.00	7560.00	0 00:00	0.00
JJ	JUNCTION	0.00	0.00	7575.00	0 00:00	0.00
K	JUNCTION	0.00	0.00	7585.00	0 00:00	0.00
KK	JUNCTION	0.00	0.00	7590.00	0 00:00	0.00

```
  L                    JUNCTION     0.00     0.00  7548.00     0  00:00        0.00
  LL                   JUNCTION     0.00     0.00  7580.00     0  00:00        0.00
  LL1                  JUNCTION     0.00     0.00  7525.00     0  00:00        0.00
  M                    JUNCTION     0.00     0.00  7590.00     0  00:00        0.00
  N                    JUNCTION     0.00     0.00  7535.00     0  00:00        0.00
  O                    JUNCTION     0.00     0.00  7525.00     0  00:00        0.00
  P                    JUNCTION     0.00     0.00  7480.00     0  00:00        0.00
  Q                    JUNCTION     0.00     0.00  7585.00     0  00:00        0.00
  R                    JUNCTION     0.00     0.00  7596.00     0  00:00        0.00
  S                    JUNCTION     0.00     0.00  7598.00     0  00:00        0.00
  SP1                  JUNCTION     0.00     0.00  7495.00     0  00:00        0.00
  SP2                  JUNCTION     0.00     0.00  7490.00     0  00:00        0.00
  SP3                  JUNCTION     0.00     0.00  7435.00     0  00:00        0.00
  T                    JUNCTION     0.00     0.00  7583.00     0  00:00        0.00
  T1                   JUNCTION     0.00     0.00  7565.00     0  00:00        0.00
  U                    JUNCTION     0.00     0.00  7567.00     0  00:00        0.00
  T2                   JUNCTION     0.00     0.00  7555.00     0  00:00        0.00
  V                    JUNCTION     0.00     0.00  7577.00     0  00:00        0.00
  X                    JUNCTION     0.00     0.00  7500.00     0  00:00        0.00
  W                    JUNCTION     0.00     0.00  7546.00     0  00:00        0.00
  H                    JUNCTION     0.00     0.00  7560.00     0  00:00        0.00
  OF2                  OUTFALL      0.00     0.00  7550.00     0  00:00        0.00
  OF1                  OUTFALL      0.00     0.00  7430.00     0  00:00        0.00
  OF3                  OUTFALL      0.00     0.00  7435.00     0  00:00        0.00
  OF5                  OUTFALL      0.00     0.00  7520.00     0  00:00        0.00
  OF4                  OUTFALL      0.00     0.00  7325.00     0  00:00        0.00
  IRR_POND             STORAGE      2.90     4.82  7534.82     0  01:51        4.82


  *******************
  Node Inflow Summary
  *******************


-------------------------------------------------------------------------------------
-------------
                                   Maximum  Maximum                  Lateral
Total        Flow
                                   Lateral    Total  Time of Max      Inflow
Inflow     Balance
                                    Inflow   Inflow   Occurrence      Volume
Volume       Error
  Node                 Type           CFS      CFS  days hr:min    10^6 gal    10^6
gal     Percent

-------------------------------------------------------------------------------------
-------------
  A                    JUNCTION     43.83    43.83     0  00:40         1.3
1.3       0.000
  AA                   JUNCTION     80.22    80.22     0  00:40        2.31
```

2.31	0.000								
B		JUNCTION	107.33	221.28	0	00:45	4.12	7.82	0.000
BB		JUNCTION	84.15	84.15	0	00:40	2.56	2.56	0.000
BB1		JUNCTION	0.00	503.29	0	00:40	0	16.2	0.000
BB2		JUNCTION	0.00	534.86	0	00:40	0	17.3	0.000
C		JUNCTION	71.27	71.27	0	00:45	2.4	2.4	0.000
CC		JUNCTION	13.57	13.57	0	00:40	0.431	0.431	0.000
D		JUNCTION	67.84	67.84	0	00:50	2.67	2.67	0.000
DD		JUNCTION	123.69	123.69	0	00:50	4.85	4.85	0.000
E		JUNCTION	199.80	483.10	0	00:50	8.81	19.3	0.000
EE		JUNCTION	167.45	167.45	0	00:40	4.8	4.8	0.000
F		JUNCTION	51.63	51.63	0	00:45	1.73	1.73	0.000
FF		JUNCTION	41.02	340.42	0	00:45	1.21	11.3	0.000
G		JUNCTION	115.21	166.51	0	00:40	3.58	5.32	0.000
GG		JUNCTION	31.99	31.99	0	00:45	1.12	1.12	0.000
H1		JUNCTION	0.00	323.27	0	01:49	0	21.4	0.000
HH		JUNCTION	27.42	27.42	0	00:40	0.864	0.864	0.000
I		JUNCTION	72.63	72.63	0	00:40	2.19	2.19	0.000
II		JUNCTION	175.60	175.60	0	00:50	6.72	6.72	0.000
II1		JUNCTION	0.00	175.60	0	00:50	0	6.72	0.000
BB3		JUNCTION	0.00	733.92	0	00:45	0	24.9	0.000
J		JUNCTION	48.99	120.46	0	00:45	1.96	4.15	0.000
JJ		JUNCTION	20.50	20.50	0	00:40	0.592	0.592	0.000
K		JUNCTION	195.43	195.43	0	00:45	6.42	6.42	0.000
KK		JUNCTION	15.99	15.99	0	00:45	0.556	0.556	0.000
L		JUNCTION	33.30	228.73	0	00:45	1.12		

```
7.55       0.000
  LL                    JUNCTION     14.48    14.48     0  00:40       0.411
0.411       0.000
  LL1                   JUNCTION      0.00    50.88     0  00:40           0
1.56       0.000
  M                     JUNCTION     24.61    24.61     0  00:45       0.953
0.953       0.000
  N                     JUNCTION    119.24   143.11     0  00:40        3.37
4.32       0.000
  O                     JUNCTION     48.54    48.54     0  00:45         1.7
1.7       0.000
  P                     JUNCTION     82.17    82.17     0  00:45        3.01
3.01       0.000
  Q                     JUNCTION    137.80   137.80     0  00:45        4.98
4.98       0.000
  R                     JUNCTION     95.25   232.13     0  00:45        3.79
8.77       0.000
  S                     JUNCTION     54.65    54.65     0  00:40        1.67
1.67       0.000
  SP1                   JUNCTION      0.00   515.49     0  01:15           0
33.1       0.000
  SP2                   JUNCTION      0.00   653.32     0  01:09           0
39.1       0.000
  SP3                   JUNCTION      0.00   725.59     0  01:06           0
42.1       0.000
  T                     JUNCTION      8.68     8.68     0  00:45       0.359
0.359       0.000
  T1                    JUNCTION      0.00   294.73     0  00:45           0
10.8       0.000
  U                     JUNCTION      8.95     8.95     0  00:50       0.376
0.376       0.000
  T2                    JUNCTION      0.00   311.00     0  00:45           0
11.4       0.000
  V                     JUNCTION     63.92    63.92     0  00:50        2.66
2.66       0.000
  X                     JUNCTION    298.70   361.56     0  00:55        13.2
15.8       0.000
  W                     JUNCTION      7.33     7.33     0  00:45       0.255
0.255       0.000
  H                     JUNCTION     39.78    39.78     0  00:45        1.42
1.42       0.000
  OF2                   OUTFALL       0.00   311.00     0  00:45           0
11.4       0.000
  OF1                   OUTFALL       0.00   725.59     0  01:06           0
42.1       0.000
  OF3                   OUTFALL       0.00   361.56     0  00:55           0
15.8       0.000
  OF5                   OUTFALL       0.00    50.88     0  00:40           0
1.56       0.000
  OF4                   OUTFALL       0.00   733.92     0  00:45           0
```

```
24.9       0.000
  IRR_POND             STORAGE       0.00   644.35     0  00:50           0
24.6       0.038


  ********************
  Node Flooding Summary
  ********************

  No nodes were flooded.


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------------
--------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit          1000 ft3    Full  Loss  Loss      1000 ft3    Full    days
hr:min        CFS

-------------------------------------------------------------------------------------
--------------
  IRR_POND               988.180      45     0     0      1697.949      78       0
01:51     306.06


  ***********************
  Outfall Loading Summary
  ***********************

  ------------------------------------------------------------
                         Flow       Avg       Max       Total
                         Freq      Flow      Flow      Volume
  Outfall Node           Pcnt       CFS       CFS    10^6 gal
  ------------------------------------------------------------
  OF2                   76.53     92.46    311.00      11.432
  OF1                   98.33    265.29    725.59      42.145
  OF3                   83.75    116.84    361.56      15.810
  OF5                   64.58     14.95     50.88       1.559
  OF4                   74.86    205.58    733.92      24.865
  ------------------------------------------------------------
  System                79.61    695.11   2117.11      95.811
```

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
A100	DUMMY	43.83	0	00:40			
AA100	DUMMY	80.22	0	00:40			
B100	DUMMY	221.28	0	00:45			
BB100	DUMMY	84.15	0	00:40			
BB101	DUMMY	503.29	0	00:40			
BB102	DUMMY	534.86	0	00:40			
C100	DUMMY	71.27	0	00:45			
CC100	DUMMY	13.57	0	00:40			
D100	DUMMY	67.84	0	00:50			
DD100	DUMMY	123.69	0	00:50			
E100	DUMMY	483.10	0	00:50			
EE100	DUMMY	167.45	0	00:40			
EE101	DUMMY	340.42	0	00:45			
F100	DUMMY	51.63	0	00:45			
G100	DUMMY	166.51	0	00:40			
GG100	DUMMY	31.99	0	00:45			
H101	DUMMY	323.27	0	01:49			
HH100	DUMMY	27.42	0	00:40			
I100	DUMMY	72.63	0	00:40			
II100	DUMMY	175.60	0	00:50			
II101	DUMMY	175.60	0	00:50			
J100	DUMMY	120.46	0	00:45			
JJ100	DUMMY	20.50	0	00:40			
K100	DUMMY	195.43	0	00:45			
KK100	DUMMY	15.99	0	00:45			
L100	DUMMY	228.73	0	00:45			
LL100	DUMMY	14.48	0	00:40			
M100	DUMMY	24.61	0	00:45			
N100	DUMMY	143.11	0	00:40			
O100	DUMMY	48.54	0	00:45			
BB103	DUMMY	733.92	0	00:45			
OF5	DUMMY	50.88	0	00:40			
P100	DUMMY	82.17	0	00:45			
Q100	DUMMY	137.80	0	00:45			
R100	DUMMY	232.13	0	00:45			
S100	DUMMY	54.65	0	00:40			
SP101	DUMMY	515.49	0	01:15			
SP102	DUMMY	653.32	0	01:09			
SP103	DUMMY	725.59	0	01:06			
T100	DUMMY	8.68	0	00:45			
T101	DUMMY	294.73	0	00:45			

U100	DUMMY	8.95	0	00:50
U101	DUMMY	311.00	0	00:45
V100	DUMMY	63.92	0	00:50
W100	DUMMY	7.33	0	00:45
X100	DUMMY	361.56	0	00:55
H100	DUMMY	39.78	0	00:45
IRR_OUTLET	DUMMY	306.06	0	01:51

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Jul 18 10:53:23 2022
Analysis ended on: Mon Jul 18 10:53:23 2022
Total elapsed time: < 1 sec

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

*******************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*******************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/01/2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........       167.014         54.424
External Outflow .........       135.513         44.159
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......        32.666         10.645
Continuity Error (%) .....        -0.697


*******************************
Highest Flow Instability Indexes
*******************************
```

Link J1200 (3)
Link J1300 (3)
Link SP104 (3)
Link SP101 (2)
Link O7 (2)

****
Routing Time Step Summary
****

```
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
A	JUNCTION	0.00	0.00	7625.00	0 00:00	0.00
AA	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
B1	JUNCTION	0.53	1.73	7576.73	0 00:35	1.73
B2	JUNCTION	0.55	1.60	7576.60	0 00:40	1.60
BB	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
BB1	JUNCTION	0.54	1.41	7386.41	0 00:49	1.41
BB2	JUNCTION	0.00	0.00	7365.00	0 00:00	0.00
BB3	JUNCTION	0.00	0.00	7330.00	0 00:00	0.00
C	JUNCTION	0.00	0.00	7635.00	0 00:00	0.00
CC	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
D	JUNCTION	0.00	0.00	7609.00	0 00:00	0.00
DD	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
E	JUNCTION	0.62	1.37	7573.37	0 00:50	1.37
EE1	JUNCTION	0.42	1.02	7476.02	0 00:53	1.02
EE2	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
EE3	JUNCTION	0.18	0.74	7575.74	0 00:30	0.73
F	JUNCTION	0.00	0.00	7633.00	0 00:00	0.00
FF	JUNCTION	0.54	1.41	7431.41	0 00:48	1.41
G	JUNCTION	0.44	1.26	7566.26	0 00:40	1.26
GG	JUNCTION	0.00	0.00	7420.00	0 00:00	0.00
H	JUNCTION	0.00	0.00	7530.00	0 00:00	0.00
HH	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
I	JUNCTION	0.00	0.00	7595.00	0 00:00	0.00

II1	JUNCTION	0.33	0.75	7495.75	0	00:50	0.75
II2	JUNCTION	0.32	1.13	7451.13	0	00:35	1.13
II3	JUNCTION	0.20	0.71	7515.71	0	00:35	0.71
IRR_J	JUNCTION	0.00	0.00	7528.00	0	00:00	0.00
J10	JUNCTION	0.00	0.00	7520.00	0	00:00	0.00
J11	JUNCTION	0.00	0.00	7565.00	0	00:00	0.00
J12	JUNCTION	0.08	0.23	7545.23	0	01:04	0.22
J13	JUNCTION	0.31	0.74	7520.74	0	01:00	0.74
J14	JUNCTION	0.00	0.00	7375.00	0	00:00	0.00
J15	JUNCTION	0.00	0.00	7552.00	0	00:00	0.00
J2	JUNCTION	0.55	1.24	7436.24	0	01:46	1.24
J3	JUNCTION	0.82	1.35	7496.35	0	01:51	1.35
J4	JUNCTION	0.55	1.24	7466.24	0	01:42	1.24
J5	JUNCTION	0.30	0.53	7525.53	0	01:29	0.53
J6	JUNCTION	0.30	0.53	7570.53	0	01:27	0.53
J7	JUNCTION	0.40	1.23	7546.23	0	00:37	1.22
J8	JUNCTION	0.40	1.23	7526.23	0	00:38	1.23
J9	JUNCTION	0.00	0.00	7550.00	0	00:00	0.00
JJ	JUNCTION	0.00	0.00	7575.00	0	00:00	0.00
K	JUNCTION	0.32	1.48	7586.48	0	00:30	1.46
KK	JUNCTION	0.00	0.00	7590.00	0	00:00	0.00
L	JUNCTION	0.00	0.00	7548.00	0	00:00	0.00
LL	JUNCTION	0.00	0.00	7580.00	0	00:00	0.00
M	JUNCTION	0.20	0.96	7590.96	0	00:30	0.95
N	JUNCTION	0.35	1.63	7536.63	0	00:30	1.62
O	JUNCTION	0.00	0.00	7559.00	0	00:00	0.00
P	JUNCTION	0.00	0.00	7500.37	0	00:00	0.00
Q	JUNCTION	0.00	0.00	7585.00	0	00:00	0.00
R	JUNCTION	0.00	0.00	7576.00	0	00:00	0.00
S	JUNCTION	0.00	0.00	7598.00	0	00:00	0.00
SP1	JUNCTION	0.50	0.82	7510.82	0	00:39	0.82
SP2	JUNCTION	0.83	1.39	7496.39	0	00:48	1.38
SP3	JUNCTION	0.87	1.34	7491.34	0	02:06	1.34
SP4	JUNCTION	0.54	0.88	7420.88	0	01:06	0.88
T	JUNCTION	0.00	0.00	7583.00	0	00:00	0.00
T1	JUNCTION	0.00	0.00	7565.00	0	00:00	0.00
T2	JUNCTION	0.00	0.00	7555.00	0	00:00	0.00
U	JUNCTION	0.00	0.00	7567.00	0	00:00	0.00
V1	JUNCTION	0.00	0.00	7598.00	0	00:00	0.00
V2	JUNCTION	0.19	0.61	7565.61	0	00:35	0.61
W	JUNCTION	0.00	0.00	7546.00	0	00:00	0.00
X1	JUNCTION	0.00	0.00	7485.00	0	00:00	0.00
X2	JUNCTION	0.30	1.00	7506.00	0	00:35	0.99
X3	JUNCTION	0.38	1.01	7501.01	0	00:40	1.01
I2	JUNCTION	0.00	0.00	7577.00	0	00:00	0.00
P12	JUNCTION	0.00	0.00	7550.00	0	00:00	0.00
LL1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
OF3	OUTFALL	0.00	0.00	7431.00	0	00:00	0.00
OF1	OUTFALL	0.53	0.88	7415.88	0	01:07	0.88
OF2	OUTFALL	0.00	0.00	7550.00	0	00:00	0.00

```
  OF4                  OUTFALL      0.00     0.00  7325.00     0  00:00        0.00
  OF5                  OUTFALL      0.00     0.00  7520.00     0  00:00        0.00
  IRR_POND             STORAGE      2.04     3.13  7533.13     0  02:26        3.13
  P1                   STORAGE      2.52     3.53  7428.53     0  01:24        3.53
  P10                  STORAGE      3.00     4.85  7529.85     0  01:31        4.85
  P11                  STORAGE      3.04     5.09  7575.09     0  01:18        5.08
  P13                  STORAGE      2.85     3.99  7528.99     0  01:00        3.99
  P14                  STORAGE      2.97     4.54  7404.54     0  01:01        4.54
  P15                  STORAGE      2.80     4.26  7559.26     0  01:11        4.26
  P2                   STORAGE      5.57     7.19  7443.19     0  02:07        7.19
  P3                   STORAGE      4.48     6.33  7516.33     0  01:51        6.33
  P4                   STORAGE      4.93     7.13  7476.13     0  01:42        7.12
  P5                   STORAGE      3.20     4.68  7534.68     0  00:56        4.68
  P6                   STORAGE      3.85     5.74  7579.74     0  01:27        5.74
  P7                   STORAGE      4.50     7.59  7557.59     0  00:37        7.54
  P8                   STORAGE      4.01     6.15  7540.15     0  02:03        6.15
  P9                   STORAGE      3.74     5.58  7575.58     0  01:28        5.58
  P16                  STORAGE      3.37     4.66  7604.66     0  01:04        4.66
  P17                  STORAGE      4.41     5.85  7566.85     0  01:15        5.85


  ******************
  Node Inflow Summary
  ******************


-------------------------------------------------------------------------------------
-------------
                                  Maximum  Maximum                  Lateral
Total        Flow
                                  Lateral    Total  Time of Max      Inflow
Inflow     Balance
                                   Inflow   Inflow   Occurrence      Volume
Volume       Error
  Node                 Type           CFS      CFS  days hr:min    10^6 gal    10^6
gal     Percent

-------------------------------------------------------------------------------------
-------------
  A                    JUNCTION     20.84    20.84     0  00:35       0.696
0.696       0.000
  AA                   JUNCTION     39.23    39.23     0  00:35        1.26
1.26       0.000
  B1                   JUNCTION     66.93    87.77     0  00:35        2.29
2.99       0.000
  B2                   JUNCTION     17.99    53.23     0  00:40       0.762
2.1       0.000
  BB                   JUNCTION     40.62    40.62     0  00:35        1.38
1.38       0.000
  BB1                  JUNCTION      0.00   214.28     0  00:41           0
```

8.75 0.000
BB2 JUNCTION 0.00 229.61 0 00:40 0
9.36 0.000
BB3 JUNCTION 0.00 307.27 0 00:48 0
13.3 0.000
C JUNCTION 35.31 35.31 0 00:35 1.34
1.34 0.000
CC JUNCTION 6.53 6.53 0 00:35 0.232
0.232 0.000
D JUNCTION 61.12 61.12 0 00:30 1.58
1.58 0.000
DD JUNCTION 57.78 57.78 0 00:40 2.59
2.59 0.000
E JUNCTION 74.68 74.68 0 00:50 4
4 0.000
EE1 JUNCTION 53.25 60.58 0 00:53 1.89
2.62 0.000
EE2 JUNCTION 35.71 35.71 0 00:30 0.647
0.647 0.000
EE3 JUNCTION 10.38 10.38 0 00:30 0.26
0.26 0.000
F JUNCTION 24.27 24.27 0 00:35 0.927
0.927 0.000
FF JUNCTION 20.78 139.72 0 00:48 0.669
6.11 0.000
G JUNCTION 27.18 51.31 0 00:40 1.18
2.1 0.000
GG JUNCTION 15.49 15.49 0 00:35 0.607
0.607 0.000
H JUNCTION 17.86 17.86 0 00:40 0.818
0.818 0.000
HH JUNCTION 13.56 13.56 0 00:35 0.469
0.469 0.000
I JUNCTION 40.37 40.37 0 00:30 1.11
1.11 0.000
II1 JUNCTION 34.94 34.94 0 00:50 1.88
1.88 0.000
II2 JUNCTION 28.04 56.21 0 00:35 0.853
1.74 0.000
II3 JUNCTION 28.32 28.32 0 00:35 0.886
0.886 0.000
IRR_J JUNCTION 0.00 114.18 0 02:26 0
7.97 0.000
J10 JUNCTION 0.00 124.52 0 02:25 0
8.74 0.000
J11 JUNCTION 0.00 98.74 0 01:18 0
4.78 0.000
J12 JUNCTION 0.00 24.66 0 01:04 0
0.985 -0.000
J13 JUNCTION 0.00 17.17 0 01:00 0

0.729	0.000								
J14		JUNCTION	0.00	76.43	0	01:01	0	3.44	0.000
J15		JUNCTION	0.00	30.95	0	01:11	0	1.38	0.000
J2		JUNCTION	0.00	95.68	0	02:04	0	5.46	0.000
J3		JUNCTION	0.00	22.74	0	01:51	0	1.57	0.000
J4		JUNCTION	0.00	70.77	0	01:42	0	3.92	0.000
J5		JUNCTION	0.00	49.82	0	00:58	0	2.19	0.000
J6		JUNCTION	0.00	12.23	0	01:27	0	0.847	0.000
J7		JUNCTION	0.00	180.87	0	00:37	0	4.34	0.000
J8		JUNCTION	0.00	182.92	0	00:38	0	4.88	0.000
J9		JUNCTION	0.00	94.99	0	01:28	0	4.83	0.000
JJ		JUNCTION	11.49	11.49	0	00:30	0.328	0.328	0.000
K		JUNCTION	200.94	200.94	0	00:30	4.46	4.46	0.000
KK		JUNCTION	8.14	8.14	0	00:35	0.31	0.31	0.000
L		JUNCTION	15.97	15.97	0	00:35	0.603	0.603	0.000
LL		JUNCTION	7.36	7.36	0	00:30	0.226	0.226	0.000
M		JUNCTION	46.54	46.54	0	00:30	1.01	1.01	0.000
N		JUNCTION	73.48	73.48	0	00:30	1.56	1.56	0.000
O		JUNCTION	63.86	63.86	0	00:35	2.02	2.02	0.000
P		JUNCTION	40.00	40.00	0	00:40	1.66	1.66	0.000
Q		JUNCTION	64.68	64.68	0	00:40	2.66	2.66	0.000
R		JUNCTION	56.59	120.84	0	00:40	2.13	4.79	0.000
S		JUNCTION	30.83	30.83	0	00:30	0.841	0.841	0.000
SP1		JUNCTION	0.00	189.85	0	00:39	0	14.6	0.000
SP2		JUNCTION	0.00	223.43	0	00:48	0	16.7	0.000
SP3		JUNCTION	0.00	212.45	0	01:03	0		

```
18.1       0.000
  SP4                  JUNCTION      0.00   240.49     0  01:06           0
19.4       0.000
  T                    JUNCTION      4.04     4.04     0  00:40       0.192
0.192       0.000
  T1                   JUNCTION      0.00    98.27     0  01:27           0
5.02       0.000
  T2                   JUNCTION      0.00   104.34     0  01:26           0
5.37       0.000
  U                    JUNCTION      4.81     4.81     0  00:40       0.215
0.215       0.000
  V1                   JUNCTION     13.99    13.99     0  00:35       0.448
0.448       0.000
  V2                   JUNCTION     16.15    16.15     0  00:35       0.572
0.572       0.000
  W                    JUNCTION      3.45     3.45     0  00:35       0.136
0.136       0.000
  X1                   JUNCTION     80.91    80.91     0  00:35        2.94
2.94       0.000
  X2                   JUNCTION     41.46    41.46     0  00:35         1.4
1.4       0.000
  X3                   JUNCTION     47.59    76.22     0  00:40        2.33
3.35       0.000
  I2                   JUNCTION      0.00    24.36     0  01:04           0
0.936       0.000
  P12                  JUNCTION      0.30     0.30     0  00:00      0.0485
0.0484       0.000
  LL1                  JUNCTION      0.00    16.85     0  01:15           0
0.663       0.000
  OF3                  OUTFALL       0.00    95.68     0  02:04           0
5.46       0.000
  OF1                  OUTFALL       0.00   240.43     0  01:07           0
19.4       0.000
  OF2                  OUTFALL       0.00   104.34     0  01:26           0
5.37       0.000
  OF4                  OUTFALL       0.00   307.27     0  00:48           0
13.3       0.000
  OF5                  OUTFALL       0.00    16.85     0  01:15           0
0.663       0.000
  IRR_POND             STORAGE       0.00   243.77     0  01:09           0
12.3       0.046
  P1                   STORAGE       0.00    40.00     0  00:40           0
1.66       0.117
  P10                  STORAGE       0.00    17.86     0  00:40           0
0.818       0.062
  P11                  STORAGE       0.00   139.15     0  00:38           0
5.09       0.072
  P13                  STORAGE       0.00    45.11     0  00:30           0
0.907       0.149
  P14                  STORAGE       0.00    87.41     0  00:41           0
```

```
3.62       0.147
  P15                  STORAGE       0.00    61.12     0  00:30           0
1.58       0.081
  P2                   STORAGE       0.00    80.91     0  00:35           0
2.94       0.039
  P3                   STORAGE       0.00    63.86     0  00:35           0
2.02       0.027
  P4                   STORAGE       0.00   116.70     0  00:41           0
4.75       0.055
  P5                   STORAGE       0.00    72.03     0  00:32           0
1.56       0.175
  P6                   STORAGE       0.00    46.22     0  00:31           0
1.01       0.049
  P7                   STORAGE       0.00   200.43     0  00:31           0
4.46       0.122
  P8                   STORAGE       0.00    15.97     0  00:35           0
0.603       0.032
  P9                   STORAGE       0.00   148.40     0  00:40           0
5.63       0.062
  P16                  STORAGE       0.00    40.37     0  00:30           0
1.11       0.188
  P17                  STORAGE       0.00    26.64     0  00:35           0
0.864       0.119


  **********************
  Node Flooding Summary
  **********************

  No nodes were flooded.


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------
--------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit          1000 ft3    Full  Loss  Loss      1000 ft3    Full    days
hr:min        CFS

-------------------------------------------------------------------------------
--------------
  IRR_POND               674.845      31     0     0      1055.638      48       0
02:26     114.18
```

P1	32.632	11	0	0	57.543	19	0	01:24 29.38
P10	13.875	13	0	0	29.668	27	0	01:31 13.64
P11	69.800	15	0	0	160.007	35	0	01:18 98.74
P13	33.097	13	0	0	58.073	23	0	01:00 17.17
P14	31.811	14	0	0	62.216	28	0	01:01 76.43
P15	41.957	28	0	0	85.004	57	0	01:11 30.95
P2	202.937	43	0	0	286.797	61	0	02:06 27.93
P3	99.633	29	0	0	165.333	49	0	01:50 22.74
P4	136.283	35	0	0	230.559	59	0	01:42 70.77
P5	44.714	16	0	0	81.028	30	0	00:56 39.47
P6	42.385	22	0	0	77.410	40	0	01:27 12.23
P7	26.618	25	0	0	63.403	60	0	00:37 180.87
P8	22.504	21	0	0	43.356	41	0	02:02 6.50
P9	152.526	23	0	0	274.350	42	0	01:27 94.99
P16	37.021	17	0	0	61.293	29	0	01:03 24.36
P17	31.286	38	0	0	47.674	58	0	01:14 16.85

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OF3	98.06	34.46	95.68	5.458
OF1	93.61	128.25	240.43	19.393
OF2	98.33	33.80	104.34	5.371
OF4	98.47	83.41	307.27	13.270
OF5	96.39	4.25	16.85	0.663
System	96.97	284.18	707.87	44.155

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
A100	DUMMY	20.84	0	00:35			
AA100	DUMMY	39.23	0	00:35			
B100	CONDUIT	87.22	0	00:37	4.63	0.29	0.58
B200	CONDUIT	53.15	0	00:42	3.55	0.23	0.53
BB100	DUMMY	40.62	0	00:35			
BB101	DUMMY	214.28	0	00:41			
BB102	DUMMY	229.61	0	00:40			
BB103	DUMMY	307.27	0	00:48			
C100	DUMMY	35.31	0	00:35			
C900	CONDUIT	46.22	0	00:31	7.08	0.08	0.32
CC100	DUMMY	6.53	0	00:35			
D100	DUMMY	61.12	0	00:30			
DD100	DUMMY	57.78	0	00:40			
E100	CONDUIT	74.39	0	00:53	6.43	0.16	0.46
EE100	CONDUIT	60.55	0	00:55	8.40	0.09	0.34
EE101	CONDUIT	139.71	0	00:49	10.28	0.18	0.47
EE200	DUMMY	35.71	0	00:30			
EE300	CONDUIT	10.11	0	00:33	9.87	0.28	0.36
F100	DUMMY	24.27	0	00:35			
G100	CONDUIT	50.38	0	00:45	5.08	0.13	0.42
GG100	DUMMY	15.49	0	00:35			
H100	DUMMY	17.86	0	00:40			
H101	DUMMY	124.52	0	02:25			
HH100	DUMMY	13.56	0	00:35			
I100	DUMMY	40.37	0	00:30			
II100	CONDUIT	34.92	0	00:51	7.77	0.12	0.38
II200	CONDUIT	56.13	0	00:37	7.64	0.26	0.57
II300	CONDUIT	28.31	0	00:36	8.19	0.09	0.36
IRR_J100	DUMMY	114.18	0	02:26			
J1100	DUMMY	98.74	0	01:18			
J1200	CONDUIT	22.46	0	01:23	2.08	0.01	0.05
J1300	CONDUIT	17.08	0	01:06	4.66	0.10	0.37
J1400	DUMMY	76.43	0	01:01			
J1500	DUMMY	30.95	0	01:11			
J300	CONDUIT	22.56	0	02:06	2.06	0.16	0.45
J400	CONDUIT	70.72	0	01:46	5.83	0.08	0.31
J500	DUMMY	49.82	0	00:58			
J600	CONDUIT	12.23	0	01:29	5.66	0.05	0.26
J700	CONDUIT	180.84	0	00:38	23.78	0.02	0.25

J800	DUMMY	182.92	0	00:38			
J900	DUMMY	94.99	0	01:28			
JJ100	DUMMY	11.49	0	00:30			
JP20	DUMMY	95.68	0	02:04			
K100	CONDUIT	200.43	0	00:31	13.74	0.20	0.49
L100	DUMMY	15.97	0	00:35			
LL100	DUMMY	7.36	0	00:30			
N100	CONDUIT	72.03	0	00:32	4.31	0.25	0.54
O100	DUMMY	63.86	0	00:35			
P100	DUMMY	40.00	0	00:40			
Q100	DUMMY	64.68	0	00:40			
R100	DUMMY	120.84	0	00:40			
S100	DUMMY	30.83	0	00:30			
SP101	CONDUIT	186.49	0	00:44	3.96	0.05	0.20
SP102	CONDUIT	208.08	0	01:03	2.46	0.12	0.33
SP103	CONDUIT	212.07	0	01:06	6.78	0.02	0.11
SP104	CONDUIT	240.43	0	01:07	4.59	0.04	0.18
SP206	DUMMY	104.34	0	01:26			
T100	DUMMY	4.04	0	00:40			
T101	DUMMY	98.27	0	01:27			
U100	DUMMY	4.81	0	00:40			
V100	DUMMY	13.99	0	00:35			
V200	CONDUIT	16.01	0	00:38	5.98	0.07	0.30
W100	DUMMY	3.45	0	00:35			
X100	DUMMY	80.91	0	00:35			
X200	CONDUIT	41.01	0	00:38	5.96	0.08	0.33
X300	CONDUIT	76.15	0	00:41	9.36	0.09	0.34
I200	DUMMY	24.36	0	01:04			
O12	DUMMY	0.30	0	00:00			
KK100	DUMMY	8.14	0	00:35			
LL200	DUMMY	16.85	0	01:15			
IRR_OUTLET	DUMMY	114.18	0	02:26			
O1	DUMMY	29.38	0	01:24			
O10	DUMMY	13.64	0	01:31			
O11	DUMMY	98.74	0	01:18			
O13	DUMMY	17.17	0	01:00			
O14	DUMMY	76.43	0	01:01			
O2	DUMMY	27.93	0	02:07			
O3	DUMMY	22.74	0	01:51			
O5	DUMMY	39.47	0	00:56			
O6	DUMMY	12.23	0	01:27			
O7	DUMMY	180.87	0	00:37			
O8	DUMMY	6.50	0	02:03			
O9	DUMMY	94.99	0	01:28			
O16	DUMMY	24.36	0	01:04			
O15	DUMMY	30.95	0	01:11			
O17	DUMMY	16.85	0	01:15			
O4	DUMMY	70.77	0	01:42			

```
************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Thu Jul 28 14:53:53 2022
Analysis ended on:  Thu Jul 28 14:53:53 2022
Total elapsed time: < 1 sec
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

*******************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*******************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/01/2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 30.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........       328.826        107.153
External Outflow .........       290.042         94.514
Flooding Loss ............         2.515          0.820
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......        37.312         12.159
Continuity Error (%) .....        -0.317


*******************************
Highest Flow Instability Indexes
*******************************
```

Link J700 (3)
Link O7 (3)
Link J1300 (2)
Link J1200 (2)
Link J500 (2)

****
Routing Time Step Summary
****

```
Minimum Time Step           :    30.00 sec
Average Time Step           :    30.00 sec
Maximum Time Step           :    30.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
A	JUNCTION	0.00	0.00	7625.00	0 00:00	0.00
AA	JUNCTION	0.00	0.00	7525.00	0 00:00	0.00
B1	JUNCTION	0.67	2.37	7577.37	0 00:40	2.37
B2	JUNCTION	0.71	2.22	7577.22	0 00:45	2.21
BB	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
BB1	JUNCTION	0.69	2.09	7387.09	0 00:52	2.08
BB2	JUNCTION	0.00	0.00	7365.00	0 00:00	0.00
BB3	JUNCTION	0.00	0.00	7330.00	0 00:00	0.00
C	JUNCTION	0.00	0.00	7635.00	0 00:00	0.00
CC	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
D	JUNCTION	0.00	0.00	7609.00	0 00:00	0.00
DD	JUNCTION	0.00	0.00	7495.00	0 00:00	0.00
E	JUNCTION	0.81	1.91	7573.91	0 00:55	1.91
EE1	JUNCTION	0.52	1.57	7476.57	0 00:52	1.57
EE2	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
EE3	JUNCTION	0.23	1.05	7576.05	0 00:35	1.04
F	JUNCTION	0.00	0.00	7633.00	0 00:00	0.00
FF	JUNCTION	0.69	2.09	7432.09	0 00:51	2.08
G	JUNCTION	0.57	1.76	7566.76	0 00:45	1.76
GG	JUNCTION	0.00	0.00	7420.00	0 00:00	0.00
H	JUNCTION	0.00	0.00	7530.00	0 00:00	0.00
HH	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
I	JUNCTION	0.00	0.00	7595.00	0 00:00	0.00

II1	JUNCTION	0.44	1.08	7496.08	0	00:50	1.08
II2	JUNCTION	0.41	1.55	7451.55	0	00:40	1.55
II3	JUNCTION	0.26	0.99	7515.99	0	00:40	0.99
IRR_J	JUNCTION	0.00	0.00	7528.00	0	00:00	0.00
J10	JUNCTION	0.00	0.00	7520.00	0	00:00	0.00
J11	JUNCTION	0.00	0.00	7565.00	0	00:00	0.00
J12	JUNCTION	0.36	0.54	7545.54	0	00:55	0.54
J13	JUNCTION	0.39	1.25	7521.25	0	00:51	1.24
J14	JUNCTION	0.00	0.00	7375.00	0	00:00	0.00
J15	JUNCTION	0.00	0.00	7552.00	0	00:00	0.00
J2	JUNCTION	0.76	2.02	7437.02	0	01:15	2.02
J3	JUNCTION	1.10	1.84	7496.84	0	01:39	1.84
J4	JUNCTION	0.75	2.02	7467.02	0	01:12	2.02
J5	JUNCTION	0.41	0.99	7525.99	0	01:07	0.99
J6	JUNCTION	0.41	0.99	7570.99	0	01:05	0.99
J7	JUNCTION	0.46	1.36	7546.36	0	00:31	1.36
J8	JUNCTION	0.46	1.37	7526.37	0	00:32	1.36
J9	JUNCTION	0.00	0.00	7550.00	0	00:00	0.00
JJ	JUNCTION	0.00	0.00	7575.00	0	00:00	0.00
K	JUNCTION	0.41	1.98	7586.98	0	00:35	1.96
KK	JUNCTION	0.00	0.00	7590.00	0	00:00	0.00
L	JUNCTION	0.00	0.00	7548.00	0	00:00	0.00
LL	JUNCTION	0.00	0.00	7580.00	0	00:00	0.00
M	JUNCTION	0.26	1.30	7591.30	0	00:35	1.29
N	JUNCTION	0.44	2.18	7537.18	0	00:35	2.17
O	JUNCTION	0.00	0.00	7559.00	0	00:00	0.00
P	JUNCTION	0.00	0.00	7500.37	0	00:00	0.00
Q	JUNCTION	0.00	0.00	7585.00	0	00:00	0.00
R	JUNCTION	0.00	0.00	7576.00	0	00:00	0.00
S	JUNCTION	0.00	0.00	7598.00	0	00:00	0.00
SP1	JUNCTION	0.85	1.43	7511.43	0	01:14	1.43
SP2	JUNCTION	1.37	2.40	7497.40	0	01:16	2.38
SP3	JUNCTION	1.33	2.37	7492.37	0	01:20	2.37
SP4	JUNCTION	0.87	1.61	7421.61	0	01:22	1.60
T	JUNCTION	0.00	0.00	7583.00	0	00:00	0.00
T1	JUNCTION	0.00	0.00	7565.00	0	00:00	0.00
T2	JUNCTION	0.00	0.00	7555.00	0	00:00	0.00
U	JUNCTION	0.00	0.00	7567.00	0	00:00	0.00
V1	JUNCTION	0.00	0.00	7598.00	0	00:00	0.00
V2	JUNCTION	0.24	0.85	7565.85	0	00:40	0.85
W	JUNCTION	0.00	0.00	7546.00	0	00:00	0.00
X1	JUNCTION	0.00	0.00	7485.00	0	00:00	0.00
X2	JUNCTION	0.38	1.37	7506.37	0	00:40	1.36
X3	JUNCTION	0.50	1.44	7501.44	0	00:46	1.43
I2	JUNCTION	0.00	0.00	7577.00	0	00:00	0.00
P12	JUNCTION	0.00	0.00	7550.00	0	00:00	0.00
LL1	JUNCTION	0.00	0.00	0.00	0	00:00	0.00
OF3	OUTFALL	0.00	0.00	7431.00	0	00:00	0.00
OF1	OUTFALL	0.87	1.61	7416.61	0	01:22	1.60
OF2	OUTFALL	0.00	0.00	7550.00	0	00:00	0.00

OF4	OUTFALL	0.00	0.00	7325.00	0	00:00	0.00
OF5	OUTFALL	0.00	0.00	7520.00	0	00:00	0.00
IRR_POND	STORAGE	2.76	4.57	7534.57	0	02:06	4.57
P1	STORAGE	2.80	4.52	7429.52	0	01:07	4.52
P10	STORAGE	3.39	5.83	7530.83	0	01:09	5.83
P11	STORAGE	3.68	7.59	7577.59	0	01:11	7.59
P13	STORAGE	3.01	4.81	7529.81	0	00:51	4.80
P14	STORAGE	3.99	8.57	7408.57	0	01:10	8.57
P15	STORAGE	3.14	5.82	7560.82	0	01:09	5.82
P2	STORAGE	6.20	8.76	7444.76	0	01:38	8.76
P3	STORAGE	5.54	8.81	7518.81	0	01:39	8.81
P4	STORAGE	5.49	8.80	7477.80	0	01:12	8.79
P5	STORAGE	3.36	5.72	7535.72	0	00:52	5.70
P6	STORAGE	4.75	7.78	7581.78	0	01:05	7.78
P7	STORAGE	4.94	10.00	7560.00	0	00:55	10.00
P8	STORAGE	4.50	7.09	7541.09	0	01:14	7.09
P9	STORAGE	4.37	7.80	7577.80	0	01:17	7.79
P16	STORAGE	3.53	5.40	7605.40	0	00:55	5.40
P17	STORAGE	4.59	6.39	7567.39	0	00:53	6.39

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
A	JUNCTION	43.83	43.83	0 00:40	1.3	1.3	0.000
AA	JUNCTION	81.18	81.18	0 00:40	2.33	2.33	0.000
B1	JUNCTION	133.69	177.52	0 00:40	4.17	5.47	0.000
B2	JUNCTION	37.14	112.42	0 00:45	1.39	3.89	0.000
BB	JUNCTION	84.15	84.15	0 00:40	2.56	2.56	0.000
BB1	JUNCTION	0.00	483.72	0 00:50	0		

16.3	0.000								
BB2		JUNCTION	0.00	515.49	0	00:50	0	17.4	0.000
BB3		JUNCTION	0.00	646.46	0	00:51	0	24.8	0.000
C		JUNCTION	75.28	75.28	0	00:45	2.5	2.5	0.000
CC		JUNCTION	13.57	13.57	0	00:40	0.431	0.431	0.000
D		JUNCTION	117.38	117.38	0	00:35	2.86	2.86	0.000
DD		JUNCTION	122.41	122.41	0	00:50	4.81	4.81	0.000
E		JUNCTION	157.91	157.91	0	00:55	7.39	7.39	0.000
EE1		JUNCTION	110.30	156.68	0	00:52	3.51	4.92	0.000
EE2		JUNCTION	63.62	63.62	0	00:35	1.13	1.13	0.000
EE3		JUNCTION	19.33	19.33	0	00:35	0.463	0.463	0.000
F		JUNCTION	51.63	51.63	0	00:45	1.73	1.73	0.000
FF		JUNCTION	43.07	330.28	0	00:51	1.24	11.4	-0.000
G		JUNCTION	57.12	108.76	0	00:45	2.18	3.91	0.000
GG		JUNCTION	32.48	32.48	0	00:45	1.13	1.13	0.000
H		JUNCTION	37.80	37.80	0	00:45	1.52	1.52	0.000
HH		JUNCTION	28.16	28.16	0	00:40	0.87	0.87	0.000
I		JUNCTION	78.06	78.06	0	00:35	2.02	2.02	0.000
II1		JUNCTION	74.39	74.39	0	00:50	3.49	3.49	0.000
II2		JUNCTION	57.88	116.26	0	00:40	1.58	3.23	0.000
II3		JUNCTION	58.65	58.65	0	00:40	1.64	1.64	0.000
IRR_J		JUNCTION	0.00	274.80	0	02:06	0	18.3	0.000
J10		JUNCTION	0.00	292.64	0	02:03	0	19.7	0.000
J11		JUNCTION	0.00	230.44	0	01:11	0	9.06	0.000
J12		JUNCTION	0.00	108.72	0	00:55	0	9.1	0.000
J13		JUNCTION	0.00	54.35	0	00:51	0		

J14	JUNCTION	0.00	155.08	0	01:10	0	1.41	0.000
J15	JUNCTION	0.00	68.43	0	01:09	0	6.54	0.000
J2	JUNCTION	0.00	271.49	0	01:15	0	2.65	0.000
J3	JUNCTION	0.00	46.10	0	01:39	0	11.8	0.000
J4	JUNCTION	0.00	199.13	0	01:12	0	3.15	0.000
J5	JUNCTION	0.00	139.06	0	01:02	0	7.87	0.000
J6	JUNCTION	0.00	47.71	0	01:05	0	4.27	0.000
J7	JUNCTION	0.00	234.87	0	00:31	0	1.65	0.000
J8	JUNCTION	0.00	259.47	0	01:14	0	7.11	0.000
J9	JUNCTION	0.00	221.14	0	01:17	0	8.15	0.000
JJ	JUNCTION	22.80	22.80	0	00:35	0.603	9.59	0.000
K	JUNCTION	382.30	382.30	0	00:35	8.05	0.603	0.000
KK	JUNCTION	16.95	16.95	0	00:40	0.575	8.05	0.000
L	JUNCTION	32.40	32.40	0	00:40	1.1	0.575	0.000
LL	JUNCTION	15.07	15.07	0	00:40	0.418	1.1	0.000
M	JUNCTION	89.08	89.08	0	00:35	1.83	0.418	0.000
N	JUNCTION	141.24	141.24	0	00:35	2.84	1.83	0.000
O	JUNCTION	127.40	127.40	0	00:40	3.67	2.84	0.000
P	JUNCTION	82.83	82.83	0	00:45	3.04	3.67	0.000
Q	JUNCTION	137.80	137.80	0	00:45	4.98	3.04	0.000
R	JUNCTION	116.06	253.86	0	00:45	3.91	4.98	0.000
S	JUNCTION	58.96	58.96	0	00:35	1.52	8.89	0.000
SP1	JUNCTION	0.00	511.89	0	01:14	0	1.52	0.000
SP2	JUNCTION	0.00	618.35	0	01:16	0	36.8	0.000
SP3	JUNCTION	0.00	641.31	0	01:20	0	40.8	0.000

```
43.3       0.000
  SP4                  JUNCTION      0.00   706.05     0  01:22           0
46       0.000
  T                    JUNCTION      8.68     8.68     0  00:45       0.359
0.359       0.000
  T1                   JUNCTION      0.00   228.33     0  01:17           0
9.95       0.000
  T2                   JUNCTION      0.00   242.18     0  01:16           0
10.6       0.000
  U                    JUNCTION     10.51    10.51     0  00:45       0.402
0.402       0.000
  V1                   JUNCTION     27.67    27.67     0  00:40       0.808
0.808       0.000
  V2                   JUNCTION     33.25    33.25     0  00:40        1.06
1.06       0.000
  W                    JUNCTION      7.46     7.46     0  00:40       0.255
0.255       0.000
  X1                   JUNCTION    163.27   163.27     0  00:45        5.34
5.34       0.000
  X2                   JUNCTION     82.46    82.46     0  00:40        2.54
2.54       0.000
  X3                   JUNCTION    100.73   158.96     0  00:46         4.3
6.17       0.000
  I2                   JUNCTION      0.00    63.72     0  00:55           0
1.84       0.000
  P12                  JUNCTION     45.00    45.00     0  00:00        7.27
7.27       0.000
  LL1                  JUNCTION      0.00    49.55     0  00:53           0
1.39       0.000
  OF3                  OUTFALL       0.00   271.49     0  01:15           0
11.8       0.000
  OF1                  OUTFALL       0.00   705.93     0  01:22           0
45.9       0.000
  OF2                  OUTFALL       0.00   242.18     0  01:16           0
10.6       0.000
  OF4                  OUTFALL       0.00   646.46     0  00:51           0
24.8       0.000
  OF5                  OUTFALL       0.00    49.55     0  00:53           0
1.39       0.000
  IRR_POND             STORAGE       0.00   550.27     0  01:07           0
23       0.038
  P1                   STORAGE       0.00    82.83     0  00:45           0
3.04       0.095
  P10                  STORAGE       0.00    37.80     0  00:45           0
1.52       0.076
  P11                  STORAGE       0.00   287.54     0  00:46           0
9.37       0.043
  P13                  STORAGE       0.00    81.59     0  00:35           0
1.59       0.115
  P14                  STORAGE       0.00   184.37     0  00:47           0
```

```
6.72       0.071
  P15                  STORAGE       0.00   117.38     0  00:35           0
2.86       0.060
  P2                   STORAGE       0.00   163.27     0  00:45           0
5.34       0.041
  P3                   STORAGE       0.00   127.40     0  00:40           0
3.67       0.027
  P4                   STORAGE       0.00   240.47     0  00:46           0
8.71       0.064
  P5                   STORAGE       0.00   139.56     0  00:37           0
2.84       0.133
  P6                   STORAGE       0.00    88.72     0  00:36           0
1.83       0.087
  P7                   STORAGE       0.00   381.85     0  00:36           0
8.05       0.051
  P8                   STORAGE       0.00    32.40     0  00:40           0
1.1       0.111
  P9                   STORAGE       0.00   309.44     0  00:45           0
10.4       0.048
  P16                  STORAGE       0.00    78.06     0  00:35           0
2.02       0.131
  P17                  STORAGE       0.00    54.80     0  00:40           0
1.6       0.221


  **********************
  Node Flooding Summary
  **********************

  Flooding refers to all water that overflows a node, whether it ponds or not.
  --------------------------------------------------------------------------
                                                                 Total   Maximum
                                  Maximum   Time of Max          Flood    Ponded
                        Hours       Rate    Occurrence         Volume    Volume
  Node                  Flooded      CFS   days hr:min       10^6 gal  1000 ft3
  --------------------------------------------------------------------------
  P7                       0.39    144.38      0  00:37          0.819     0.000


  **********************
  Storage Volume Summary
  **********************


-------------------------------------------------------------------------------------
--------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
```

```
  Storage Unit          1000 ft3    Full  Loss  Loss      1000 ft3    Full    days
hr:min        CFS

--------------------------------------------------------------------------------
--------------
  IRR_POND              937.643      43     0     0      1601.097      73       0
02:06     274.80
  P1                     40.419      13     0     0        86.546      29       0
01:06      73.03
  P10                    17.750      16     0     0        40.965      37       0
01:09      33.90
  P11                   102.795      23     0     0       298.174      65       0
01:10     230.44
  P13                    36.773      14     0     0        78.989      31       0
00:51      54.35
  P14                    58.001      26     0     0       174.628      77       0
01:09     155.08
  P15                    53.042      36     0     0       140.809      95       0
01:09      68.43
  P2                    240.111      51     0     0       385.792      82       0
01:38      74.57
  P3                    143.247      42     0     0       277.490      82       0
01:39      46.10
  P4                    163.739      42     0     0       320.570      82       0
01:11     199.13
  P5                     49.222      18     0     0       111.726      41       0
00:52     103.73
  P6                     61.785      32     0     0       127.676      65       0
01:05      47.71
  P7                     33.332      32     0     0       105.140     100       0
00:36     234.87
  P8                     27.994      26     0     0        56.030      53       0
01:14      24.60
  P9                    198.987      31     0     0       450.202      69       0
01:17     221.14
  P16                    40.266      19     0     0        77.891      37       0
00:55      63.72
  P17                    33.643      41     0     0        55.496      68       0
00:52      49.55


  **********************
  Outfall Loading Summary
  **********************

  ------------------------------------------------------------
                        Flow       Avg       Max       Total
                        Freq      Flow      Flow      Volume
  Outfall Node          Pcnt       CFS       CFS    10^6 gal
  ------------------------------------------------------------
```

OF3	98.19	74.32	271.49	11.790
OF1	93.47	303.87	705.93	45.881
OF2	98.47	66.67	242.18	10.607
OF4	98.47	156.12	646.46	24.839
OF5	96.53	8.92	49.55	1.391
System	97.03	609.90	1777.26	94.507

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
A100	DUMMY	43.83	0 00:40			
AA100	DUMMY	81.18	0 00:40			
B100	CONDUIT	176.88	0 00:42	5.55	0.58	0.79
B200	CONDUIT	112.09	0 00:47	4.28	0.49	0.74
BB100	DUMMY	84.15	0 00:40			
BB101	DUMMY	483.72	0 00:50			
BB102	DUMMY	515.49	0 00:50			
BB103	DUMMY	646.46	0 00:51			
C100	DUMMY	75.28	0 00:45			
C900	CONDUIT	88.72	0 00:36	8.38	0.14	0.43
CC100	DUMMY	13.57	0 00:40			
D100	DUMMY	117.38	0 00:35			
DD100	DUMMY	122.41	0 00:50			
E100	CONDUIT	157.49	0 00:58	7.78	0.34	0.64
EE100	CONDUIT	156.62	0 00:53	10.75	0.22	0.52
EE101	CONDUIT	330.14	0 00:52	12.84	0.43	0.70
EE200	DUMMY	63.62	0 00:35			
EE300	CONDUIT	19.07	0 00:39	11.63	0.53	0.52
F100	DUMMY	51.63	0 00:45			
G100	CONDUIT	107.69	0 00:51	6.18	0.28	0.58
GG100	DUMMY	32.48	0 00:45			
H100	DUMMY	37.80	0 00:45			
H101	DUMMY	292.64	0 02:03			
HH100	DUMMY	28.16	0 00:40			
I100	DUMMY	78.06	0 00:35			
II100	CONDUIT	74.41	0 00:56	9.49	0.25	0.54
II200	CONDUIT	116.09	0 00:42	9.17	0.54	0.77
II300	CONDUIT	58.55	0 00:41	9.88	0.20	0.50
IRR_J100	DUMMY	274.80	0 02:06			
J1100	DUMMY	230.44	0 01:11			
J1200	CONDUIT	107.12	0 01:04	3.63	0.03	0.13
J1300	CONDUIT	53.90	0 00:55	6.31	0.33	0.62

J1400	DUMMY	155.08	0	01:10			
J1500	DUMMY	68.43	0	01:09			
J300	CONDUIT	45.89	0	01:51	2.49	0.32	0.61
J400	CONDUIT	198.78	0	01:15	7.55	0.21	0.51
J500	DUMMY	139.06	0	01:02			
J600	CONDUIT	47.66	0	01:07	8.11	0.19	0.49
J700	CONDUIT	238.60	0	00:32	25.63	0.03	0.27
J800	DUMMY	259.47	0	01:14			
J900	DUMMY	221.14	0	01:17			
JJ100	DUMMY	22.80	0	00:35			
JP20	DUMMY	271.49	0	01:15			
K100	CONDUIT	381.85	0	00:36	16.23	0.38	0.66
L100	DUMMY	32.40	0	00:40			
LL100	DUMMY	15.07	0	00:40			
N100	CONDUIT	139.56	0	00:37	5.09	0.48	0.72
O100	DUMMY	127.40	0	00:40			
P100	DUMMY	82.83	0	00:45			
Q100	DUMMY	137.80	0	00:45			
R100	DUMMY	253.86	0	00:45			
S100	DUMMY	58.96	0	00:35			
SP101	CONDUIT	511.87	0	01:16	5.57	0.14	0.35
SP102	CONDUIT	600.43	0	01:20	3.41	0.36	0.59
SP103	CONDUIT	640.21	0	01:22	9.89	0.05	0.21
SP104	CONDUIT	705.93	0	01:22	6.50	0.11	0.32
SP206	DUMMY	242.18	0	01:16			
T100	DUMMY	8.68	0	00:45			
T101	DUMMY	228.33	0	01:17			
U100	DUMMY	10.51	0	00:45			
V100	DUMMY	27.67	0	00:40			
V200	CONDUIT	33.09	0	00:43	7.22	0.14	0.43
W100	DUMMY	7.46	0	00:40			
X100	DUMMY	163.27	0	00:45			
X200	CONDUIT	81.91	0	00:43	7.13	0.16	0.45
X300	CONDUIT	158.95	0	00:47	11.36	0.19	0.48
I200	DUMMY	63.72	0	00:55			
O12	DUMMY	45.00	0	00:00			
KK100	DUMMY	16.95	0	00:40			
LL200	DUMMY	49.55	0	00:53			
IRR_OUTLET	DUMMY	274.80	0	02:06			
O1	DUMMY	73.03	0	01:07			
O10	DUMMY	33.90	0	01:09			
O11	DUMMY	230.44	0	01:11			
O13	DUMMY	54.35	0	00:51			
O14	DUMMY	155.08	0	01:10			
O2	DUMMY	74.57	0	01:38			
O3	DUMMY	46.10	0	01:39			
O5	DUMMY	103.73	0	00:52			
O6	DUMMY	47.71	0	01:05			
O7	DUMMY	234.87	0	00:31			
O8	DUMMY	24.60	0	01:14			

O9	DUMMY	221.14	0	01:17
O16	DUMMY	63.72	0	00:55
O15	DUMMY	68.43	0	01:09
O17	DUMMY	49.55	0	00:53
O4	DUMMY	199.13	0	01:12

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Jul 28 14:48:24 2022
Analysis ended on: Thu Jul 28 14:48:24 2022
Total elapsed time: < 1 sec

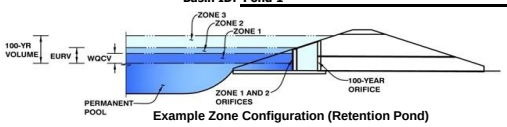
Appendix D

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Drainage Plan**

Basin ID: **Pond 1**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	43.71	acres
Watershed Length =	2,540	ft
Watershed Length to Centroid =	870	ft
Watershed Slope =	0.046	ft/ft
Watershed Imperviousness =	34.30%	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.

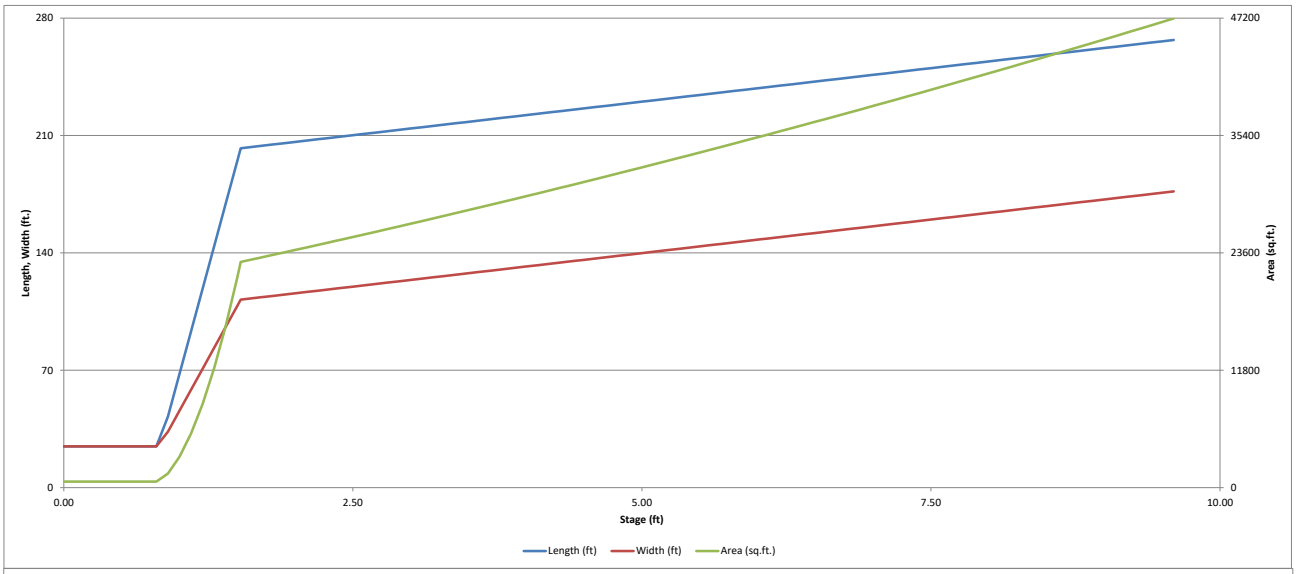
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.598	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.555	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.962	acre-feet	0.92	inches
5-yr Runoff Volume (P1 = 1.2 in.) =	1.511	acre-feet	1.20	inches
10-yr Runoff Volume (P1 = 1.45 in.) =	2.197	acre-feet	1.45	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	3.278	acre-feet		inches
50-yr Runoff Volume (P1 = 2.15 in.) =	4.893	acre-feet	2.15	inches
100-yr Runoff Volume (P1 = 2.49 in.) =	6.323	acre-feet	2.49	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	8.741	acre-feet		inches
Approximate 2-yr Detention Volume =	0.872	acre-feet		
Approximate 5-yr Detention Volume =	1.277	acre-feet		
Approximate 10-yr Detention Volume =	1.875	acre-feet		
Approximate 25-yr Detention Volume =	2.178	acre-feet		
Approximate 50-yr Detention Volume =	2.590	acre-feet		
Approximate 100-yr Detention Volume =	3.122	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.598	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.679	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.845	acre-feet
Total Detention Basin Volume =	3.122	acre-feet
Initial Surcharge Volume (ISV) =	200	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	606	ft^2
Surcharge Volume Length (L_{ISV}) =	24.6	ft
Surcharge Volume Width (W_{ISV}) =	24.6	ft
Depth of Basin Floor (H_{FLOOR}) =	0.70	ft
Length of Basin Floor (L_{FLOOR}) =	202.4	ft
Width of Basin Floor (W_{FLOOR}) =	112.1	ft
Area of Basin Floor (A_{FLOOR}) =	22,695	ft^2
Volume of Basin Floor (V_{FLOOR}) =	6,302	ft^3
Depth of Main Basin (H_{MAIN}) =	4.47	ft
Length of Main Basin (L_{MAIN}) =	238.2	ft
Width of Main Basin (W_{MAIN}) =	147.9	ft
Area of Main Basin (A_{MAIN}) =	35,221	ft^2
Volume of Main Basin (V_{MAIN}) =	128,421	ft^3
Calculated Total Basin Volume (V_{total}) =	**3.104**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		24.6	24.6	606		0.014		
ISV	0.33		24.6	24.6	606		0.014	200	0.005
	0.40		24.6	24.6	606		0.014	242	0.006
	0.50		24.6	24.6	606		0.014	303	0.007
	0.60		24.6	24.6	606		0.014	364	0.008
	0.70		24.6	24.6	606		0.014	424	0.010
	0.80		24.6	24.6	606		0.014	485	0.011
	0.90		42.4	33.4	1,415		0.032	572	0.013
	1.00		67.8	45.9	3,110		0.071	793	0.018
	1.10		93.2	58.4	5,440		0.125	1,215	0.028
	1.20		118.6	70.9	8,405		0.193	1,902	0.044
	1.30		144.0	83.4	12,005		0.276	2,917	0.067
	1.40		169.4	95.9	16,240		0.373	4,324	0.099
	1.50		194.8	108.4	21,110		0.485	6,186	0.142
Floor	1.53		202.4	112.1	22,695		0.521	6,843	0.157
	1.60		203.0	112.7	22,871		0.525	8,438	0.194
	1.70		203.8	113.5	23,124		0.531	10,738	0.247
	1.80		204.6	114.3	23,379		0.537	13,063	0.300
	1.90		205.4	115.1	23,635		0.543	15,414	0.354
	2.00		206.2	115.9	23,892		0.548	17,790	0.408
	2.10		207.0	116.7	24,150		0.554	20,192	0.464
	2.20		207.8	117.5	24,409		0.560	22,620	0.519
	2.30		208.6	118.3	24,670		0.566	25,074	0.576
Zone 1 (WQCV)	2.34		208.9	118.6	24,775		0.569	26,063	0.598
	2.40		209.4	119.1	24,932		0.572	27,554	0.633
	2.50		210.2	119.9	25,196		0.578	30,060	0.690
	2.60		211.0	120.7	25,461		0.584	32,593	0.748
	2.70		211.8	121.5	25,726		0.591	35,153	0.807
	2.80		212.6	122.3	25,994		0.597	37,739	0.866
	2.90		213.4	123.1	26,262		0.603	40,351	0.926
	3.00		214.2	123.9	26,532		0.609	42,991	0.987
	3.10		215.0	124.7	26,803		0.615	45,658	1.048
	3.20		215.8	125.5	27,075		0.622	48,352	1.110
	3.30		216.6	126.3	27,349		0.628	51,073	1.172
	3.40		217.4	127.1	27,624		0.634	53,822	1.236
Zone 2 (5-year)	3.47		217.9	127.6	27,817		0.639	55,762	1.280
	3.50		218.2	127.9	27,900		0.641	56,598	1.299
	3.60		219.0	128.7	28,178		0.647	59,402	1.364
	3.70		219.8	129.5	28,457		0.653	62,233	1.429
	3.80		220.6	130.3	28,737		0.660	65,093	1.494
	3.90		221.4	131.1	29,018		0.666	67,981	1.561
	4.00		222.2	131.9	29,300		0.673	70,897	1.628
	4.10		223.0	132.7	29,584		0.679	73,841	1.695
	4.20		223.8	133.5	29,870		0.686	76,814	1.763
	4.30		224.6	134.3	30,156		0.692	79,815	1.832
	4.40		225.4	135.1	30,444		0.699	82,845	1.902
	4.50		226.2	135.9	30,733		0.706	85,904	1.972
	4.60		227.0	136.7	31,023		0.712	88,991	2.043
	4.70		227.8	137.5	31,315		0.719	92,108	2.115
	4.80		228.6	138.3	31,607		0.726	95,254	2.187
	4.90		229.4	139.1	31,902		0.732	98,430	2.260
	5.00		230.2	139.9	32,197		0.739	101,635	2.333
	5.10		231.0	140.7	32,494		0.746	104,869	2.407
	5.20		231.8	141.5	32,792		0.753	108,134	2.482
	5.30		232.6	142.3	33,091		0.760	111,428	2.558
	5.40		233.4	143.1	33,391		0.767	114,752	2.634
	5.50		234.2	143.9	33,693		0.773	118,106	2.711
	5.60		235.0	144.7	33,996		0.780	121,490	2.789
	5.70		235.8	145.5	34,301		0.787	124,905	2.867
	5.80		236.6	146.3	34,606		0.794	128,351	2.947
	5.90		237.4	147.1	34,913		0.801	131,827	3.026
	6.00		238.2	147.9	35,221		0.809	135,333	3.107
Zone 3 (100-year)	6.02		238.3	148.0	35,283		0.810	136,038	3.123
	6.10		239.0	148.7	35,531		0.816	138,871	3.188
	6.20		239.8	149.5	35,842		0.823	142,440	3.270
	6.30		240.6	150.3	36,154		0.830	146,039	3.353
	6.40		241.4	151.1	36,467		0.837	149,670	3.436
	6.50		242.2	151.9	36,782		0.844	153,333	3.520
	6.60		243.0	152.7	37,098		0.852	157,027	3.605
	6.70		243.8	153.5	37,415		0.859	160,752	3.690
	6.80		244.6	154.3	37,733		0.866	164,510	3.777
	6.90		245.4	155.1	38,053		0.874	168,299	3.864
	7.00		246.2	155.9	38,374		0.881	172,120	3.951
	7.10		247.0	156.7	38,696		0.888	175,974	4.040
	7.20		247.8	157.5	39,020		0.896	179,860	4.129
	7.30		248.6	158.3	39,345		0.903	183,778	4.219
	7.40		249.4	159.1	39,671		0.911	187,728	4.310
	7.50		250.2	159.9	39,998		0.918	191,712	4.401
	7.60		251.0	160.7	40,327		0.926	195,728	4.493
	7.70		251.8	161.5	40,657		0.933	199,777	4.586
	7.80		252.6	162.3	40,988		0.941	203,860	4.680
	7.90		253.4	163.1	41,321		0.949	207,975	4.774
	8.00		254.2	163.9	41,654		0.956	212,124	4.870
	8.10		255.0	164.7	41,989		0.964	216,306	4.966
	8.20		255.8	165.5	42,326		0.972	220,522	5.062
	8.30		256.6	166.3	42,663		0.979	224,771	5.160
	8.40		257.4	167.1	43,002		0.987	229,054	5.258
	8.50		258.2	167.9	43,343		0.995	233,372	5.357
	8.60		259.0	168.7	43,684		1.003	237,723	5.457
	8.70		259.8	169.5	44,027		1.011	242,108	5.558
	8.80		260.6	170.3	44,371		1.019	246,528	5.660
	8.90		261.4	171.1	44,716		1.027	250,983	5.762
	9.00		262.2	171.9	45,063		1.034	255,472	5.865
	9.10		263.0	172.7	45,411		1.042	259,995	5.969
	9.20		263.8	173.5	45,760		1.051	264,554	6.073
	9.30		264.6	174.3	46,110		1.059	269,147	6.179
	9.40		265.4	175.1	46,462		1.067	273,776	6.285
	9.50		266.2	175.9	46,815		1.075	278,440	6.392
	9.60		267.0	176.7	47,169		1.083	283,139	6.500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Area (sq.ft.)
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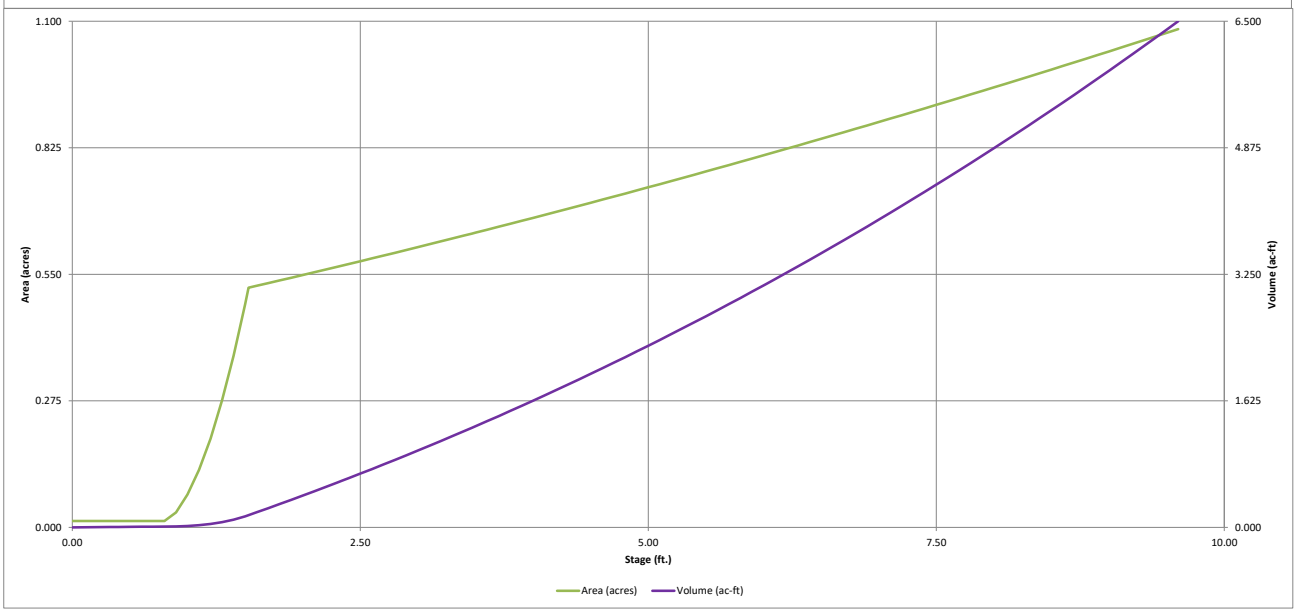
Length (ft)
Width (ft)
Area (sq.ft.)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7.50
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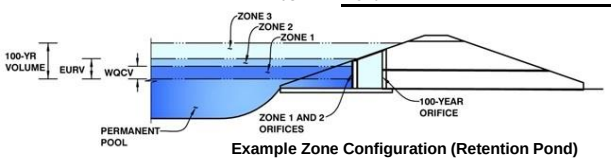
Area (acres)
Volume (ac-ft)
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Drainage Plan**

Basin ID: **Pond 1**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.34	0.598	Orifice Plate
Zone 2 (5-year)	3.47	0.679	Weir&Pipe (Circular)
Zone 3 (100-year)	6.02	1.845	Weir&Pipe (Restrict)
Total (all zones)		3.122	

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 =	1.472E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.34	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.12	sq. inches (diameter = 1-5/8 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	0.78	1.56					
Orifice Area (sq. inches)	2.12	2.12	2.12					

	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 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	2.34	3.47	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	6.00	feet
Overflow Weir Grate Slope =	0.00	0.00	H:V
Horiz. Length of Weir Sides =	6.00	6.00	feet
Overflow Grate Type =	Type C Grate	Type C Grate	
Debris Clogging % =	50%	50%	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir	
Height of Grate Upper Edge, H_t =	2.34	3.47	feet
Overflow Weir Slope Length =	6.00	6.00	feet
Grate Open Area / 100-yr Orifice Area =	9.49	3.69	
Overflow Grate Open Area w/o Debris =	25.06	25.06	ft^2
Overflow Grate Open Area w/ Debris =	12.53	12.53	ft^2

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

	Zone 2 Circular	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.50	2.70	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter or Pipe Diameter =	22.00	36.00	inches
Restrictor Plate Height Above Pipe Invert =		33.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Zone 3 Restrictor	
Outlet Orifice Area =	2.64	6.79	ft^2
Outlet Orifice Centroid =	0.92	1.44	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	2.56	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.93	feet
Spillway Crest Length =	27.00	feet	Stage at Top of Freeboard =	6.93	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.88	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.89	acre-ft

Calculated Parameters for Spillway

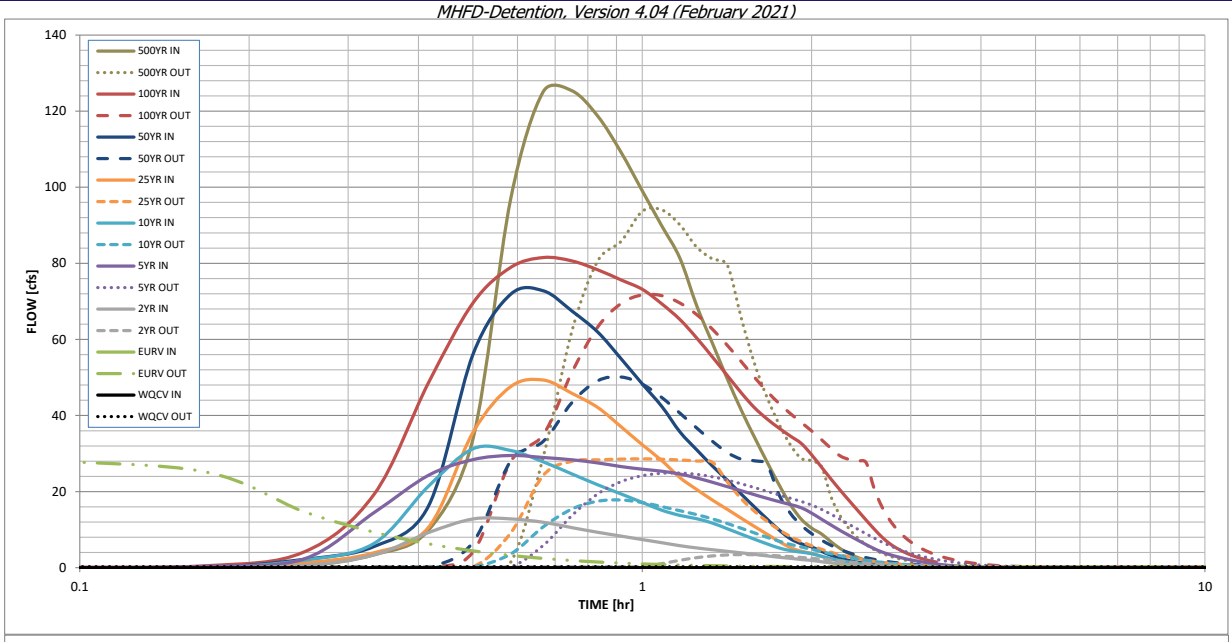
Routed Hydrograph Results

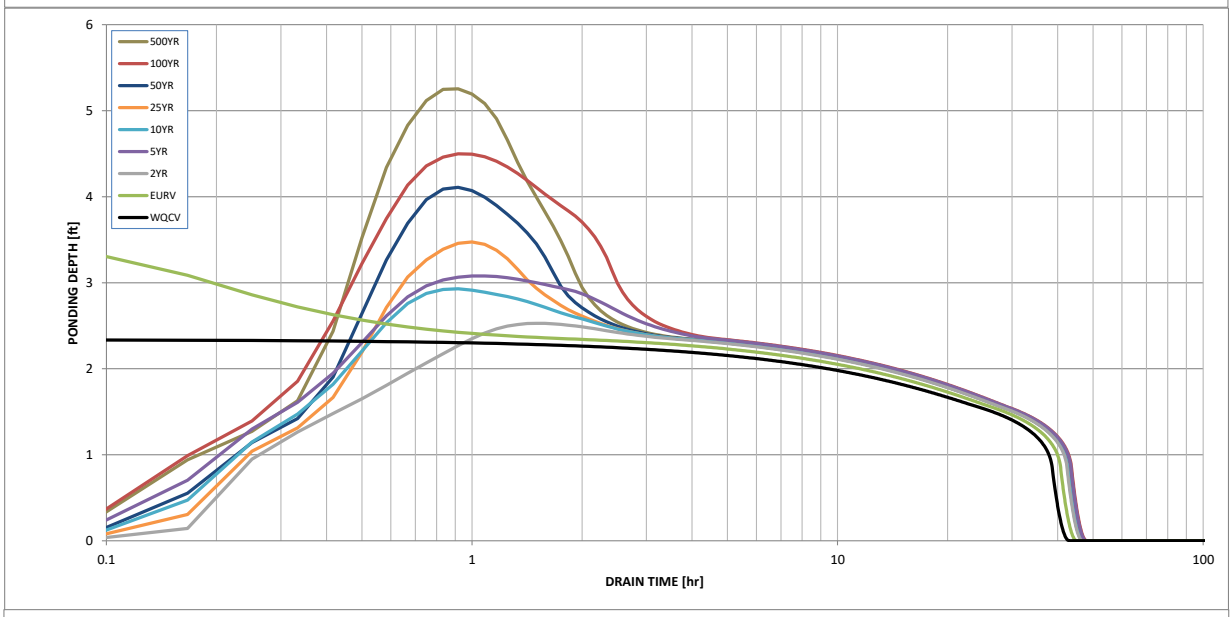
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

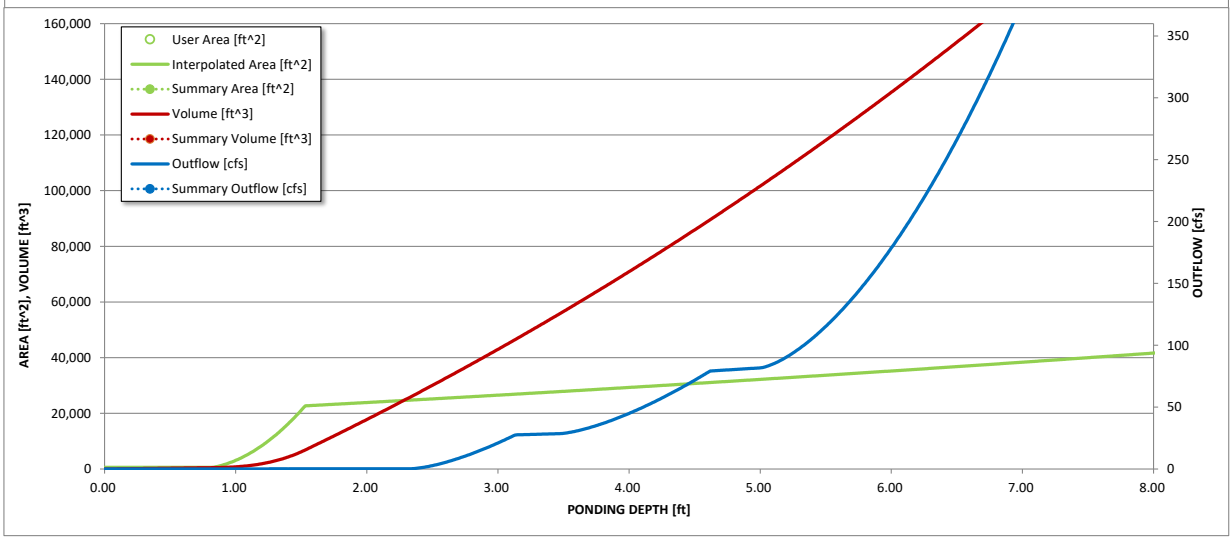
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
CUHP Runoff Volume (acre-ft) =	0.598	1.555	0.962	1.511	2.197	3.278	4.893	6.323	8.741
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.962	3.851	2.197	3.278	4.893	9.206	8.741
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.5	3.9	11.5	26.5	44.5	60.8	86.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		27.9				81.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.64	0.26	0.61	1.02	1.85	1.97
Peak Inflow Q (cfs) =	N/A	N/A	12.8	29.5	31.3	49.3	72.8	81.5	125.3
Peak Outflow Q (cfs) =	0.3	33.9	3.4	24.9	17.8	28.6	50.1	71.7	94.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	1.6	1.1	1.1	0.9	1.1
Structure Controlling Flow =	Overflow Weir 1	Overflow Weir 2	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Spillway
Max Velocity through Grate 1 (fps) =	N/A	1.17	0.13	1.0	0.7	1.1	1.2	1.2	1.3
Max Velocity through Grate 2 (fps) =	N/A	0.44	N/A	N/A	N/A	0.0	0.8	1.6	2.0
Time to Drain 97% of Inflow Volume (hours) =	38	37	41	34	37	34	30	22	22
Time to Drain 99% of Inflow Volume (hours) =	**40**	41	43	41	42	40	39	36	35
Maximum Ponding Depth (ft) =	2.34	3.90	2.53	3.08	2.93	3.48	4.11	4.50	5.25
Area at Maximum Ponding Depth (acres) =	0.57	0.67	0.58	0.61	0.60	0.64	0.68	0.70	0.76
Maximum Volume Stored (acre-ft) =	0.598	1.561	0.702	1.030	0.938	1.280	1.695	1.965	2.520

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

Inflow Hydrographs

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

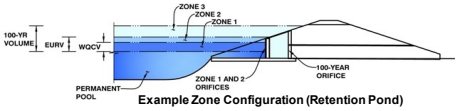
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
	0:10:00	0.00	0.00	0.00	0.33	0.00	0.00	0.06	0.49	0.51
	0:15:00	0.00	0.00	0.60	2.28	1.96	1.28	2.18	4.09	3.39
	0:20:00	0.00	0.00	3.35	14.46	6.37	3.91	5.55	19.23	9.84
	0:25:00	0.00	0.00	9.22	24.28	21.41	10.60	16.17	48.59	33.82
	0:30:00	0.00	0.00	12.81	28.40	31.25	35.56	56.08	69.57	96.85
	0:35:00	0.00	0.00	12.83	29.49	30.81	47.58	71.86	78.91	125.12
	0:40:00	0.00	0.00	11.94	28.96	27.81	49.32	72.78	81.52	125.34
	0:45:00	0.00	0.00	10.52	28.36	24.63	45.81	67.44	80.62	118.69
	0:50:00	0.00	0.00	9.31	27.54	21.78	42.11	61.92	78.29	109.19
	0:55:00	0.00	0.00	8.31	26.58	19.39	37.05	54.93	75.63	99.04
	1:00:00	0.00	0.00	7.39	25.89	17.15	32.31	48.29	73.17	89.80
	1:05:00	0.00	0.00	6.57	25.36	15.10	28.14	42.37	69.34	81.30
	1:10:00	0.00	0.00	5.78	24.60	13.74	23.67	35.68	65.22	68.77
	1:15:00	0.00	0.00	5.19	23.58	12.87	20.54	30.96	60.34	58.88
	1:20:00	0.00	0.00	4.72	22.44	11.71	17.74	26.69	55.32	49.58
	1:25:00	0.00	0.00	4.30	21.29	10.22	15.33	22.96	50.50	41.35
	1:30:00	0.00	0.00	3.90	20.22	8.81	12.98	19.31	45.93	34.25
	1:35:00	0.00	0.00	3.50	19.18	7.48	10.83	15.93	42.03	27.75
	1:40:00	0.00	0.00	3.10	18.23	6.26	8.80	12.80	39.09	21.80
	1:45:00	0.00	0.00	2.74	17.37	5.19	6.92	9.92	36.69	16.59
	1:50:00	0.00	0.00	2.47	16.59	4.51	5.28	7.60	34.59	12.76
	1:55:00	0.00	0.00	2.15	15.76	4.08	4.33	6.29	32.67	10.41
	2:00:00	0.00	0.00	1.92	14.33	3.68	3.77	5.47	29.67	8.86
	2:05:00	0.00	0.00	1.57	12.73	2.99	2.96	4.27	26.39	6.77
	2:10:00	0.00	0.00	1.26	11.19	2.37	2.26	3.25	23.24	5.00
	2:15:00	0.00	0.00	1.00	9.75	1.86	1.75	2.49	20.31	3.66
	2:20:00	0.00	0.00	0.80	8.45	1.45	1.34	1.88	17.59	2.65
	2:25:00	0.00	0.00	0.63	7.22	1.11	1.02	1.42	15.00	1.96
	2:30:00	0.00	0.00	0.49	6.07	0.84	0.78	1.08	12.51	1.47
	2:35:00	0.00	0.00	0.39	5.01	0.63	0.58	0.80	10.17	1.11
	2:40:00	0.00	0.00	0.30	4.14	0.48	0.44	0.60	8.06	0.85
	2:45:00	0.00	0.00	0.23	3.47	0.37	0.34	0.46	6.38	0.65
	2:50:00	0.00	0.00	0.17	2.93	0.27	0.25	0.34	5.13	0.48
	2:55:00	0.00	0.00	0.12	2.46	0.19	0.18	0.24	4.15	0.34
	3:00:00	0.00	0.00	0.08	2.06	0.13	0.12	0.16	3.36	0.22
	3:05:00	0.00	0.00	0.05	1.73	0.07	0.07	0.09	2.73	0.12
	3:10:00	0.00	0.00	0.03	1.45	0.04	0.04	0.05	2.23	0.06
	3:15:00	0.00	0.00	0.01	1.20	0.01	0.01	0.01	1.81	0.02
	3:20:00	0.00	0.00	0.00	0.98	0.00	0.00	0.00	1.48	0.00
	3:25:00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	1.20	0.00
	3:30:00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.97	0.00
	3:35:00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.76	0.00
	3:40:00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.59	0.00
	3:45:00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.43	0.00
	3:50:00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.30	0.00
	3:55:00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.19	0.00
	4:00:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.11	0.00
	4:05:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.05	0.00
	4:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	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
					0	5:50:00	0			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Flying Horse North MDDP

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	76.38	acres
Watershed Length =	3,200	ft
Watershed Length to Centroid =	1,813	ft
Watershed Slope =	0.046	ft/ft
Watershed Imperviousness =	29.50%	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 =	Denver - Capitol Building	

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

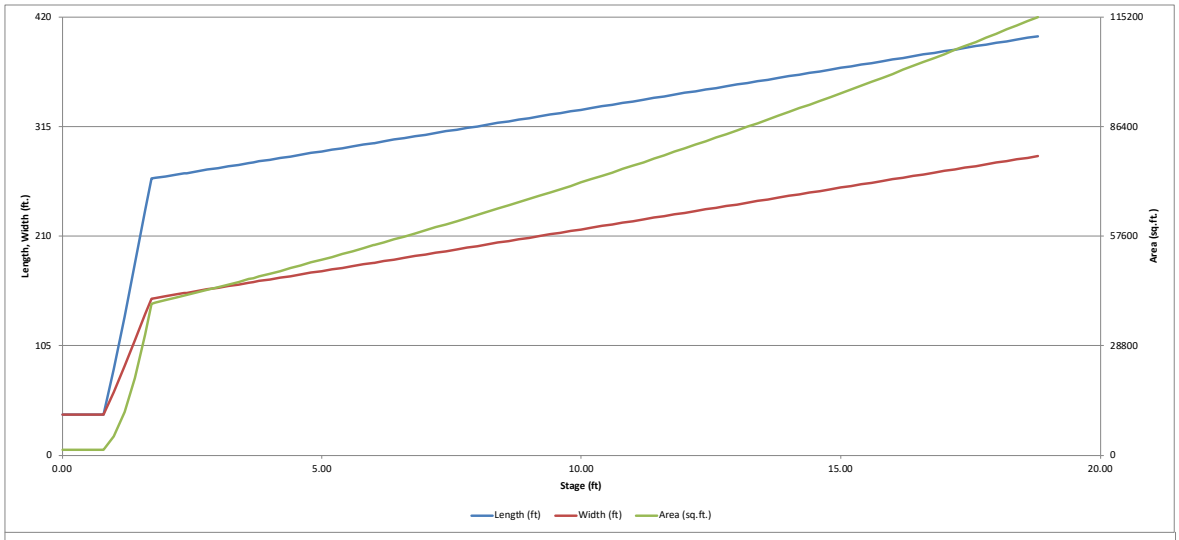
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.954	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.309	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.348	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.828	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.193	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.260	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	8.821	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	10.908	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	14.934	acre-feet		inches
Approximate 2-yr Detention Volume =	1.649	acre-feet		
Approximate 5-yr Detention Volume =	2.363	acre-feet		
Approximate 10-yr Detention Volume =	3.460	acre-feet		
Approximate 25-yr Detention Volume =	4.023	acre-feet		
Approximate 50-yr Detention Volume =	4.239	acre-feet		
Approximate 100-yr Detention Volume =	5.021	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.954	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.355	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.712	acre-feet
Total Detention Basin Volume =	5.021	acre-feet
Initial Surcharge Volume (ISV) =	500	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	1,515	ft^2
Surcharge Volume Length (L_{ISV}) =	38.9	ft
Surcharge Volume Width (W_{ISV}) =	38.9	ft
Depth of Basin Floor (H_{FLOOR}) =	0.89	ft
Length of Basin Floor (L_{FLOOR}) =	265.0	ft
Width of Basin Floor (W_{FLOOR}) =	150.2	ft
Area of Basin Floor (A_{FLOOR}) =	39,794	ft^2
Volume of Basin Floor (V_{FLOOR}) =	14,559	ft^3
Depth of Main Basin (H_{MAIN}) =	4.28	ft
Length of Main Basin (L_{MAIN}) =	299.2	ft
Width of Main Basin (W_{MAIN}) =	184.4	ft
Area of Main Basin (A_{MAIN}) =	55,182	ft^2
Volume of Main Basin (V_{MAIN}) =	202,353	ft^3
Calculated Total Basin Volume (V_{total}) =	**5.008**	acre-feet

Depth Increment = 0.20 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		38.9	38.9	1,515		0.035		
ISV	0.33		38.9	38.9	1,515		0.035	500	0.011
	0.40		38.9	38.9	1,515		0.035	606	0.014
	0.60		38.9	38.9	1,515		0.035	909	0.021
	0.80		38.9	38.9	1,515		0.035	1,212	0.028
	1.00		82.1	60.2	4,941		0.113	1,780	0.041
	1.20		132.9	85.2	11,320		0.260	3,364	0.077
	1.40		183.7	110.2	20,240		0.465	6,478	0.149
	1.60		234.5	135.2	31,699		0.728	11,629	0.267
Floor	1.72		265.0	150.2	39,794		0.914	15,910	0.365
	1.80		265.6	150.8	40,060		0.920	19,104	0.439
	2.00		267.2	152.4	40,729		0.935	27,183	0.624
	2.20		268.8	154.0	41,403		0.950	35,396	0.813
Zone 1 (WQCV)	2.35		270.0	155.2	41,912		0.962	41,644	0.956
	2.40		270.4	155.6	42,082		0.966	43,744	1.004
	2.60		272.0	157.2	42,766		0.982	52,229	1.199
	2.80		273.6	158.8	43,456		0.998	60,851	1.397
	3.00		275.2	160.4	44,150		1.014	69,612	1.598
	3.20		276.8	162.0	44,850		1.030	78,512	1.802
	3.40		278.4	163.6	45,554		1.046	87,552	2.010
	3.60		280.0	165.2	46,264		1.062	96,734	2.221
Zone 2 (EURV)	3.69		280.7	165.9	46,585		1.069	100,912	2.317
	3.80		281.6	166.8	46,979		1.078	106,058	2.435
	4.00		283.2	168.4	47,699		1.095	115,526	2.652
	4.20		284.8	170.0	48,424		1.112	125,138	2.873
	4.40		286.4	171.6	49,155		1.128	134,896	3.097
	4.60		288.0	173.2	49,890		1.145	144,800	3.324
	4.80		289.6	174.8	50,631		1.162	154,852	3.555
	5.00		291.2	176.4	51,376		1.179	165,053	3.789
	5.20		292.8	178.0	52,127		1.197	175,403	4.027
	5.40		294.4	179.6	52,883		1.214	185,904	4.268
	5.60		296.0	181.2	53,644		1.232	196,557	4.512
	5.80		297.6	182.8	54,410		1.249	207,362	4.760
	6.00		299.2	184.4	55,182		1.267	218,321	5.012
Zone 3 (100-year)	6.01		299.3	184.5	55,220		1.268	218,873	5.025
	6.20		300.8	186.0	55,958		1.285	229,435	5.267
	6.40		302.4	187.6	56,739		1.303	240,705	5.526
	6.60		304.0	189.2	57,526		1.321	252,131	5.788
	6.80		305.6	190.8	58,318		1.339	263,716	6.054
	7.00		307.2	192.4	59,115		1.357	275,459	6.324
	7.20		308.8	194.0	59,917		1.375	287,362	6.597
	7.40		310.4	195.6	60,724		1.394	299,426	6.874
	7.60		312.0	197.2	61,536		1.413	311,652	7.155
	7.80		313.6	198.8	62,353		1.431	324,041	7.439
	8.00		315.2	200.4	63,176		1.450	336,593	7.727
	8.20		316.8	202.0	64,003		1.469	349,311	8.019
	8.40		318.4	203.6	64,836		1.488	362,195	8.315
	8.60		320.0	205.2	65,674		1.508	375,246	8.614
	8.80		321.6	206.8	66,517		1.527	388,465	8.918
	9.00		323.2	208.4	67,365		1.546	401,853	9.225
	9.20		324.8	210.0	68,218		1.566	415,411	9.537
	9.40		326.4	211.6	69,076		1.586	429,141	9.852
	9.60		328.0	213.2	69,940		1.606	443,042	10.171
	9.80		329.6	214.8	70,808		1.626	457,117	10.494
	10.00		331.2	216.4	71,682		1.646	471,366	10.821
	10.20		332.8	218.0	72,561		1.666	485,790	11.152
	10.40		334.4	219.6	73,445		1.686	500,390	11.487
	10.60		336.0	221.2	74,334		1.706	515,168	11.827
	10.80		337.6	222.8	75,228		1.727	530,124	12.170
	11.00		339.2	224.4	76,127		1.748	545,260	12.517
	11.20		340.8	226.0	77,032		1.768	560,576	12.869
	11.40		342.4	227.6	77,941		1.789	576,073	13.225
	11.60		344.0	229.2	78,856		1.810	591,752	13.585
	11.80		345.6	230.8	79,775		1.831	607,615	13.949
	12.00		347.2	232.4	80,700		1.853	623,663	14.317
	12.20		348.8	234.0	81,630		1.874	639,896	14.690
	12.40		350.4	235.6	82,565		1.895	656,315	15.067
	12.60		352.0	237.2	83,506		1.917	672,922	15.448
	12.80		353.6	238.8	84,451		1.939	689,718	15.834
	13.00		355.2	240.4	85,401		1.961	706,703	16.224
	13.20		356.8	242.0	86,357		1.982	723,879	16.618
	13.40		358.4	243.6	87,318		2.005	741,246	17.017
	13.60		360.0	245.2	88,283		2.027	758,806	17.420
	13.80		361.6	246.8	89,254		2.049	776,560	17.827
	14.00		363.2	248.4	90,231		2.071	794,508	18.239
	14.20		364.8	250.0	91,212		2.094	812,652	18.656
	14.40		366.4	251.6	92,198		2.117	830,993	19.077
	14.60		368.0	253.2	93,189		2.139	849,532	19.503
	14.80		369.6	254.8	94,186		2.162	868,269	19.933
	15.00		371.2	256.4	95,188		2.185	887,207	20.367
	15.20		372.8	258.0	96,194		2.208	906,345	20.807
	15.40		374.4	259.6	97,206		2.232	925,685	21.251
	15.60		376.0	261.2	98,223		2.255	945,228	21.699
	15.80		377.6	262.8	99,245		2.278	964,974	22.153
	16.00		379.2	264.4	100,273		2.302	984,926	22.611
	16.20		380.8	266.0	101,305		2.326	1,005,084	23.074
	16.40		382.4	267.6	102,343		2.349	1,025,449	23.541
	16.60		384.0	269.2	103,385		2.373	1,046,021	24.013
	16.80		385.6	270.8	104,433		2.397	1,066,803	24.490
	17.00		387.2	272.4	105,486		2.422	1,087,795	24.972
	17.20		388.8	274.0	106,544		2.446	1,108,998	25.459
	17.40		390.4	275.6	107,607		2.470	1,130,413	25.951
	17.60		392.0	277.2	108,675		2.495	1,152,041	26.447
	17.80		393.6	278.8	109,749		2.519	1,173,883	26.949
	18.00		395.2	280.4	110,827		2.544	1,195,941	27.455
	18.20		396.8	282.0	111,911		2.569	1,218,214	27.966
	18.40		398.4	283.6	112,999		2.594	1,240,705	28.483
	18.60		400.0	285.2	114,093		2.619	1,263,414	29.004
	18.80		401.6	286.8	115,192		2.644	1,286,343	29.530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28800
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Area (sq.ft.)
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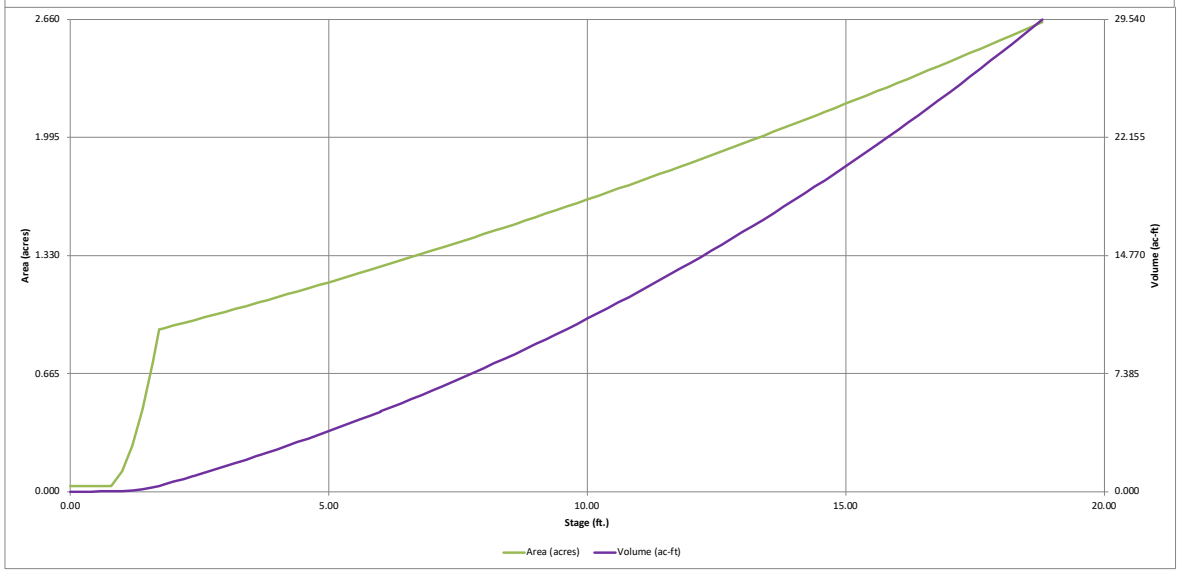
10.00
15.00
20.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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Volume (ac-ft)
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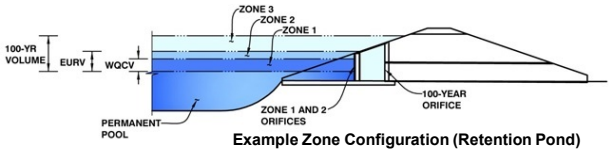
5.00
10.00
15.00
20.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.35	0.954	Orifice Plate
Zone 2 (EURV)	3.69	1.355	Circular Orifice
Zone 3 (100-year)	6.01	2.712	Weir&Pipe (Restrict)
Total (all zones)		5.021	

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 =	2.368E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.35	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.41	sq. inches (use rectangular openings)	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	0.78	1.57					
Orifice Area (sq. inches)	3.41	3.41	3.41					

	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)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected
Invert of Vertical Orifice =	2.35	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.58	N/A
Depth at top of Zone using Vertical Orifice =	3.69	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.43	N/A
Vertical Orifice Diameter =	10.34	N/A	inches			

Calculated Parameters for Vertical Orif

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 =	6.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.00	N/A
Overflow Weir Front Edge Length =	6.50	N/A	feet	Overflow Weir Slope Length =	7.07	N/A
Overflow Weir Grate Slope =	7.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.05	N/A
Horiz. Length of Weir Sides =	7.00	N/A	feet	Overflow Grate Open Area w/o Debris =	31.99	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	15.99	N/A
Debris Clogging % =	50%	N/A	%			

Calculated Parameters for Overflow We

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 =	5.29	N/A
Outlet Pipe Diameter =	36.00	N/A	inches	Outlet Orifice Centroid =	1.17	N/A
Restrictor Plate Height Above Pipe Invert =	25.20		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.98	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.96	feet
Spillway Crest Length =	54.00	feet	Stage at Top of Freeboard =	10.76	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.72	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	12.10	acre-ft

Calculated Parameters for Spillway

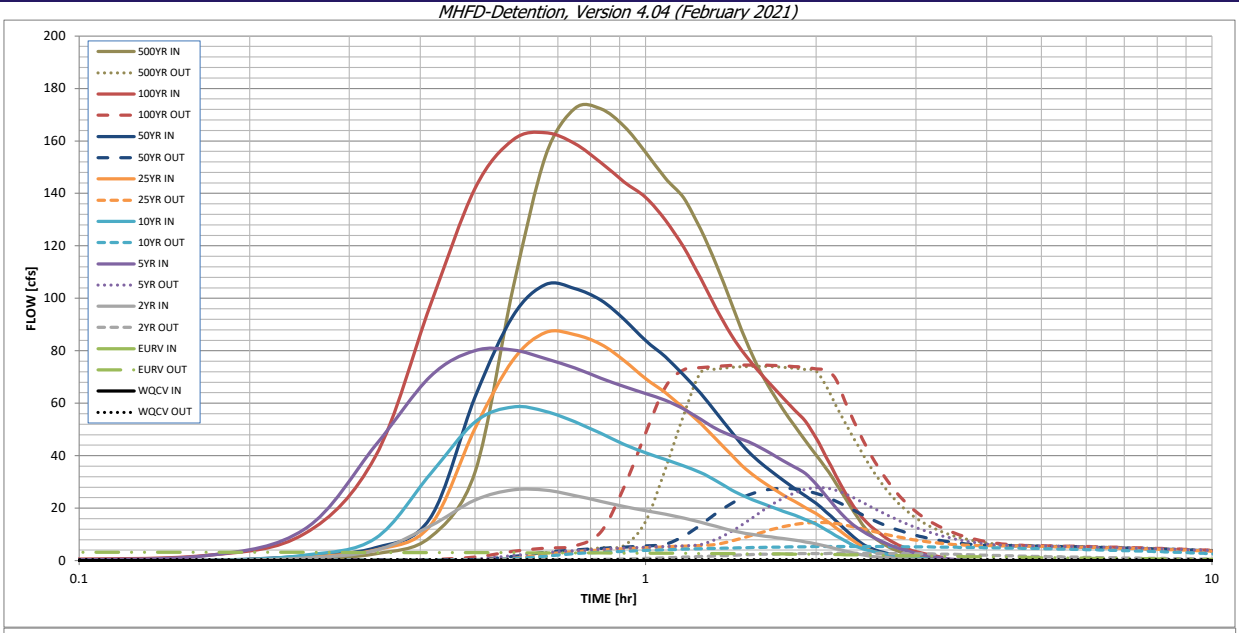
Routed Hydrograph Results

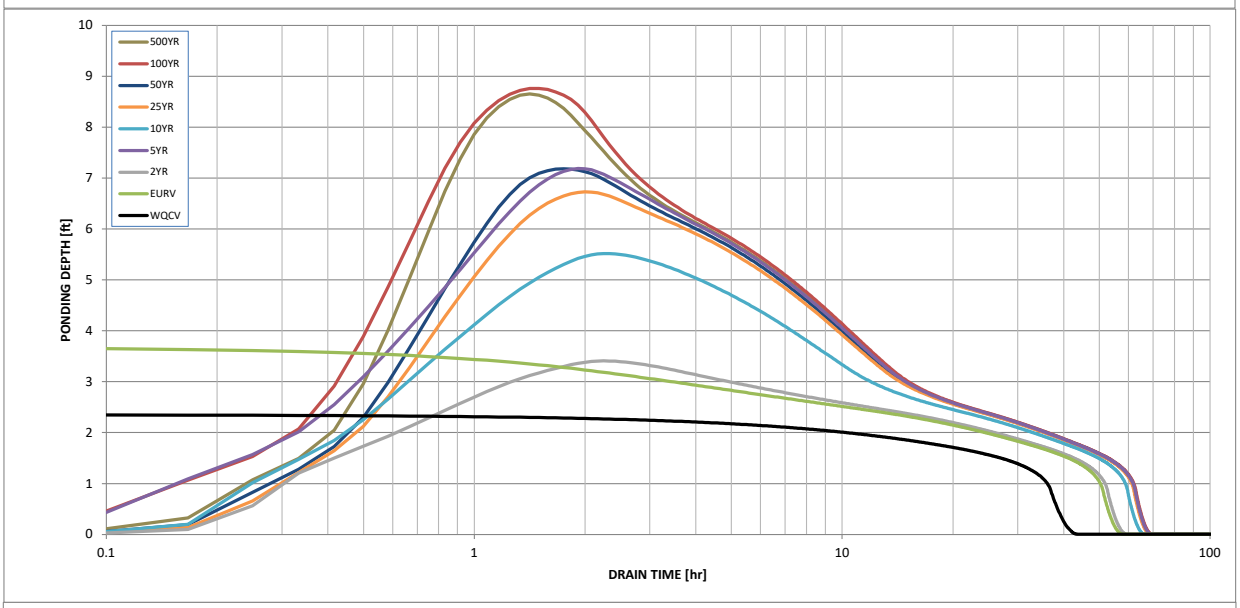
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through A

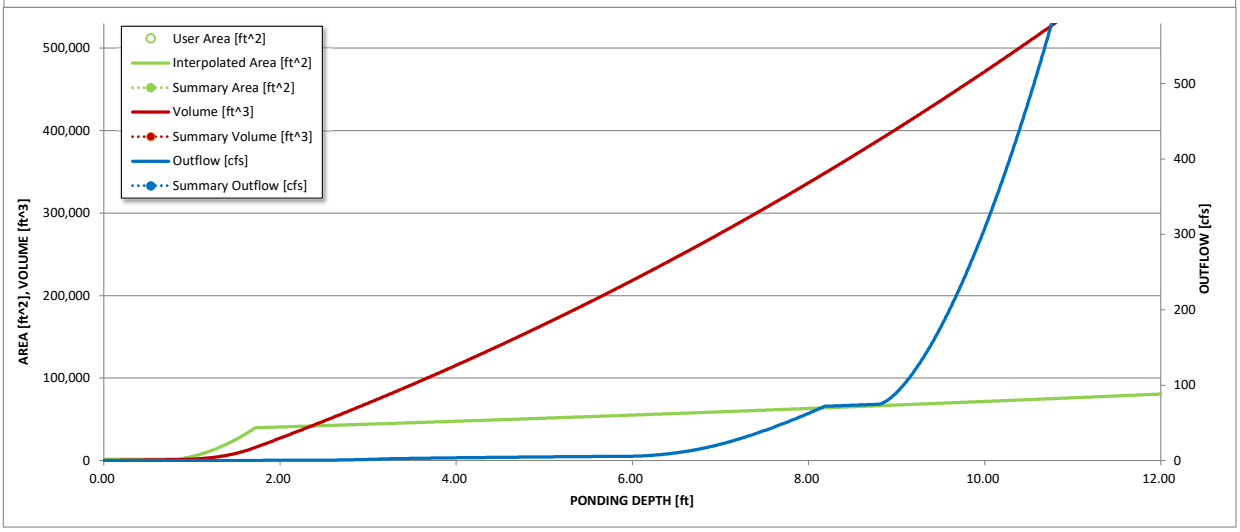
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.954	2.309	2.348	3.828	5.193	7.260	8.821	10.908
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.348	9.011	5.193	7.260	8.821	16.404
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	7.6	21.4	32.6	58.3	73.3	93.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		27.9				81.0
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.37	0.43	0.76	0.96	1.06
Peak Inflow Q (cfs) =	N/A	N/A	26.9	80.3	58.6	87.0	105.2	163.2
Peak Outflow Q (cfs) =	0.4	3.2	2.8	27.8	5.4	14.5	27.5	74.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.2	0.2	0.4	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.7	N/A	0.3	0.7	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	49	50	49	52	51	49	41
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	54	59	58	59	59	55
Maximum Ponding Depth (ft) =	2.35	3.69	3.41	7.19	5.52	6.72	7.18	8.76
Area at Maximum Ponding Depth (acres) =	0.96	1.07	1.05	1.37	1.22	1.33	1.37	1.52
Maximum Volume Stored (acre-ft) =	0.956	2.317	2.010	6.569	4.402	5.947	6.556	8.842

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	USER	CUHP	CUHP	CUHP	USER	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	0.13	0.00	0.00	0.00	0.32	0.00
	0:10:00	0.00	0.00	0.00	1.80	0.00	0.00	0.11	1.90	0.37
	0:15:00	0.00	0.00	0.97	11.97	2.02	1.37	1.76	10.22	2.60
	0:20:00	0.00	0.00	3.87	43.79	8.48	4.07	4.83	39.58	8.88
	0:25:00	0.00	0.00	13.19	70.16	32.99	13.33	16.21	97.23	33.67
	0:30:00	0.00	0.00	23.12	80.09	52.87	50.35	62.29	141.84	103.95
	0:35:00	0.00	0.00	26.92	80.26	58.60	76.45	93.34	160.45	154.46
	0:40:00	0.00	0.00	26.87	76.94	56.82	86.98	105.24	163.15	172.38
	0:45:00	0.00	0.00	24.83	73.40	52.91	86.09	103.73	158.97	172.22
	0:50:00	0.00	0.00	22.58	69.54	48.53	82.51	99.35	151.80	165.57
	0:55:00	0.00	0.00	20.60	66.38	44.34	76.24	91.93	144.38	155.67
	1:00:00	0.00	0.00	18.99	63.71	41.14	69.38	83.89	138.52	145.77
	1:05:00	0.00	0.00	17.72	61.08	38.56	64.02	77.70	129.85	138.29
	1:10:00	0.00	0.00	16.21	57.80	36.08	58.18	70.80	119.57	126.35
	1:15:00	0.00	0.00	14.59	53.88	33.59	52.31	63.81	107.76	112.87
	1:20:00	0.00	0.00	13.00	50.24	30.43	46.20	56.32	96.06	98.23
	1:25:00	0.00	0.00	11.52	47.71	27.01	40.35	49.12	86.02	84.46
	1:30:00	0.00	0.00	10.40	45.81	24.37	35.06	42.76	78.34	73.27
	1:35:00	0.00	0.00	9.62	43.38	22.31	31.09	37.98	72.21	64.70
	1:40:00	0.00	0.00	8.98	40.71	20.50	27.87	34.07	66.82	57.64
	1:45:00	0.00	0.00	8.41	38.11	18.84	25.07	30.63	61.95	51.34
	1:50:00	0.00	0.00	7.85	35.67	17.29	22.53	27.51	57.40	45.60
	1:55:00	0.00	0.00	7.14	33.13	15.68	20.18	24.61	53.06	40.22
	2:00:00	0.00	0.00	6.38	29.16	13.87	17.91	21.82	46.73	35.16
	2:05:00	0.00	0.00	5.48	24.64	11.73	15.27	18.55	39.57	29.60
	2:10:00	0.00	0.00	4.57	20.28	9.56	12.56	15.20	32.54	24.00
	2:15:00	0.00	0.00	3.69	16.43	7.53	9.93	11.96	26.09	18.60
	2:20:00	0.00	0.00	2.87	13.45	5.75	7.44	8.92	20.54	13.70
	2:25:00	0.00	0.00	2.15	11.17	4.48	5.23	6.32	16.29	9.92
	2:30:00	0.00	0.00	1.65	9.34	3.63	3.85	4.72	13.11	7.39
	2:35:00	0.00	0.00	1.33	7.79	2.98	2.91	3.60	10.56	5.56
	2:40:00	0.00	0.00	1.09	6.44	2.43	2.24	2.78	8.46	4.15
	2:45:00	0.00	0.00	0.90	5.28	1.98	1.71	2.13	6.74	3.06
	2:50:00	0.00	0.00	0.73	4.30	1.59	1.33	1.65	5.35	2.23
	2:55:00	0.00	0.00	0.60	3.49	1.26	1.02	1.26	4.27	1.62
	3:00:00	0.00	0.00	0.49	2.84	1.00	0.79	0.98	3.48	1.22
	3:05:00	0.00	0.00	0.40	2.27	0.78	0.63	0.78	2.82	0.97
	3:10:00	0.00	0.00	0.33	1.78	0.61	0.49	0.61	2.27	0.77
	3:15:00	0.00	0.00	0.26	1.36	0.47	0.39	0.48	1.78	0.61
	3:20:00	0.00	0.00	0.20	1.00	0.36	0.30	0.36	1.35	0.47
	3:25:00	0.00	0.00	0.15	0.71	0.27	0.22	0.27	0.99	0.34
	3:30:00	0.00	0.00	0.11	0.48	0.19	0.16	0.19	0.68	0.24
	3:35:00	0.00	0.00	0.08	0.30	0.12	0.11	0.13	0.42	0.15
	3:40:00	0.00	0.00	0.05	0.16	0.07	0.06	0.08	0.23	0.09
	3:45:00	0.00	0.00	0.02	0.06	0.03	0.03	0.04	0.10	0.04
	3:50:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01
	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
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	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
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	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

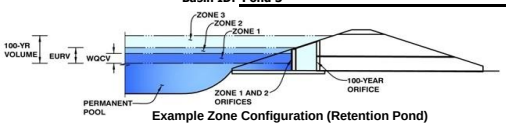
0 5:50:00 0.72

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 3**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	52.52	acres
Watershed Length =	2,370	ft
Watershed Length to Centroid =	1,179	ft
Watershed Slope =	0.033	ft/ft
Watershed Imperviousness =	30.10%	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.

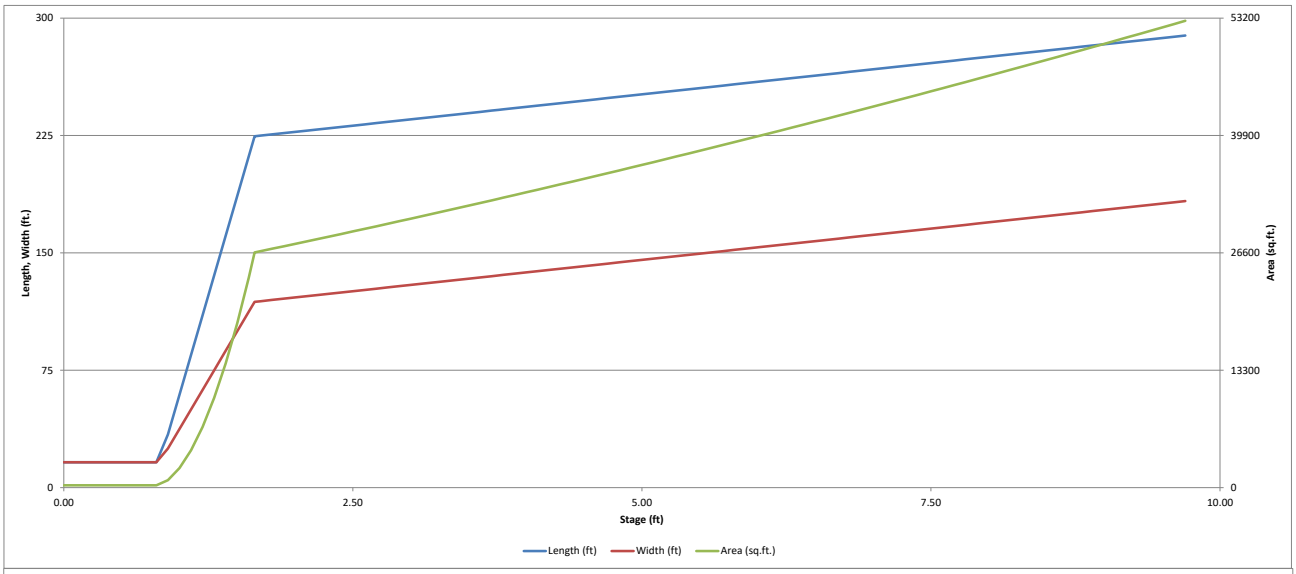
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.664	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.623	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.643	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.665	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.605	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.023	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	6.095	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.524	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	10.289	acre-feet		inches
Approximate 2-yr Detention Volume =	1.161	acre-feet		
Approximate 5-yr Detention Volume =	1.661	acre-feet		
Approximate 10-yr Detention Volume =	2.421	acre-feet		
Approximate 25-yr Detention Volume =	2.807	acre-feet		
Approximate 50-yr Detention Volume =	2.958	acre-feet		
Approximate 100-yr Detention Volume =	3.496	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.664	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.958	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.873	acre-feet
Total Detention Basin Volume =	3.496	acre-feet
Initial Surcharge Volume (ISV) =	87	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	263	ft^2
Surcharge Volume Length (L_{ISV}) =	16.2	ft
Surcharge Volume Width (W_{ISV}) =	16.2	ft
Depth of Basin Floor (H_{FLOOR}) =	0.82	ft
Length of Basin Floor (L_{FLOOR}) =	224.5	ft
Width of Basin Floor (W_{FLOOR}) =	118.7	ft
Area of Basin Floor (A_{FLOOR}) =	26,652	ft^2
Volume of Basin Floor (V_{FLOOR}) =	8,081	ft^3
Depth of Main Basin (H_{MAIN}) =	4.35	ft
Length of Main Basin (L_{MAIN}) =	259.3	ft
Width of Main Basin (W_{MAIN}) =	153.5	ft
Area of Main Basin (A_{MAIN}) =	39,807	ft^2
Volume of Main Basin (V_{MAIN}) =	143,597	ft^3
Calculated Total Basin Volume (V_{total}) =	**3.487**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		16.2	16.2	263		0.006		
ISV	0.33		16.2	16.2	263		0.006	87	0.002
	0.40		16.2	16.2	263		0.006	105	0.002
	0.50		16.2	16.2	263		0.006	132	0.003
	0.60		16.2	16.2	263		0.006	158	0.004
	0.70		16.2	16.2	263		0.006	184	0.004
	0.80		16.2	16.2	263		0.006	210	0.005
	0.90		34.0	25.0	849		0.019	255	0.006
	1.00		59.4	37.5	2,226		0.051	404	0.009
	1.10		84.8	50.0	4,237		0.097	722	0.017
	1.20		110.2	62.5	6,884		0.158	1,273	0.029
	1.30		135.6	75.0	10,166		0.233	2,120	0.049
	1.40		161.0	87.5	14,082		0.323	3,327	0.076
	1.50		186.4	100.0	18,634		0.428	4,957	0.114
	1.60		211.8	112.5	23,821		0.547	7,075	0.162
Floor	1.65		224.5	118.7	26,652		0.612	8,336	0.191
	1.70		224.9	119.1	26,790		0.615	9,672	0.222
	1.80		225.7	119.9	27,066		0.621	12,365	0.284
	1.90		226.5	120.7	27,343		0.628	15,085	0.346
	2.00		227.3	121.5	27,621		0.634	17,833	0.409
	2.10		228.1	122.3	27,901		0.641	20,610	0.473
	2.20		228.9	123.1	28,182		0.647	23,414	0.538
	2.30		229.7	123.9	28,464		0.653	26,246	0.603
Zone 1 (WQCV)	2.40		230.5	124.7	28,748		0.660	29,107	0.668
	2.50		231.3	125.5	29,032		0.666	31,996	0.735
	2.60		232.1	126.3	29,319		0.673	34,913	0.801
	2.70		232.9	127.1	29,606		0.680	37,859	0.869
	2.80		233.7	127.9	29,895		0.686	40,834	0.937
	2.90		234.5	128.7	30,185		0.693	43,838	1.006
	3.00		235.3	129.5	30,476		0.700	46,871	1.076
	3.10		236.1	130.3	30,768		0.706	49,933	1.146
	3.20		236.9	131.1	31,062		0.713	53,025	1.217
	3.30		237.7	131.9	31,357		0.720	56,146	1.289
	3.40		238.5	132.7	31,653		0.727	59,296	1.361
	3.50		239.3	133.5	31,951		0.733	62,477	1.434
	3.60		240.1	134.3	32,250		0.740	65,687	1.508
	3.70		240.9	135.1	32,550		0.747	68,927	1.582
Zone 2 (EURV)	3.76		241.4	135.6	32,731		0.751	70,885	1.627
	3.80		241.7	135.9	32,852		0.754	72,197	1.657
	3.90		242.5	136.7	33,154		0.761	75,497	1.733
	4.00		243.3	137.5	33,458		0.768	78,828	1.810
	4.10		244.1	138.3	33,764		0.775	82,189	1.887
	4.20		244.9	139.1	34,070		0.782	85,580	1.965
	4.30		245.7	139.9	34,378		0.789	89,003	2.043
	4.40		246.5	140.7	34,687		0.796	92,456	2.122
	4.50		247.3	141.5	34,998		0.803	95,940	2.202
	4.60		248.1	142.3	35,309		0.811	99,456	2.283
	4.70		248.9	143.1	35,622		0.818	103,002	2.365
	4.80		249.7	143.9	35,936		0.825	106,580	2.447
	4.90		250.5	144.7	36,252		0.832	110,189	2.530
	5.00		251.3	145.5	36,569		0.840	113,830	2.613
	5.10		252.1	146.3	36,887		0.847	117,503	2.698
	5.20		252.9	147.1	37,206		0.854	121,208	2.783
	5.30		253.7	147.9	37,527		0.862	124,945	2.868
	5.40		254.5	148.7	37,849		0.869	128,713	2.955
	5.50		255.3	149.5	38,172		0.876	132,514	3.042
	5.60		256.1	150.3	38,497		0.884	136,348	3.130
	5.70		256.9	151.1	38,822		0.891	140,214	3.219
	5.80		257.7	151.9	39,149		0.899	144,112	3.308
	5.90		258.5	152.7	39,478		0.906	148,044	3.399
	6.00		259.3	153.5	39,807		0.914	152,008	3.490
Zone 3 (100-year)	6.01		259.4	153.6	39,840		0.915	152,406	3.499
	6.10		260.1	154.3	40,138		0.921	156,005	3.581
	6.20		260.9	155.1	40,470		0.929	160,036	3.674
	6.30		261.7	155.9	40,804		0.937	164,099	3.767
	6.40		262.5	156.7	41,139		0.944	168,196	3.861
	6.50		263.3	157.5	41,475		0.952	172,327	3.956
	6.60		264.1	158.3	41,812		0.960	176,491	4.052
	6.70		264.9	159.1	42,151		0.968	180,690	4.148
	6.80		265.7	159.9	42,490		0.975	184,922	4.245
	6.90		266.5	160.7	42,832		0.983	189,188	4.343
	7.00		267.3	161.5	43,174		0.991	193,488	4.442
	7.10		268.1	162.3	43,518		0.999	197,823	4.541
	7.20		268.9	163.1	43,863		1.007	202,192	4.642
	7.30		269.7	163.9	44,209		1.015	206,595	4.743
	7.40		270.5	164.7	44,556		1.023	211,033	4.845
	7.50		271.3	165.5	44,905		1.031	215,506	4.947
	7.60		272.1	166.3	45,255		1.039	220,014	5.051
	7.70		272.9	167.1	45,607		1.047	224,557	5.155
	7.80		273.7	167.9	45,959		1.055	229,136	5.260
	7.90		274.5	168.7	46,313		1.063	233,749	5.366
	8.00		275.3	169.5	46,668		1.071	238,398	5.473
	8.10		276.1	170.3	47,025		1.080	243,083	5.580
	8.20		276.9	171.1	47,383		1.088	247,804	5.689
	8.30		277.7	171.9	47,742		1.096	252,560	5.798
	8.40		278.5	172.7	48,102		1.104	257,352	5.908
	8.50		279.3	173.5	48,464		1.113	262,180	6.019
	8.60		280.1	174.3	48,827		1.121	267,045	6.131
	8.70		280.9	175.1	49,191		1.129	271,946	6.243
	8.80		281.7	175.9	49,556		1.138	276,883	6.356
	8.90		282.5	176.7	49,923		1.146	281,857	6.471
	9.00		283.3	177.5	50,291		1.155	286,868	6.586
	9.10		284.1	178.3	50,660		1.163	291,915	6.701
	9.20		284.9	179.1	51,031		1.172	297,000	6.818
	9.30		285.7	179.9	51,403		1.180	302,121	6.936
	9.40		286.5	180.7	51,776		1.189	307,280	7.054
	9.50		287.3	181.5	52,150		1.197	312,477	7.173
	9.60		288.1	182.3	52,526		1.206	317,710	7.294
	9.70		288.9	183.1	52,903		1.214	322,982	7.415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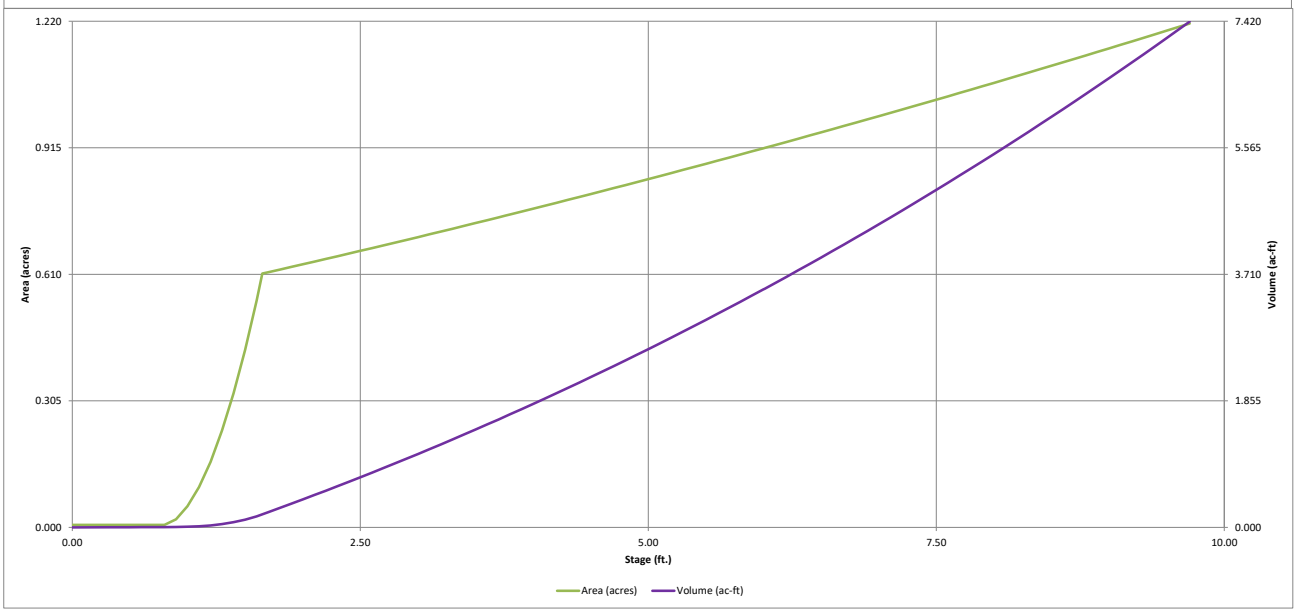
Area (sq.ft.)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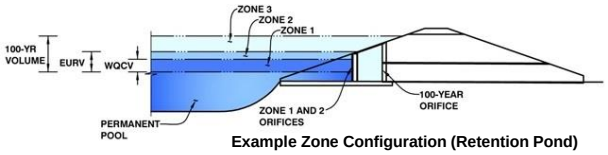
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 3**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.40	0.664	Orifice Plate
Zone 2 (EURV)	3.76	0.958	Rectangular Orifice
Zone 3 (100-year)	6.01	1.873	Weir&Pipe (Restrict)
Total (all zones)		3.496	

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 =	1.528E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.36	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.20	sq. inches (diameter = 1-11/16 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	0.79	1.57					
Orifice Area (sq. inches)	2.20	2.20	2.20					

	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)

	Zone 2 Rectangular	Not Selected			Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.43	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.71	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.66	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.13	N/A	feet
Vertical Orifice Height =	3.00	N/A	inches				
Vertical Orifice Width =	34.00		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 =	3.76	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.76	N/A	feet
Overflow Weir Front Edge Length =	3.60	N/A	feet	Overflow Weir Slope Length =	3.16	N/A	feet
Overflow Weir Grate Slope =	3.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	2.48	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	7.92	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	3.96	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 =	3.20	N/A	ft^2
Outlet Pipe Diameter =	28.00	N/A	inches	Outlet Orifice Centroid =	0.91	N/A	feet
Restrictor Plate Height Above Pipe Invert =	19.60		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=	8.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.95	feet
Spillway Crest Length =	42.00	feet	Stage at Top of Freeboard =	10.75	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.31	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	8.74	acre-ft

Calculated Parameters for Spillway

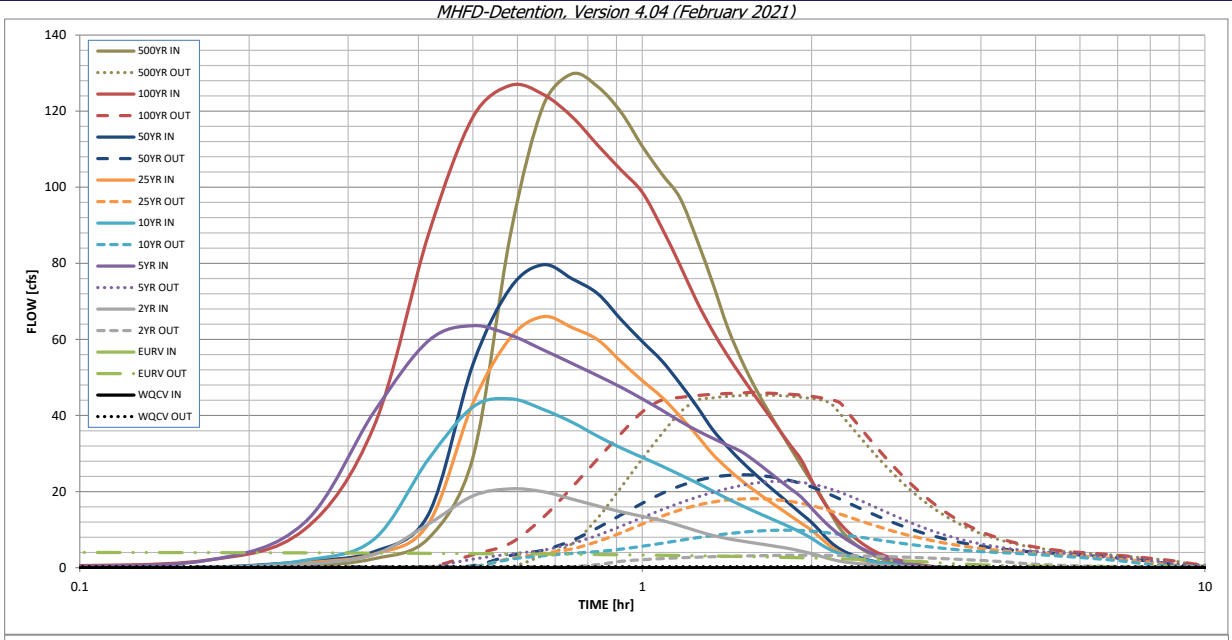
Routed Hydrograph Results

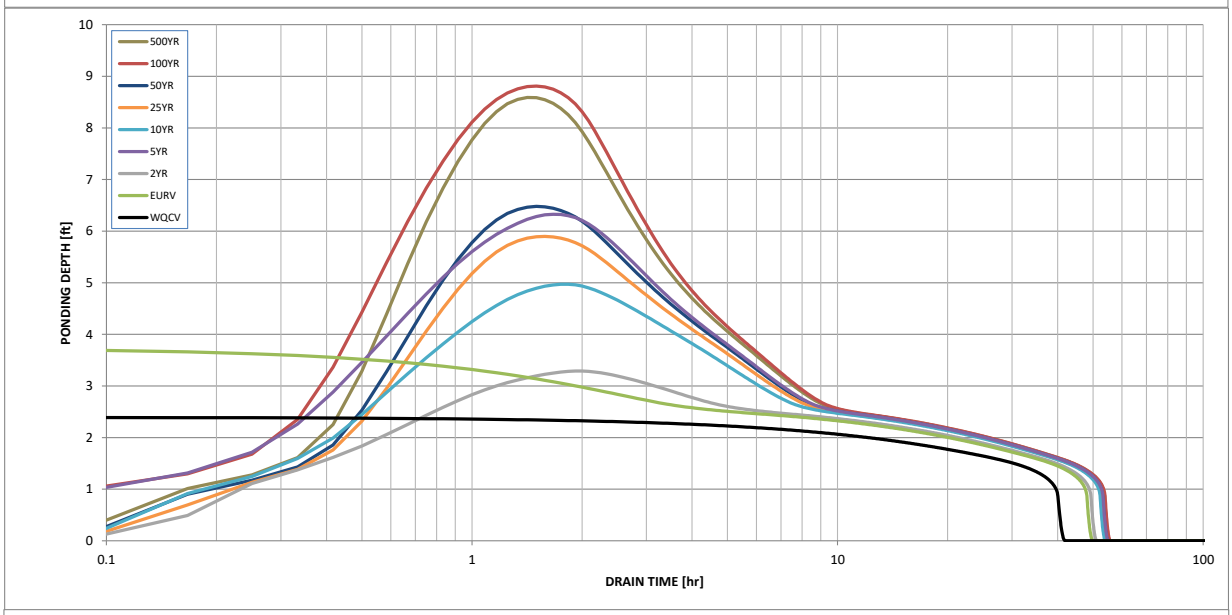
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

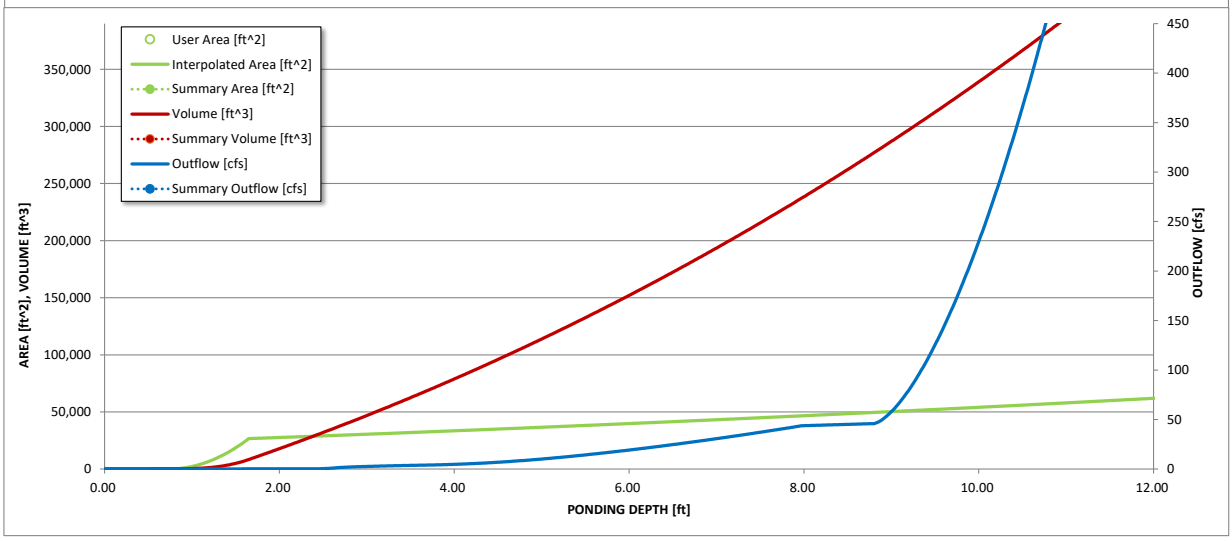
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.664	1.623	1.643	2.665	3.605	5.023	6.095	7.524	10.289
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.643	6.195	3.605	5.023	6.095	11.270	10.289
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	5.7	16.0	24.2	43.4	54.4	69.3	96.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		22.7				48.5	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.43	0.46	0.83	1.04	0.92	1.84
Peak Inflow Q (cfs) =	N/A	N/A	20.7	63.6	44.4	66.0	79.6	126.8	129.8
Peak Outflow Q (cfs) =	0.3	4.1	3.3	22.7	9.9	18.1	24.4	46.1	45.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.4	0.4	0.4	0.9	0.5
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	2.0	0.5	1.4	2.2	4.6	4.6
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	44	45	38	43	40	38	30	31
Time to Drain 99% of Inflow Volume (hours) =	**40**	47	48	48	49	49	48	44	45
Maximum Ponding Depth (ft) =	2.40	3.76	3.29	6.33	4.97	5.90	6.48	8.81	8.59
Area at Maximum Ponding Depth (acres) =	0.66	0.75	0.72	0.94	0.84	0.91	0.95	1.14	1.12
Maximum Volume Stored (acre-ft) =	0.668	1.627	1.275	3.786	2.580	3.390	3.928	6.368	6.108

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.13	0.00	0.00	0.00	0.33	0.00
	0:10:00	0.00	0.00	0.00	1.83	0.00	0.00	0.11	1.89	0.35
	0:15:00	0.00	0.00	0.91	11.64	1.89	1.28	1.63	9.87	2.36
	0:20:00	0.00	0.00	3.46	40.91	7.45	3.55	4.20	37.13	7.71
	0:25:00	0.00	0.00	11.48	59.62	28.51	11.54	14.03	87.57	29.01
	0:30:00	0.00	0.00	18.87	63.61	42.26	43.25	53.46	118.46	87.82
	0:35:00	0.00	0.00	20.73	61.11	44.37	60.48	73.62	126.79	121.47
	0:40:00	0.00	0.00	19.96	57.24	41.59	65.99	79.62	124.39	129.80
	0:45:00	0.00	0.00	18.03	53.69	38.23	63.11	75.94	118.52	126.42
	0:50:00	0.00	0.00	16.23	50.46	34.54	59.90	72.01	111.04	119.71
	0:55:00	0.00	0.00	14.69	47.42	31.48	54.16	65.22	104.53	110.75
	1:00:00	0.00	0.00	13.49	44.36	29.00	49.17	59.44	98.67	103.46
	1:05:00	0.00	0.00	12.42	41.41	26.70	44.83	54.37	89.30	97.18
	1:10:00	0.00	0.00	11.05	38.52	24.44	39.84	48.42	79.54	86.29
	1:15:00	0.00	0.00	9.67	36.09	22.31	34.83	42.42	69.99	74.89
	1:20:00	0.00	0.00	8.49	34.04	20.16	29.85	36.33	62.24	63.32
	1:25:00	0.00	0.00	7.64	32.21	18.16	26.08	31.81	55.82	54.62
	1:30:00	0.00	0.00	7.02	30.50	16.38	22.93	27.98	50.32	47.61
	1:35:00	0.00	0.00	6.48	28.09	14.79	20.27	24.73	45.34	41.70
	1:40:00	0.00	0.00	5.97	25.54	13.34	17.87	21.79	40.71	36.37
	1:45:00	0.00	0.00	5.47	23.07	11.96	15.71	19.14	36.32	31.50
	1:50:00	0.00	0.00	4.98	20.78	10.64	13.66	16.61	32.17	26.90
	1:55:00	0.00	0.00	4.34	18.57	9.24	11.69	14.19	28.35	22.58
	2:00:00	0.00	0.00	3.69	15.62	7.71	9.81	11.89	22.96	18.59
	2:05:00	0.00	0.00	2.93	12.84	5.99	7.59	9.15	18.22	14.08
	2:10:00	0.00	0.00	2.21	10.46	4.61	5.47	6.57	14.45	10.15
	2:15:00	0.00	0.00	1.69	8.53	3.67	3.96	4.83	11.50	7.51
	2:20:00	0.00	0.00	1.35	6.94	2.99	2.97	3.67	9.12	5.66
	2:25:00	0.00	0.00	1.10	5.63	2.43	2.27	2.82	7.22	4.23
	2:30:00	0.00	0.00	0.90	4.51	1.97	1.74	2.17	5.65	3.15
	2:35:00	0.00	0.00	0.73	3.57	1.58	1.34	1.67	4.39	2.31
	2:40:00	0.00	0.00	0.59	2.79	1.24	1.03	1.28	3.45	1.66
	2:45:00	0.00	0.00	0.47	2.19	0.97	0.78	0.97	2.73	1.21
	2:50:00	0.00	0.00	0.38	1.71	0.75	0.60	0.75	2.18	0.93
	2:55:00	0.00	0.00	0.31	1.30	0.58	0.47	0.58	1.71	0.74
	3:00:00	0.00	0.00	0.25	0.95	0.45	0.37	0.46	1.29	0.59
	3:05:00	0.00	0.00	0.19	0.66	0.35	0.29	0.35	0.93	0.46
	3:10:00	0.00	0.00	0.15	0.44	0.26	0.22	0.27	0.63	0.34
	3:15:00	0.00	0.00	0.11	0.27	0.18	0.16	0.19	0.39	0.24
	3:20:00	0.00	0.00	0.07	0.14	0.12	0.11	0.13	0.20	0.16
	3:25:00	0.00	0.00	0.05	0.05	0.07	0.07	0.08	0.08	0.09
	3:30:00	0.00	0.00	0.02	0.01	0.04	0.04	0.04	0.01	0.05
	3:35:00	0.00	0.00	0.01	0.00	0.01	0.01	0.02	0.00	0.01
	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
					0	5:50:00	0			

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'.

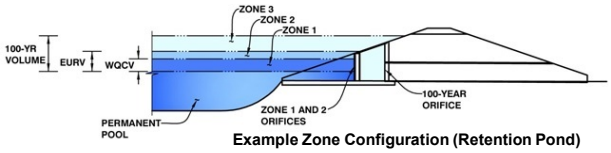
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 4**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.90	1.201	Orifice Plate
Zone 2 (5-year)	4.54	1.398	Weir&Pipe (Circular)
Zone 3 (100-year)	8.10	3.853	Weir&Pipe (Restrict)
Total (all zones)		6.452	

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 =	3.854E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.54	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.50	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	5.55	sq. inches (use rectangular openings)	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	1.51	3.03					
Orifice Area (sq. inches)	5.55	5.55	5.55					

	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
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
Vertical Orifice Diameter =	N/A	N/A	inches			

Calculated Parameters for Vertical Orif

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

	Zone 2 Weir	Zone 3 Weir			Zone 2 Weir	Zone 3 Weir
Overflow Weir Front Edge Height, Ho =	4.54	7.00	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.54	7.00
Overflow Weir Front Edge Length =	6.00	6.00	feet	Overflow Weir Slope Length =	6.00	10.00
Overflow Weir Grate Slope =	0.00	0.00	H:V	Grate Open Area / 100-yr Orifice Area =	5.10	2.01
Horiz. Length of Weir Sides =	6.00	10.00	feet	Overflow Grate Open Area w/o Debris =	25.06	41.76
Overflow Grate Type =	Type C Grate	Type C Grate		Overflow Grate Open Area w/ Debris =	12.53	20.88
Debris Clogging % =	50%	50%	%			

Calculated Parameters for Overflow W

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

	Zone 2 Circular	Zone 3 Restrictor			Zone 2 Circular	Zone 3 Restrictor
Depth to Invert of Outlet Pipe =	2.50	2.60	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.91	20.80
Circular Orifice Diameter or Pipe Diameter =	30.00	65.00	inches	Outlet Orifice Centroid =	1.25	2.47
Restrictor Plate Height Above Pipe Invert =		55.00	inches	Half-Central Angle of Restrictor Plate on Pipe =	N/A	2.34

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	11.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.97	feet
Spillway Crest Length =	79.00	feet	Stage at Top of Freeboard =	12.97	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.77	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	13.79	acre-ft

Calculated Parameters for Spillway

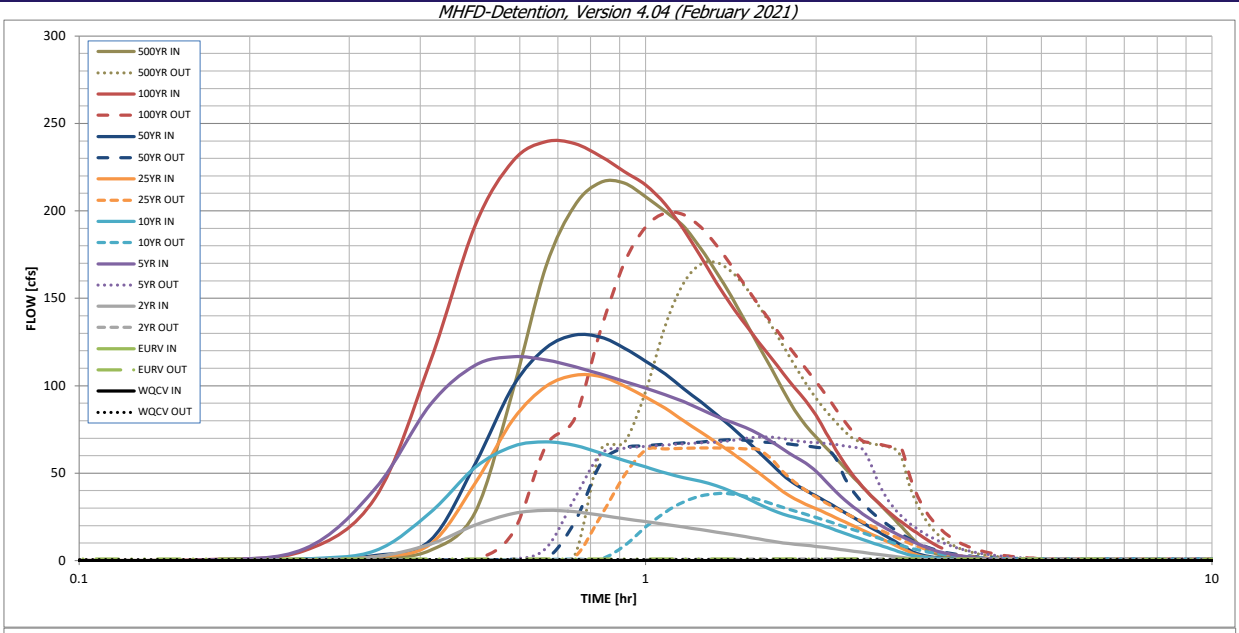
Routed Hydrograph Results

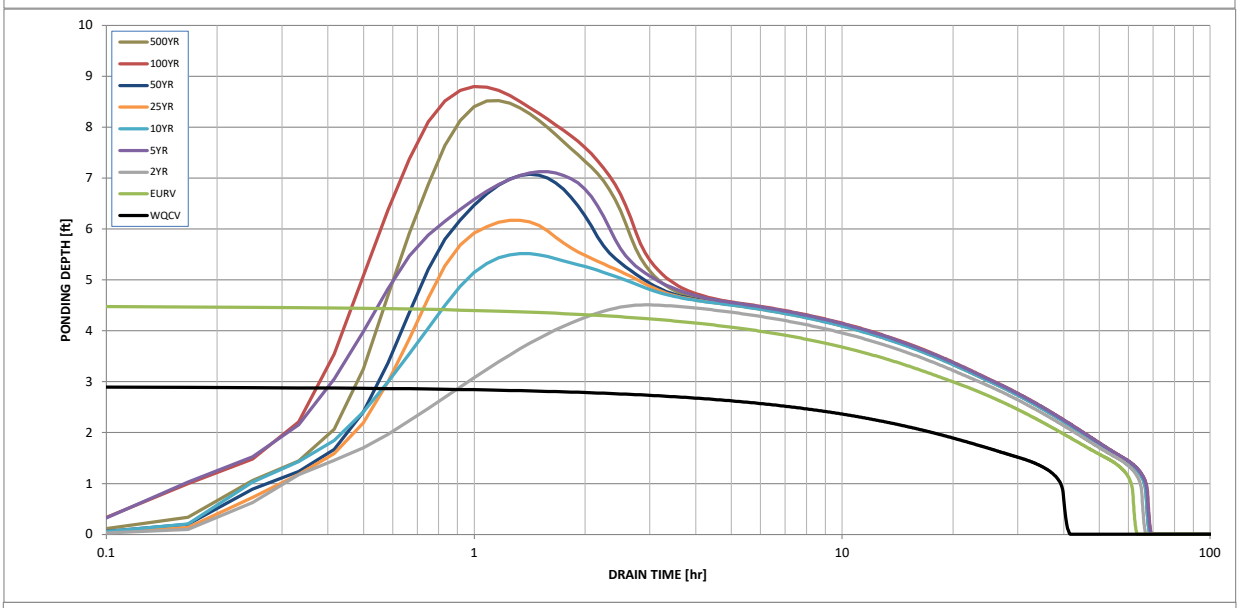
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through A

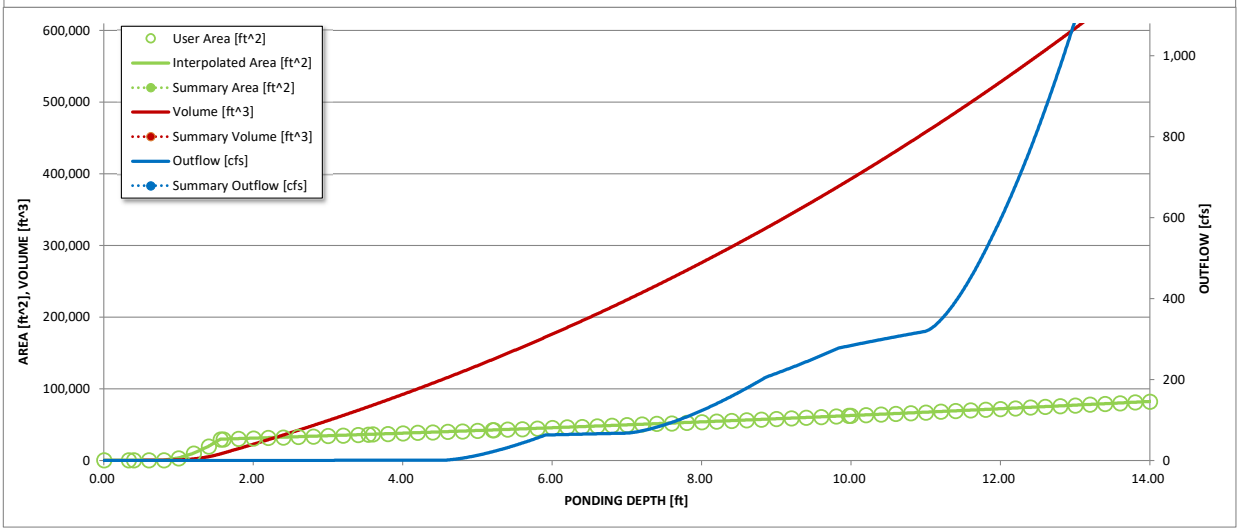
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	1.201	2.555	2.764	4.915	6.951	10.216	12.579	15.835
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.764	14.585	6.951	10.216	12.579	26.746
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	10.7	29.9	46.0	84.0	105.5	134.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		69.9				231.6
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.60	0.39	0.72	0.90	1.97
Peak Inflow Q (cfs) =	N/A	N/A	28.7	116.6	67.8	106.0	128.9	239.6
Peak Outflow Q (cfs) =	0.5	0.9	0.9	70.6	38.3	64.4	69.2	198.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.8	0.8	0.7	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 2	Overflow Weir 1	Outlet Plate 1	Overflow Weir 2	Overflow Weir 2
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	2.7	1.5	2.5	2.7	2.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	0.1	N/A	N/A	0.0	3.0
Time to Drain 97% of Inflow Volume (hours) =	38	58	61	48	56	52	50	38
Time to Drain 99% of Inflow Volume (hours) =	**40**	61	64	60	64	62	60	54
Maximum Ponding Depth (ft) =	2.90	4.49	4.51	7.12	5.52	6.17	7.07	8.79
Area at Maximum Ponding Depth (acres) =	0.79	0.92	0.92	1.16	1.01	1.07	1.15	1.32
Maximum Volume Stored (acre-ft) =	1.203	2.560	2.569	5.284	3.543	4.228	5.226	7.349

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.

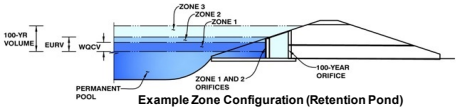
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	0:10:00	0.00	0.00	0.00	0.36	0.00	0.00	0.06	0.49	0.18
	0:15:00	0.00	0.00	0.48	6.73	0.99	0.67	0.88	5.67	1.32
	0:20:00	0.00	0.00	2.13	41.21	5.65	2.26	2.89	35.90	5.82
	0:25:00	0.00	0.00	9.38	89.05	27.50	9.26	11.47	113.64	27.45
	0:30:00	0.00	0.00	20.30	111.59	53.20	44.07	55.13	191.47	97.49
	0:35:00	0.00	0.00	26.92	116.56	65.38	80.67	99.67	228.61	167.89
	0:40:00	0.00	0.00	28.75	114.74	67.85	99.55	121.59	239.57	203.14
	0:45:00	0.00	0.00	27.97	110.81	65.87	105.99	128.94	238.45	216.31
	0:50:00	0.00	0.00	25.92	106.63	61.53	105.24	127.82	231.20	215.91
	0:55:00	0.00	0.00	23.93	102.54	57.32	99.95	121.53	222.57	208.11
	1:00:00	0.00	0.00	22.26	98.67	53.59	93.45	114.06	214.84	199.58
	1:05:00	0.00	0.00	20.71	94.84	50.07	87.10	106.71	203.76	191.23
	1:10:00	0.00	0.00	19.18	90.87	47.47	79.98	98.34	189.33	178.69
	1:15:00	0.00	0.00	17.72	86.57	45.43	73.58	90.88	174.06	165.11
	1:20:00	0.00	0.00	16.34	82.55	42.85	67.61	83.67	159.11	151.09
	1:25:00	0.00	0.00	15.00	79.15	39.55	61.79	76.45	146.10	136.67
	1:30:00	0.00	0.00	13.68	76.09	36.01	55.97	69.25	135.00	122.93
	1:35:00	0.00	0.00	12.39	72.49	32.45	50.28	62.20	125.07	109.91
	1:40:00	0.00	0.00	11.15	68.09	29.09	44.69	55.31	115.83	97.41
	1:45:00	0.00	0.00	10.11	63.64	26.50	39.42	48.83	107.08	86.08
	1:50:00	0.00	0.00	9.38	59.52	24.62	35.39	43.95	98.86	77.49
	1:55:00	0.00	0.00	8.76	55.77	22.98	32.29	40.17	91.43	70.60
	2:00:00	0.00	0.00	8.13	51.08	21.28	29.70	36.99	83.00	64.62
	2:05:00	0.00	0.00	7.45	45.18	19.40	27.11	33.76	73.06	58.71
	2:10:00	0.00	0.00	6.72	39.50	17.45	24.54	30.53	63.57	52.86
	2:15:00	0.00	0.00	6.01	34.58	15.56	22.07	27.42	55.20	47.30
	2:20:00	0.00	0.00	5.34	30.40	13.75	19.69	24.44	48.18	42.08
	2:25:00	0.00	0.00	4.70	26.78	12.05	17.43	21.62	42.28	37.24
	2:30:00	0.00	0.00	4.09	23.59	10.43	15.25	18.91	37.20	32.58
	2:35:00	0.00	0.00	3.50	20.73	8.90	13.13	16.27	32.73	28.03
	2:40:00	0.00	0.00	2.92	18.16	7.42	11.04	13.68	28.74	23.55
	2:45:00	0.00	0.00	2.35	15.85	5.98	8.99	11.15	25.16	19.13
	2:50:00	0.00	0.00	1.80	13.75	4.59	6.98	8.65	21.91	14.79
	2:55:00	0.00	0.00	1.28	11.84	3.38	5.04	6.26	18.95	10.72
	3:00:00	0.00	0.00	0.92	10.10	2.62	3.40	4.29	16.20	7.55
	3:05:00	0.00	0.00	0.72	8.49	2.13	2.42	3.11	13.61	5.49
	3:10:00	0.00	0.00	0.59	7.01	1.76	1.78	2.31	11.16	4.04
	3:15:00	0.00	0.00	0.49	5.74	1.45	1.33	1.75	8.92	2.96
	3:20:00	0.00	0.00	0.41	4.74	1.19	1.01	1.34	7.06	2.16
	3:25:00	0.00	0.00	0.33	3.97	0.96	0.79	1.03	5.65	1.55
	3:30:00	0.00	0.00	0.27	3.35	0.77	0.60	0.79	4.58	1.10
	3:35:00	0.00	0.00	0.22	2.82	0.60	0.47	0.61	3.73	0.82
	3:40:00	0.00	0.00	0.18	2.36	0.46	0.37	0.48	3.04	0.64
	3:45:00	0.00	0.00	0.15	1.96	0.35	0.29	0.37	2.45	0.50
	3:50:00	0.00	0.00	0.11	1.61	0.27	0.22	0.29	1.98	0.40
	3:55:00	0.00	0.00	0.09	1.31	0.20	0.17	0.22	1.60	0.31
	4:00:00	0.00	0.00	0.06	1.06	0.15	0.13	0.16	1.30	0.23
	4:05:00	0.00	0.00	0.04	0.85	0.10	0.09	0.11	1.05	0.16
	4:10:00	0.00	0.00	0.03	0.67	0.06	0.06	0.07	0.85	0.10
	4:15:00	0.00	0.00	0.01	0.52	0.03	0.03	0.04	0.67	0.06
	4:20:00	0.00	0.00	0.01	0.39	0.01	0.02	0.02	0.51	0.03
	4:25:00	0.00	0.00	0.00	0.28	0.00	0.00	0.01	0.38	0.01
	4:30:00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.27	0.00
	4:35:00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.18	0.00
	4:40:00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.12	0.00
	4:45:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.07	0.00
	4:50:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00
	4:55:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	5:00:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:05:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 4**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	117.41	acres
Watershed Length =	4,350	ft
Watershed Length to Centroid =	2,200	ft
Watershed Slope =	0.036	ft/ft
Watershed Imperviousness =	21.76%	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 = Denver - Capitol Building

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) =	1.201	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.555	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.764	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	4.915	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	6.951	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	10.216	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	12.579	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	15.835	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	21.970	acre-feet		inches
Approximate 2-yr Detention Volume =	1.768	acre-feet		
Approximate 5-yr Detention Volume =	2.599	acre-feet		
Approximate 10-yr Detention Volume =	4.104	acre-feet		
Approximate 25-yr Detention Volume =	5.007	acre-feet		
Approximate 50-yr Detention Volume =	5.288	acre-feet		
Approximate 100-yr Detention Volume =	6.452	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.201	acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.398	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.853	acre-feet
Total Detention Basin Volume =	6.452	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 Increement = 0.20 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	--	--	--	680	0.016		
	--	0.33	--	--	--	680	0.016	225	0.005
	--	0.40	--	--	--	680	0.016	272	0.006
	--	0.60	--	--	--	680	0.016	408	0.009
	--	0.80	--	--	--	680	0.016	544	0.012
	--	1.00	--	--	--	3,706	0.085	983	0.023
	--	1.20	--	--	--	10,203	0.234	2,374	0.054
	--	1.40	--	--	--	19,875	0.456	5,381	0.124
	--	1.56	--	--	--	29,898	0.686	9,363	0.215
	--	1.60	--	--	--	30,028	0.689	10,561	0.242
	--	1.80	--	--	--	30,679	0.704	16,632	0.382
	--	2.00	--	--	--	31,336	0.719	22,834	0.524
	--	2.20	--	--	--	32,000	0.735	29,167	0.670
	--	2.40	--	--	--	32,671	0.750	35,634	0.818
	--	2.60	--	--	--	33,347	0.766	42,236	0.970
	--	2.80	--	--	--	34,030	0.781	48,974	1.124
	--	3.00	--	--	--	34,720	0.797	55,849	1.282
	--	3.20	--	--	--	35,416	0.813	62,862	1.443
	--	3.40	--	--	--	36,118	0.829	70,016	1.607
	--	3.54	--	--	--	36,614	0.841	75,107	1.724
	--	3.60	--	--	--	36,827	0.845	77,310	1.775
	--	3.80	--	--	--	37,542	0.862	84,747	1.946
	--	4.00	--	--	--	38,264	0.878	92,328	2.120
	--	4.20	--	--	--	38,992	0.895	100,053	2.297
	--	4.40	--	--	--	39,726	0.912	107,925	2.478
	--	4.60	--	--	--	40,467	0.929	115,944	2.662
	--	4.80	--	--	--	41,214	0.946	124,112	2.849
	--	5.00	--	--	--	41,967	0.963	132,431	3.040
	--	5.20	--	--	--	42,727	0.981	140,900	3.235
	--	5.22	--	--	--	42,804	0.983	141,755	3.254
	--	5.40	--	--	--	43,494	0.998	149,522	3.433
	--	5.60	--	--	--	44,266	1.016	158,298	3.634
	--	5.80	--	--	--	45,045	1.034	167,229	3.839
	--	6.00	--	--	--	45,831	1.052	176,317	4.048
	--	6.20	--	--	--	46,623	1.070	185,562	4.260
	--	6.40	--	--	--	47,421	1.089	194,967	4.476
	--	6.60	--	--	--	48,226	1.107	204,531	4.695
	--	6.80	--	--	--	49,037	1.126	214,258	4.919
	--	7.00	--	--	--	49,855	1.145	224,147	5.146
	--	7.20	--	--	--	50,679	1.163	234,200	5.376
	--	7.40	--	--	--	51,509	1.182	244,419	5.611
	--	7.60	--	--	--	52,346	1.202	254,805	5.850
	--	7.80	--	--	--	53,189	1.221	265,358	6.092
	--	8.00	--	--	--	54,038	1.241	276,081	6.338
	--	8.20	--	--	--	54,894	1.260	286,974	6.588
	--	8.40	--	--	--	55,757	1.280	298,039	6.842
	--	8.60	--	--	--	56,625	1.300	309,277	7.100
	--	8.80	--	--	--	57,501	1.320	320,690	7.362
	--	9.00	--	--	--	58,382	1.340	332,278	7.628
	--	9.20	--	--	--	59,270	1.361	344,043	7.898
	--	9.40	--	--	--	60,164	1.381	355,987	8.172
	--	9.60	--	--	--	61,065	1.402	368,110	8.451
	--	9.80	--	--	--	61,972	1.423	380,414	8.733
	--	9.97	--	--	--	62,748	1.441	391,015	8.976
	--	10.00	--	--	--	62,886	1.444	392,899	9.020
	--	10.20	--	--	--	63,806	1.465	405,568	9.311
	--	10.40	--	--	--	64,732	1.486	418,422	9.606
	--	10.60	--	--	--	65,665	1.507	431,462	9.905
	--	10.80	--	--	--	66,604	1.529	444,689	10.209
	--	11.00	--	--	--	67,550	1.551	458,104	10.517
	--	11.20	--	--	--	68,501	1.573	471,709	10.829
	--	11.40	--	--	--	69,460	1.595	485,505	11.146
	--	11.60	--	--	--	70,425	1.617	499,494	11.467
	--	11.80	--	--	--	71,396	1.639	513,676	11.792
	--	12.00	--	--	--	72,373	1.661	528,053	12.122
	--	12.20	--	--	--	73,357	1.684	542,626	12.457
	--	12.40	--	--	--	74,347	1.707	557,396	12.796
	--	12.60	--	--	--	75,344	1.730	572,365	13.140
	--	12.80	--	--	--	76,347	1.753	587,535	13.488
	--	13.00	--	--	--	77,357	1.776	602,905	13.841
	--	13.20	--	--	--	78,373	1.799	618,478	14.198
	--	13.40	--	--	--	79,395	1.823	634,255	14.560
	--	13.60	--	--	--	80,424	1.846	650,237	14.927
	--	13.80	--	--	--	81,459	1.870	666,425	15.299
	--	14.00	--	--	--	82,501	1.894	682,821	15.675
	--	14.20	--	--	--	83,549	1.918	699,426	16.057
	--	14.40	--	--	--	84,603	1.942	716,241	16.443
	--	14.60	--	--	--	85,664	1.967	733,268	16.834
	--	14.80	--	--	--	86,731	1.991	750,507	17.229
	--	15.00	--	--	--	87,804	2.016	767,961	17.630
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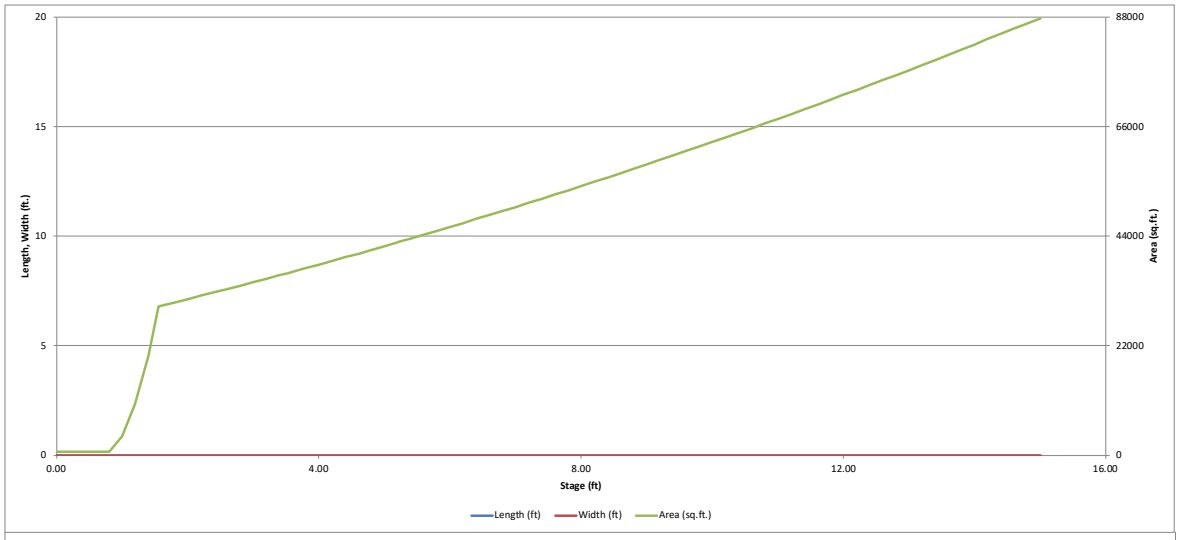
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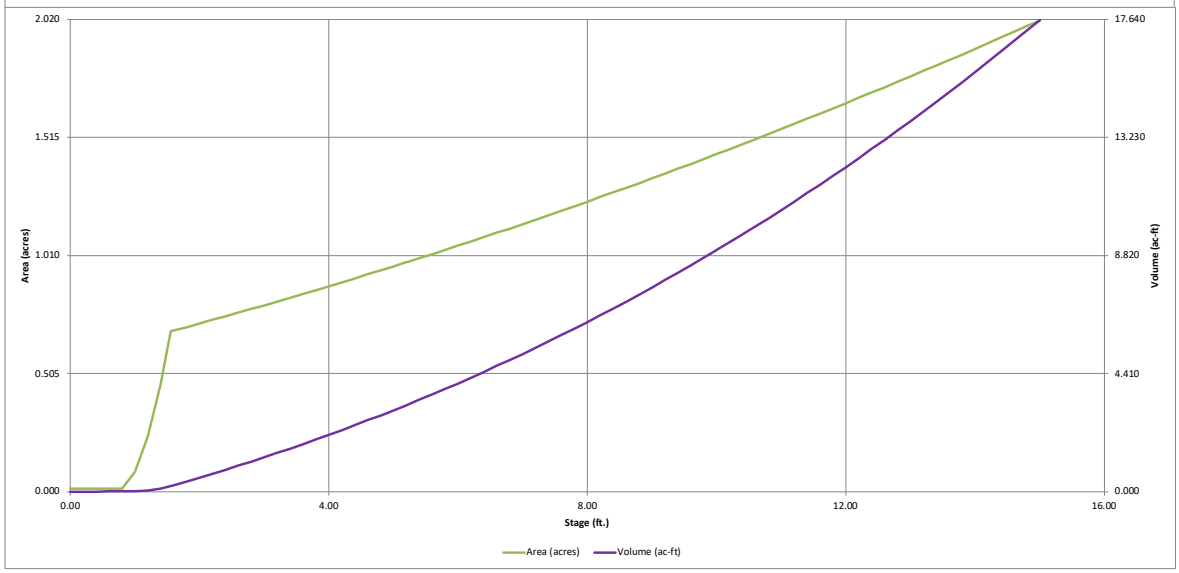
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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12.00
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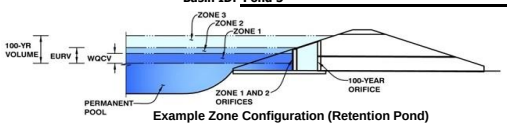
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 5**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**		**Note: L / W Ratio < 1**
Watershed Area =	41.57	acres	**L / W Ratio = 0.52**
Watershed Length =	967	ft	
Watershed Length to Centroid =	450	ft	
Watershed Slope =	0.045	ft/ft	
Watershed Imperviousness =	29.60%	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.

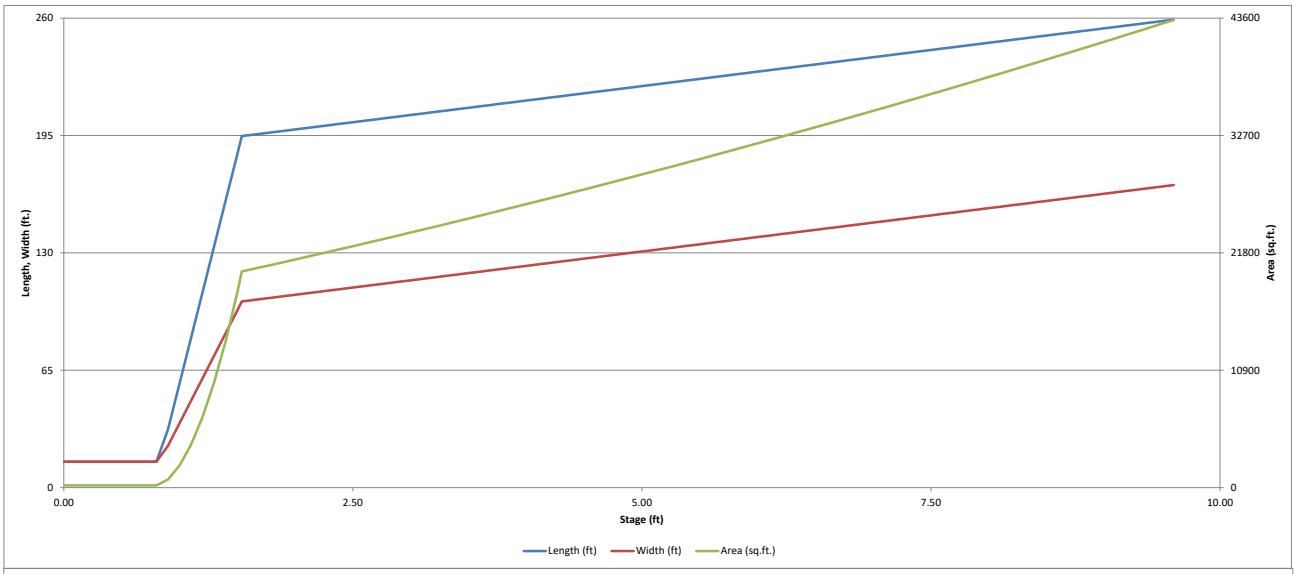
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.520	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.261	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.226	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.996	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.708	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.784	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.596	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	5.681	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	7.783	acre-feet		inches
Approximate 2-yr Detention Volume =	0.901	acre-feet		
Approximate 5-yr Detention Volume =	1.291	acre-feet		
Approximate 10-yr Detention Volume =	1.889	acre-feet		
Approximate 25-yr Detention Volume =	2.195	acre-feet		
Approximate 50-yr Detention Volume =	2.313	acre-feet		
Approximate 100-yr Detention Volume =	2.738	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.520	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.741	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.477	acre-feet
Total Detention Basin Volume =	2.738	acre-feet
Initial Surcharge Volume (ISV) =	68	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	206	ft^2
Surcharge Volume Length (L_{ISV}) =	14.4	ft
Surcharge Volume Width (W_{ISV}) =	14.4	ft
Depth of Basin Floor (H_{FLOOR}) =	0.71	ft
Length of Basin Floor (L_{FLOOR}) =	194.7	ft
Width of Basin Floor (W_{FLOOR}) =	103.1	ft
Area of Basin Floor (A_{FLOOR}) =	20,074	ft^2
Volume of Basin Floor (V_{FLOOR}) =	5,281	ft^3
Depth of Main Basin (H_{MAIN}) =	4.46	ft
Length of Main Basin (L_{MAIN}) =	230.4	ft
Width of Main Basin (W_{MAIN}) =	138.8	ft
Area of Main Basin (A_{MAIN}) =	31,973	ft^2
Volume of Main Basin (V_{MAIN}) =	115,040	ft^3
Calculated Total Basin Volume (V_{total}) =	**2.766**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		14.4	14.4	206		0.005		
ISV	0.33		14.4	14.4	206		0.005	68	0.002
	0.40		14.4	14.4	206		0.005	82	0.002
	0.50		14.4	14.4	206		0.005	103	0.002
	0.60		14.4	14.4	206		0.005	124	0.003
	0.70		14.4	14.4	206		0.005	144	0.003
	0.80		14.4	14.4	206		0.005	165	0.004
	0.90		32.1	23.1	742		0.017	202	0.005
	1.00		57.5	35.6	2,049		0.047	337	0.008
	1.10		82.9	48.1	3,990		0.092	633	0.015
	1.20		108.3	60.6	6,566		0.151	1,156	0.027
	1.30		133.7	73.1	9,777		0.224	1,968	0.045
	1.40		159.1	85.6	13,623		0.313	3,132	0.072
	1.50		184.5	98.1	18,104		0.416	4,713	0.108
Floor	1.54		194.7	103.1	20,074		0.461	5,477	0.126
	1.60		195.2	103.6	20,217		0.464	6,685	0.153
	1.70		196.0	104.4	20,457		0.470	8,719	0.200
	1.80		196.8	105.2	20,698		0.475	10,777	0.247
	1.90		197.6	106.0	20,940		0.481	12,859	0.295
	2.00		198.4	106.8	21,184		0.486	14,965	0.344
	2.10		199.2	107.6	21,428		0.492	17,095	0.392
	2.20		200.0	108.4	21,674		0.498	19,250	0.442
	2.30		200.8	109.2	21,922		0.503	21,430	0.492
Zone 1 (WQCV)	2.36		201.3	109.7	22,071		0.507	22,750	0.522
	2.40		201.6	110.0	22,170		0.509	23,635	0.543
	2.50		202.4	110.8	22,420		0.515	25,864	0.594
	2.60		203.2	111.6	22,671		0.520	28,119	0.646
	2.70		204.0	112.4	22,924		0.526	30,399	0.698
	2.80		204.8	113.2	23,177		0.532	32,704	0.751
	2.90		205.6	114.0	23,433		0.538	35,034	0.804
	3.00		206.4	114.8	23,689		0.544	37,390	0.858
	3.10		207.2	115.6	23,946		0.550	39,772	0.913
	3.20		208.0	116.4	24,205		0.556	42,180	0.968
	3.30		208.8	117.2	24,465		0.562	44,613	1.024
	3.40		209.6	118.0	24,727		0.568	47,073	1.081
	3.50		210.4	118.8	24,989		0.574	49,558	1.138
	3.60		211.2	119.6	25,253		0.580	52,071	1.195
	3.70		212.0	120.4	25,519		0.586	54,609	1.254
Zone 2 (EURV)	3.72		212.1	120.5	25,572		0.587	55,120	1.265
	3.80		212.8	121.2	25,785		0.592	57,174	1.313
	3.90		213.6	122.0	26,053		0.598	59,766	1.372
	4.00		214.4	122.8	26,322		0.604	62,385	1.432
	4.10		215.2	123.6	26,592		0.610	65,031	1.493
	4.20		216.0	124.4	26,864		0.617	67,704	1.554
	4.30		216.8	125.2	27,137		0.623	70,404	1.616
	4.40		217.6	126.0	27,411		0.629	73,131	1.679
	4.50		218.4	126.8	27,687		0.636	75,886	1.742
	4.60		219.2	127.6	27,963		0.642	78,668	1.806
	4.70		220.0	128.4	28,242		0.648	81,479	1.870
	4.80		220.8	129.2	28,521		0.655	84,317	1.936
	4.90		221.6	130.0	28,801		0.661	87,183	2.001
	5.00		222.4	130.8	29,083		0.668	90,077	2.068
	5.10		223.2	131.6	29,367		0.674	93,000	2.135
	5.20		224.0	132.4	29,651		0.681	95,950	2.203
	5.30		224.8	133.2	29,937		0.687	98,930	2.271
	5.40		225.6	134.0	30,224		0.694	101,938	2.340
	5.50		226.4	134.8	30,512		0.700	104,975	2.410
	5.60		227.2	135.6	30,802		0.707	108,040	2.480
	5.70		228.0	136.4	31,092		0.714	111,135	2.551
	5.80		228.8	137.2	31,385		0.720	114,259	2.623
	5.90		229.6	138.0	31,678		0.727	117,412	2.695
Zone 3 (100-year)	5.96		230.1	138.5	31,855		0.731	119,318	2.739
	6.00		230.4	138.8	31,973		0.734	120,594	2.768
	6.10		231.2	139.6	32,269		0.741	123,806	2.842
	6.20		232.0	140.4	32,566		0.748	127,048	2.917
	6.30		232.8	141.2	32,864		0.754	130,320	2.992
	6.40		233.6	142.0	33,164		0.761	133,621	3.068
	6.50		234.4	142.8	33,465		0.768	136,953	3.144
	6.60		235.2	143.6	33,768		0.775	140,314	3.221
	6.70		236.0	144.4	34,071		0.782	143,706	3.299
	6.80		236.8	145.2	34,376		0.789	147,128	3.378
	6.90		237.6	146.0	34,682		0.796	150,581	3.457
	7.00		238.4	146.8	34,990		0.803	154,065	3.537
	7.10		239.2	147.6	35,299		0.810	157,579	3.618
	7.20		240.0	148.4	35,609		0.817	161,125	3.699
	7.30		240.8	149.2	35,920		0.825	164,701	3.781
	7.40		241.6	150.0	36,233		0.832	168,309	3.864
	7.50		242.4	150.8	36,547		0.839	171,948	3.947
	7.60		243.2	151.6	36,862		0.846	175,618	4.032
	7.70		244.0	152.4	37,178		0.853	179,320	4.117
	7.80		244.8	153.2	37,496		0.861	183,054	4.202
	7.90		245.6	154.0	37,815		0.868	186,819	4.289
	8.00		246.4	154.8	38,135		0.875	190,617	4.376
	8.10		247.2	155.6	38,457		0.883	194,446	4.464
	8.20		248.0	156.4	38,780		0.890	198,308	4.553
	8.30		248.8	157.2	39,104		0.898	202,202	4.642
	8.40		249.6	158.0	39,429		0.905	206,129	4.732
	8.50		250.4	158.8	39,756		0.913	210,088	4.823
	8.60		251.2	159.6	40,084		0.920	214,080	4.915
	8.70		252.0	160.4	40,413		0.928	218,105	5.007
	8.80		252.8	161.2	40,744		0.935	222,163	5.100
	8.90		253.6	162.0	41,075		0.943	226,254	5.194
	9.00		254.4	162.8	41,408		0.951	230,378	5.289
	9.10		255.2	163.6	41,743		0.958	234,536	5.384
	9.20		256.0	164.4	42,079		0.966	238,727	5.480
	9.30		256.8	165.2	42,415		0.974	242,951	5.577
	9.40		257.6	166.0	42,754		0.981	247,210	5.675
	9.50		258.4	166.8	43,093		0.989	251,502	5.774
	9.60		259.2	167.6	43,434		0.997	255,828	5.873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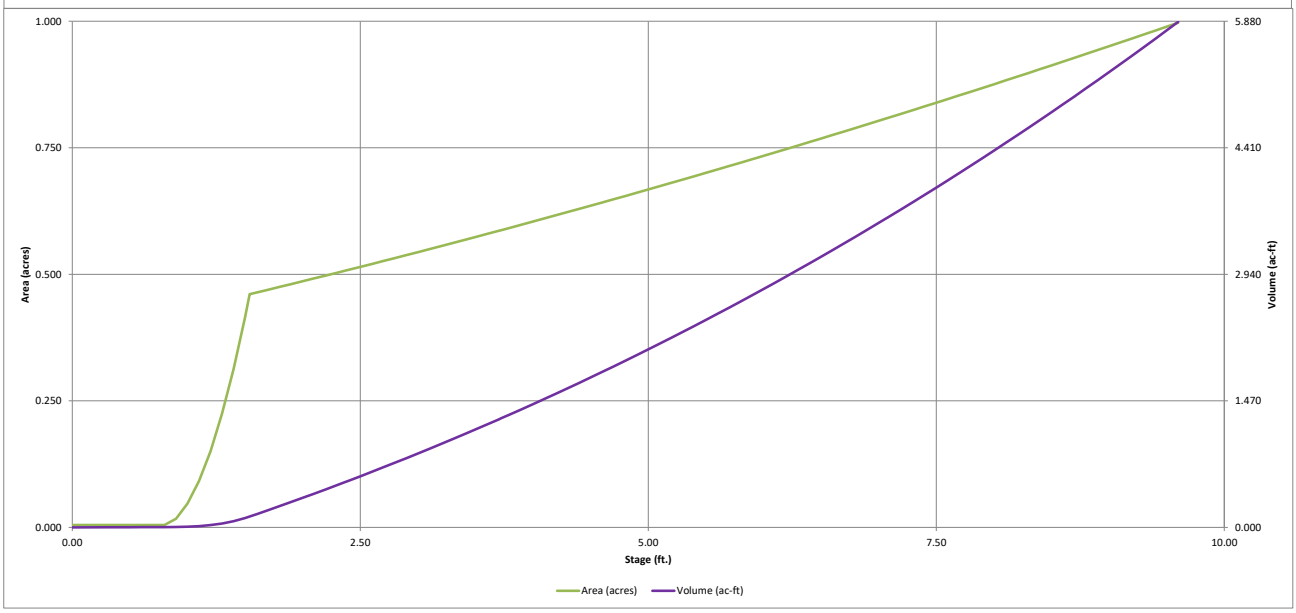
0.00
2.50
5.00
7.50
10.00
Length, Width (ft.)
Area (sq.ft.)
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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2.940
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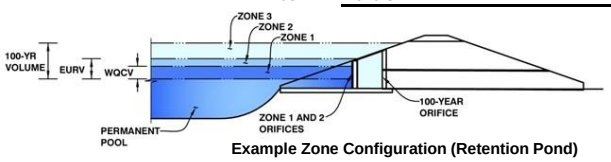
0.000
0.00
2.50
5.00
7.50
10.00
Area (acres)
Volume (ac-ft)
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 5**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.36	0.520	Orifice Plate
Zone 2 (EURV)	3.72	0.741	Circular Orifice
Zone 3 (100-year)	5.96	1.477	Weir&Pipe (Restrict)
Total (all zones)		2.738	

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 =	1.229E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.36	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.77	sq. inches (diameter = 1-1/2 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	0.79	1.57					
Orifice Area (sq. inches)	1.77	1.77	1.77					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.38	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.59	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	24.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	3.14	N/A	ft^2
Vertical Orifice Centroid =	1.00	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 =	4.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C 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 =	4.00	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.41	N/A	
Overflow Grate Open Area w/o Debris =	25.06	N/A	ft^2
Overflow Grate Open Area w/ Debris =	12.53	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 =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	37.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	10.39	N/A	ft^2
Outlet Orifice Centroid =	1.70	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.80	feet
Spillway Crest Length =	60.00	feet	Stage at Top of Freeboard =	8.80	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.94	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	5.10	acre-ft

Calculated Parameters for Spillway

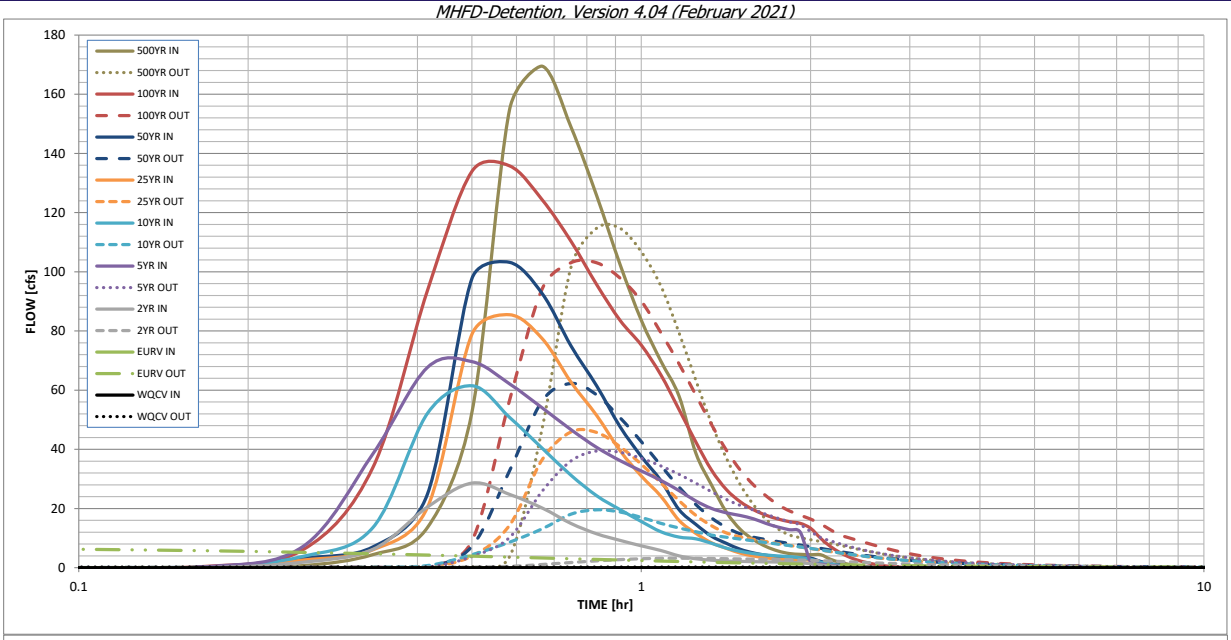
Routed Hydrograph Results

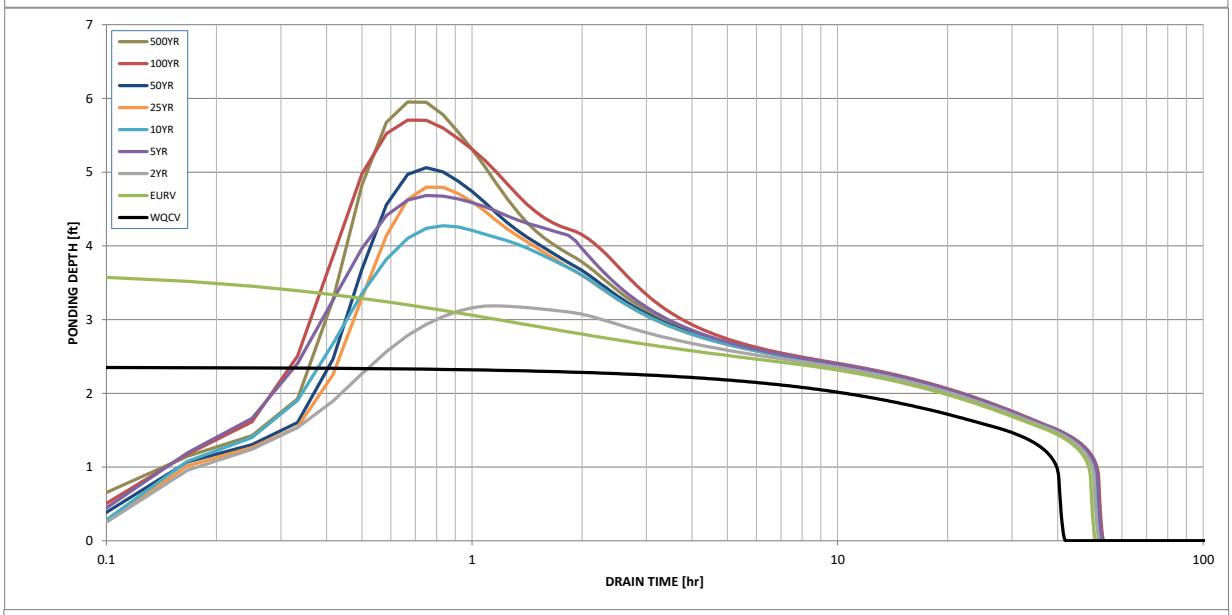
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

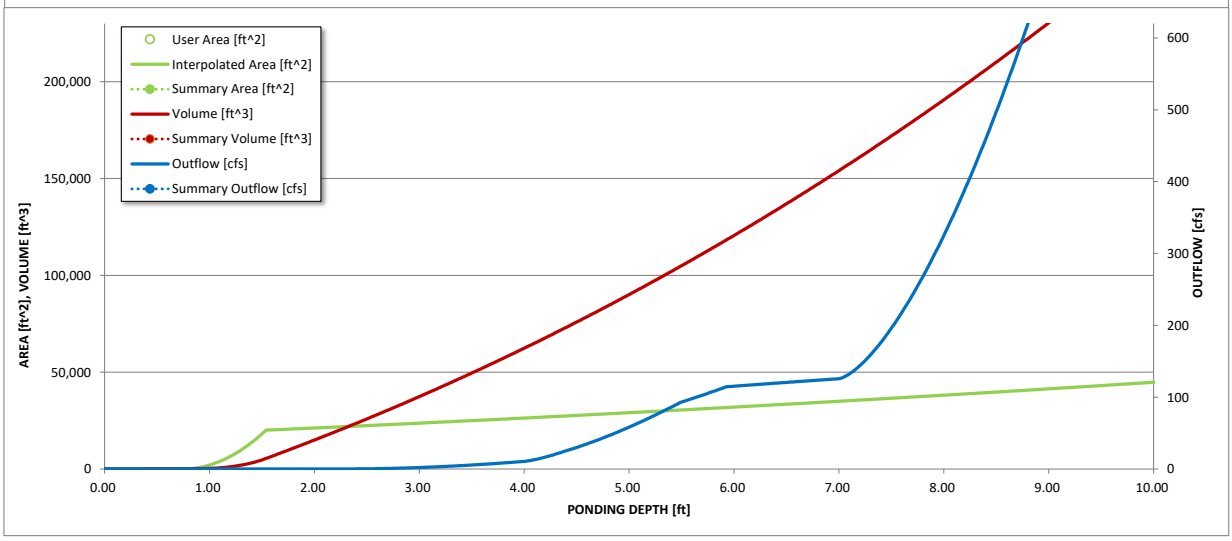
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.520	1.261	1.226	1.996	2.708	3.784	4.596	5.681	7.783
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.226	4.578	2.708	3.784	4.596	8.724	7.783
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	9.0	25.3	37.9	62.0	78.4	99.1	137.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		40.1				116.9	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.22	0.96	0.91	1.49	1.89	2.81	3.30
Peak Inflow Q (cfs) =	N/A	N/A	28.6	69.6	61.5	85.5	103.2	135.8	169.5
Peak Outflow Q (cfs) =	0.2	7.1	3.2	39.4	19.6	45.9	62.2	103.1	114.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.7	0.8	0.9	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.9	0.2	1.1	1.7	3.2	3.6
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	45	46	37	42	39	37	28	29
Time to Drain 99% of Inflow Volume (hours) =	**40**	48	49	46	48	47	46	42	43
Maximum Ponding Depth (ft) =	2.36	3.72	3.19	4.68	4.27	4.80	5.06	5.70	5.95
Area at Maximum Ponding Depth (acres) =	0.51	0.59	0.55	0.65	0.62	0.65	0.67	0.71	0.73
Maximum Volume Stored (acre-ft) =	0.522	1.265	0.957	1.858	1.598	1.929	2.108	2.551	2.732

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.27	0.00	0.00	0.22	0.40	0.70
	0:15:00	0.00	0.00	1.84	7.09	3.80	2.57	3.17	6.01	4.42
	0:20:00	0.00	0.00	6.21	38.48	13.58	6.05	7.03	33.89	13.57
	0:25:00	0.00	0.00	20.49	67.67	52.13	20.37	24.85	93.63	52.58
	0:30:00	0.00	0.00	28.59	69.63	61.49	78.91	97.73	133.95	154.89
	0:35:00	0.00	0.00	24.76	62.10	50.77	85.48	103.19	135.78	169.46
	0:40:00	0.00	0.00	20.16	54.00	40.35	77.39	92.60	124.29	148.88
	0:45:00	0.00	0.00	14.94	46.63	31.22	62.69	74.92	110.29	125.63
	0:50:00	0.00	0.00	11.44	40.64	24.29	51.40	61.39	95.61	102.47
	0:55:00	0.00	0.00	9.23	36.18	19.62	39.56	47.65	83.59	83.62
	1:00:00	0.00	0.00	7.39	32.69	15.61	30.99	37.59	75.22	69.81
	1:05:00	0.00	0.00	5.81	29.50	12.14	24.16	29.44	65.17	58.06
	1:10:00	0.00	0.00	4.00	26.06	10.35	16.01	19.65	53.50	38.75
	1:15:00	0.00	0.00	3.01	22.56	9.76	11.60	14.65	42.49	27.91
	1:20:00	0.00	0.00	2.54	20.01	8.24	8.40	10.62	32.94	18.76
	1:25:00	0.00	0.00	2.28	18.54	6.59	6.53	8.22	26.39	12.92
	1:30:00	0.00	0.00	2.14	17.63	5.51	4.92	6.21	22.26	9.46
	1:35:00	0.00	0.00	2.04	16.51	4.77	3.94	4.98	19.57	7.13
	1:40:00	0.00	0.00	1.96	14.95	4.30	3.32	4.19	17.72	5.64
	1:45:00	0.00	0.00	1.92	13.73	3.97	2.92	3.68	16.45	4.78
	1:50:00	0.00	0.00	1.90	12.82	3.73	2.73	3.44	15.55	4.51
	1:55:00	0.00	0.00	1.59	12.02	3.37	2.61	3.29	14.99	4.39
	2:00:00	0.00	0.00	1.38	1.90	2.81	2.56	3.23	13.30	4.39
	2:05:00	0.00	0.00	0.92	1.25	1.86	1.68	2.12	9.94	2.89
	2:10:00	0.00	0.00	0.60	0.80	1.20	1.10	1.38	7.23	1.87
	2:15:00	0.00	0.00	0.39	0.49	0.76	0.70	0.88	5.23	1.18
	2:20:00	0.00	0.00	0.24	0.30	0.46	0.43	0.53	3.73	0.71
	2:25:00	0.00	0.00	0.14	0.19	0.27	0.26	0.32	2.62	0.42
	2:30:00	0.00	0.00	0.07	0.10	0.13	0.14	0.16	1.85	0.21
	2:35:00	0.00	0.00	0.03	0.04	0.04	0.05	0.06	1.26	0.07
	2:40:00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.81	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	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'.

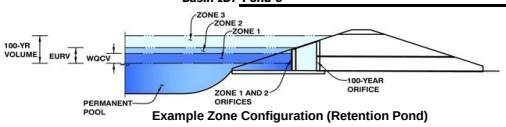
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 6**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	26.83	acres
Watershed Length =	1,140	ft
Watershed Length to Centroid =	570	ft
Watershed Slope =	0.039	ft/ft
Watershed Imperviousness =	33.19%	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.

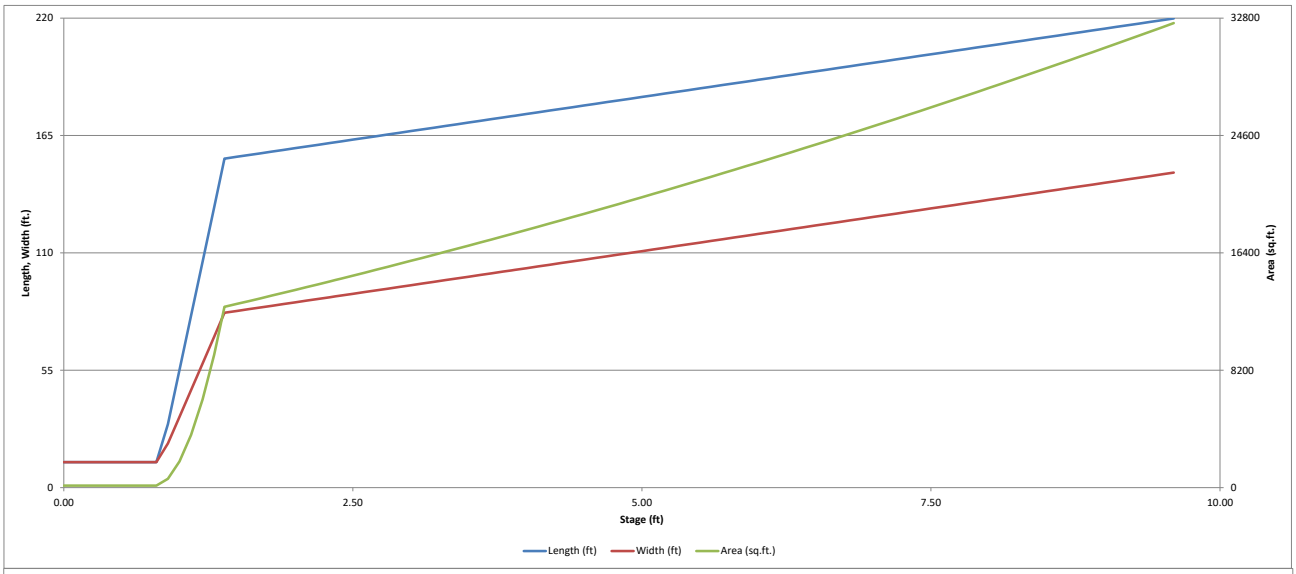
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.360	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.921	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.903	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.424	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.899	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.602	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.143	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.855	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.243	acre-feet		inches
Approximate 2-yr Detention Volume =	0.666	acre-feet		
Approximate 5-yr Detention Volume =	0.945	acre-feet		
Approximate 10-yr Detention Volume =	1.349	acre-feet		
Approximate 25-yr Detention Volume =	1.543	acre-feet		
Approximate 50-yr Detention Volume =	1.623	acre-feet		
Approximate 100-yr Detention Volume =	1.899	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.360	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.561	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.978	acre-feet
Total Detention Basin Volume =	1.899	acre-feet
Initial Surcharge Volume (ISV) =	47	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	143	ft^2
Surcharge Volume Length (L_{ISV}) =	11.9	ft
Surcharge Volume Width (W_{ISV}) =	11.9	ft
Depth of Basin Floor (H_{FLOOR}) =	0.56	ft
Length of Basin Floor (L_{FLOOR}) =	154.2	ft
Width of Basin Floor (W_{FLOOR}) =	81.9	ft
Area of Basin Floor (A_{FLOOR}) =	12,634	ft^2
Volume of Basin Floor (V_{FLOOR}) =	2,636	ft^3
Depth of Main Basin (H_{MAIN}) =	4.61	ft
Length of Main Basin (L_{MAIN}) =	191.1	ft
Width of Main Basin (W_{MAIN}) =	118.8	ft
Area of Main Basin (A_{MAIN}) =	22,702	ft^2
Volume of Main Basin (V_{MAIN}) =	80,325	ft^3
Calculated Total Basin Volume (V_{total}) =	**1.907**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		11.9	11.9	143		0.003		
ISV	0.33		11.9	11.9	143		0.003	47	0.001
	0.40		11.9	11.9	143		0.003	57	0.001
	0.50		11.9	11.9	143		0.003	71	0.002
	0.60		11.9	11.9	143		0.003	86	0.002
	0.70		11.9	11.9	143		0.003	100	0.002
	0.80		11.9	11.9	143		0.003	114	0.003
	0.90		29.7	20.7	615		0.014	143	0.003
	1.00		55.1	33.2	1,830		0.042	260	0.006
	1.10		80.5	45.7	3,679		0.084	530	0.012
	1.20		105.9	58.2	6,164		0.142	1,017	0.023
	1.30		131.3	70.7	9,283		0.213	1,784	0.041
Floor	1.39		154.2	81.9	12,634		0.290	2,766	0.064
	1.40		154.3	82.0	12,653		0.290	2,893	0.066
	1.50		155.1	82.8	12,842		0.295	4,168	0.096
	1.60		155.9	83.6	13,033		0.299	5,461	0.125
	1.70		156.7	84.4	13,226		0.304	6,774	0.156
	1.80		157.5	85.2	13,419		0.308	8,107	0.186
	1.90		158.3	86.0	13,614		0.313	9,458	0.217
	2.00		159.1	86.8	13,810		0.317	10,829	0.249
	2.10		159.9	87.6	14,007		0.322	12,220	0.281
	2.20		160.7	88.4	14,206		0.326	13,631	0.313
	2.30		161.5	89.2	14,406		0.331	15,062	0.346
Zone 1 (WQCV)	2.35		161.9	89.6	14,506		0.333	15,784	0.362
	2.40		162.3	90.0	14,607		0.335	16,512	0.379
	2.50		163.1	90.8	14,810		0.340	17,983	0.413
	2.60		163.9	91.6	15,013		0.345	19,474	0.447
	2.70		164.7	92.4	15,218		0.349	20,986	0.482
	2.80		165.5	93.2	15,425		0.354	22,518	0.517
	2.90		166.3	94.0	15,632		0.359	24,071	0.553
	3.00		167.1	94.8	15,841		0.364	25,644	0.589
	3.10		167.9	95.6	16,051		0.368	27,239	0.625
	3.20		168.7	96.4	16,263		0.373	28,855	0.662
	3.30		169.5	97.2	16,475		0.378	30,492	0.700
	3.40		170.3	98.0	16,689		0.383	32,150	0.738
	3.50		171.1	98.8	16,905		0.388	33,829	0.777
	3.60		171.9	99.6	17,121		0.393	35,531	0.816
	3.70		172.7	100.4	17,339		0.398	37,254	0.855
	3.80		173.5	101.2	17,558		0.403	38,999	0.895
Zone 2 (EURV)	3.87		174.0	101.8	17,712		0.407	40,233	0.924
	3.90		174.3	102.0	17,778		0.408	40,765	0.936
	4.00		175.1	102.8	18,000		0.413	42,554	0.977
	4.10		175.9	103.6	18,223		0.418	44,365	1.018
	4.20		176.7	104.4	18,447		0.423	46,199	1.061
	4.30		177.5	105.2	18,673		0.429	48,055	1.103
	4.40		178.3	106.0	18,900		0.434	49,934	1.146
	4.50		179.1	106.8	19,128		0.439	51,835	1.190
	4.60		179.9	107.6	19,357		0.444	53,759	1.234
	4.70		180.7	108.4	19,588		0.450	55,706	1.279
	4.80		181.5	109.2	19,820		0.455	57,677	1.324
	4.90		182.3	110.0	20,053		0.460	59,670	1.370
	5.00		183.1	110.8	20,287		0.466	61,687	1.416
	5.10		183.9	111.6	20,523		0.471	63,728	1.463
	5.20		184.7	112.4	20,760		0.477	65,792	1.510
	5.30		185.5	113.2	20,998		0.482	67,880	1.558
	5.40		186.3	114.0	21,238		0.488	69,992	1.607
	5.50		187.1	114.8	21,479		0.493	72,127	1.656
	5.60		187.9	115.6	21,721		0.499	74,287	1.705
	5.70		188.7	116.4	21,964		0.504	76,472	1.756
	5.80		189.5	117.2	22,209		0.510	78,680	1.806
	5.90		190.3	118.0	22,455		0.515	80,914	1.858
Zone 3 (100-year)	5.98		190.9	118.7	22,653		0.520	82,718	1.899
	6.00		191.1	118.8	22,702		0.521	83,171	1.909
	6.10		191.9	119.6	22,951		0.527	85,454	1.962
	6.20		192.7	120.4	23,201		0.533	87,762	2.015
	6.30		193.5	121.2	23,452		0.538	90,094	2.068
	6.40		194.3	122.0	23,704		0.544	92,452	2.122
	6.50		195.1	122.8	23,958		0.550	94,835	2.177
	6.60		195.9	123.6	24,213		0.556	97,244	2.232
	6.70		196.7	124.4	24,469		0.562	99,678	2.288
	6.80		197.5	125.2	24,727		0.568	102,137	2.345
	6.90		198.3	126.0	24,985		0.574	104,623	2.402
	7.00		199.1	126.8	25,245		0.580	107,135	2.459
	7.10		199.9	127.6	25,507		0.586	109,672	2.518
	7.20		200.7	128.4	25,769		0.592	112,236	2.577
	7.30		201.5	129.2	26,033		0.598	114,826	2.636
	7.40		202.3	130.0	26,298		0.604	117,443	2.696
	7.50		203.1	130.8	26,565		0.610	120,086	2.757
	7.60		203.9	131.6	26,833		0.616	122,756	2.818
	7.70		204.7	132.4	27,102		0.622	125,452	2.880
	7.80		205.5	133.2	27,372		0.628	128,176	2.943
	7.90		206.3	134.0	27,644		0.635	130,927	3.006
	8.00		207.1	134.8	27,916		0.641	133,705	3.069
	8.10		207.9	135.6	28,191		0.647	136,510	3.134
	8.20		208.7	136.4	28,466		0.653	139,343	3.199
	8.30		209.5	137.2	28,743		0.660	142,203	3.265
	8.40		210.3	138.0	29,021		0.666	145,092	3.331
	8.50		211.1	138.8	29,300		0.673	148,008	3.398
	8.60		211.9	139.6	29,581		0.679	150,952	3.465
	8.70		212.7	140.4	29,862		0.686	153,924	3.534
	8.80		213.5	141.2	30,145		0.692	156,924	3.602
	8.90		214.3	142.0	30,430		0.699	159,953	3.672
	9.00		215.1	142.8	30,715		0.705	163,010	3.742
	9.10		215.9	143.6	31,002		0.712	166,096	3.813
	9.20		216.7	144.4	31,291		0.718	169,211	3.885
	9.30		217.5	145.2	31,580		0.725	172,354	3.957
	9.40		218.3	146.0	31,871		0.732	175,527	4.030
	9.50		219.1	146.8	32,163		0.738	178,728	4.103
	9.60		219.9	147.6	32,456		0.745	181,959	4.177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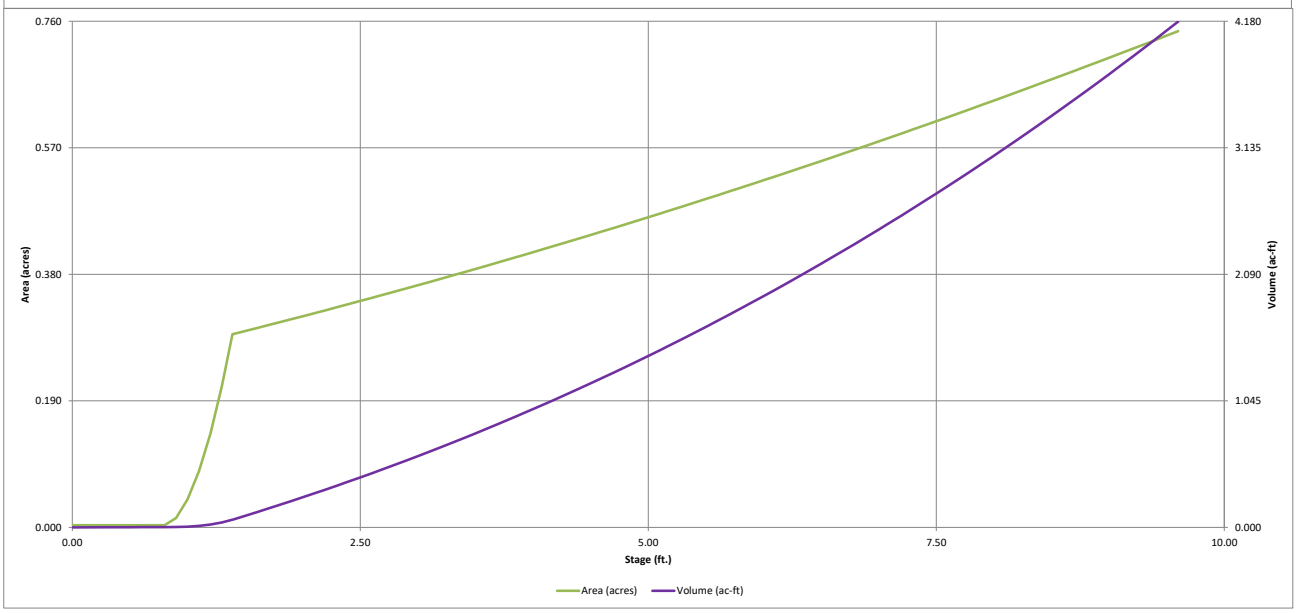
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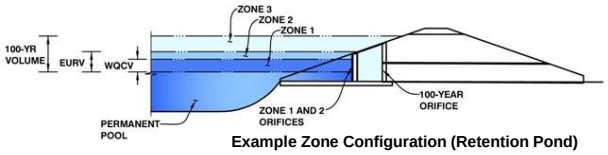
0.570
0.380
0.190
0.000
Area (acres)
4.180
3.135
2.090
1.045
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 6**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.35	0.360	Orifice Plate
Zone 2 (EURV)	3.87	0.561	Circular Orifice
Zone 3 (100-year)	5.98	0.978	Weir&Pipe (Restrict)
Total (all zones)		1.899	

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 =	8.819E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.35	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.27	sq. inches (diameter = 1-1/4 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	0.78	1.57					
Orifice Area (sq. inches)	1.27	1.27	1.27					

	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)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.35	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.79	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.87	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.50	N/A	feet
Vertical Orifice Diameter =	12.00	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 =	4.20	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.20	N/A	feet
Overflow Weir Front Edge Length =	1.50	N/A	feet	Overflow Weir Slope Length =	1.50	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	0.39	N/A	
Horiz. Length of Weir Sides =	1.50	N/A	feet	Overflow Grate Open Area w/o Debris =	1.57	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	0.78	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 =	4.04	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.05	N/A	feet
Restrictor Plate Height Above Pipe Invert =	23.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.13	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.30	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.93	feet
Spillway Crest Length =	29.00	feet	Stage at Top of Freeboard =	9.23	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.72	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.91	acre-ft

Calculated Parameters for Spillway

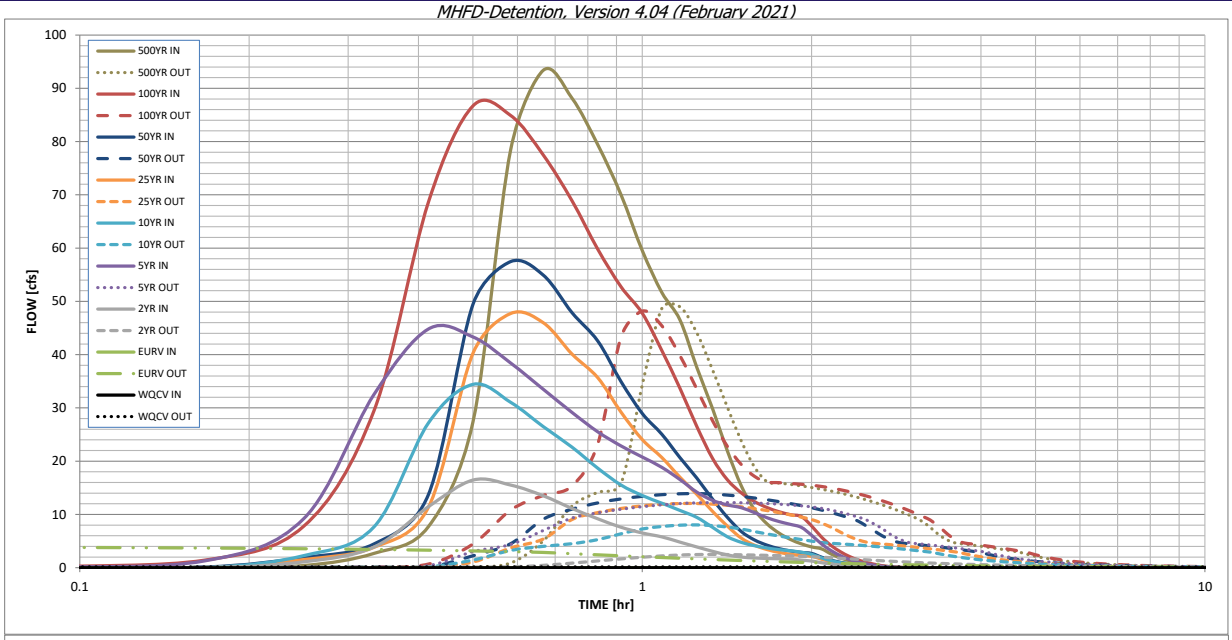
Routed Hydrograph Results

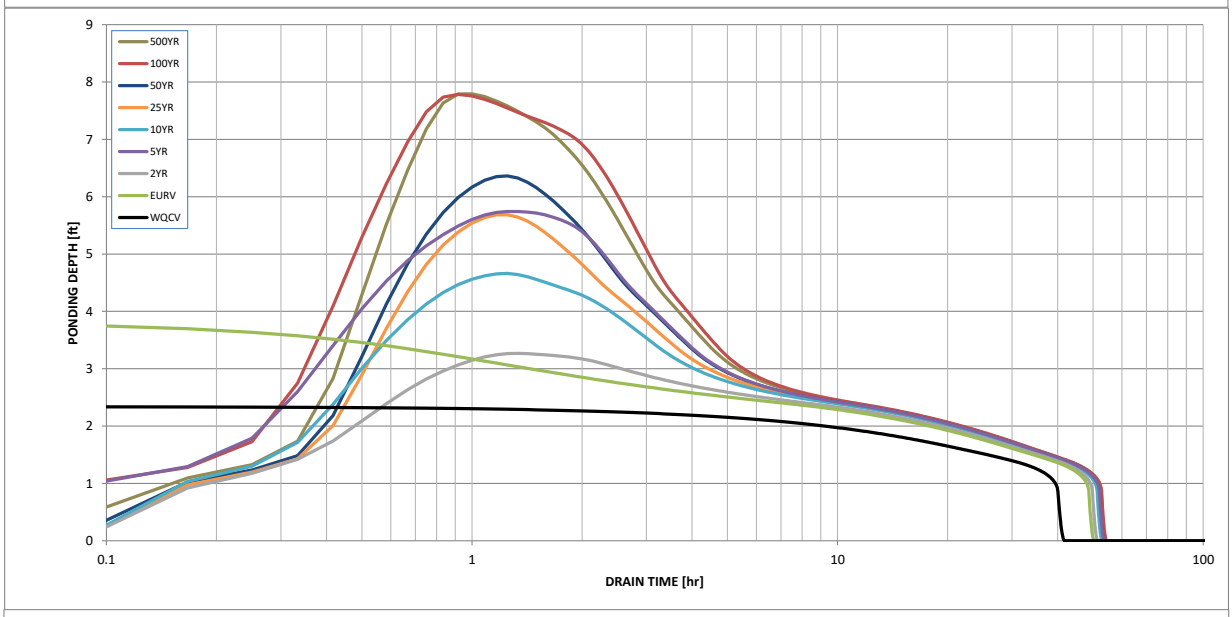
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

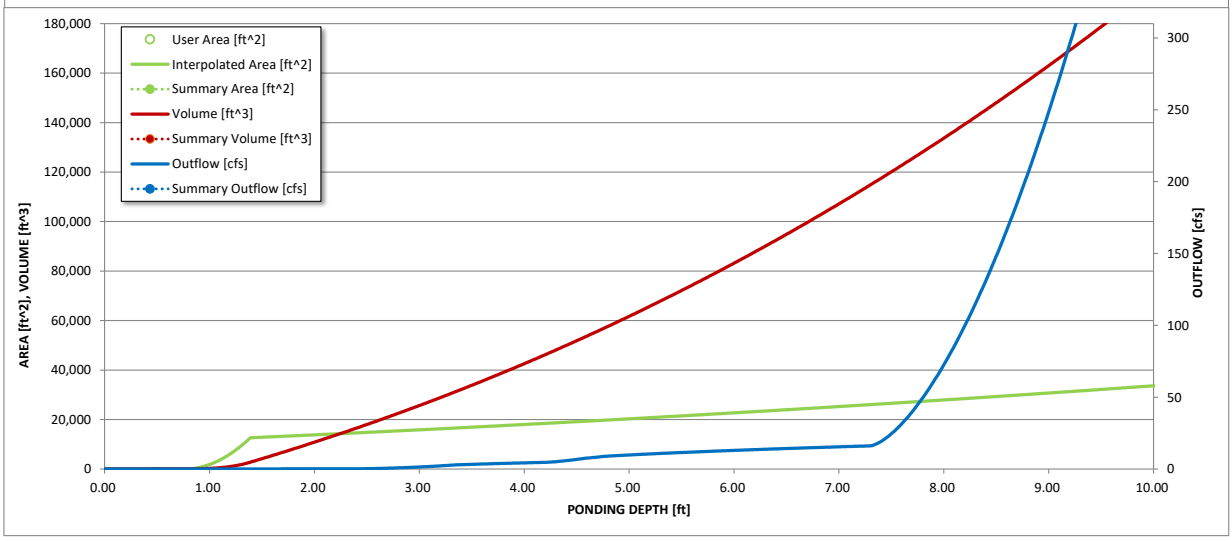
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.360	0.921	0.903	1.424	1.899	2.602	3.143	3.855	5.243
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.903	3.107	1.899	2.602	3.143	5.635	5.243
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	4.3	11.6	17.2	30.3	37.9	47.5	65.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.16	0.43	0.64	1.13	1.41	1.77	2.46
Peak Inflow Q (cfs) =	N/A	N/A	16.5	44.8	34.4	47.7	57.5	86.7	93.4
Peak Outflow Q (cfs) =	0.2	4.0	2.5	12.2	8.0	12.1	13.9	48.2	49.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.4	0.4	1.0	0.7
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	3.5	1.7	3.4	4.2	5.4	5.4
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) =	39	44	46	38	43	40	38	30	31
Time to Drain 99% of Inflow Volume (hours) =	**40**	48	49	47	48	48	47	44	44
Maximum Ponding Depth (ft) =	2.35	3.87	3.27	5.74	4.66	5.68	6.36	7.79	7.79
Area at Maximum Ponding Depth (acres) =	0.33	0.41	0.38	0.51	0.45	0.50	0.54	0.63	0.63
Maximum Volume Stored (acre-ft) =	0.362	0.924	0.685	1.776	1.261	1.745	2.101	2.930	2.936

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.02	0.00	0.00	0.00	0.09	0.00
	0:10:00	0.00	0.00	0.00	1.28	0.00	0.00	0.13	1.42	0.41
	0:15:00	0.00	0.00	1.10	9.19	2.27	1.53	1.91	7.77	2.68
	0:20:00	0.00	0.00	3.88	32.51	7.65	3.83	4.46	29.44	7.72
	0:25:00	0.00	0.00	11.46	44.81	27.18	11.35	13.73	68.64	27.37
	0:30:00	0.00	0.00	16.45	43.32	34.42	40.25	49.45	86.70	78.42
	0:35:00	0.00	0.00	15.52	38.43	31.05	47.72	57.47	84.90	93.38
	0:40:00	0.00	0.00	13.51	33.50	26.49	46.00	54.93	77.48	88.14
	0:45:00	0.00	0.00	11.12	29.15	22.63	40.10	47.88	68.88	79.41
	0:50:00	0.00	0.00	9.18	25.51	18.68	35.67	42.56	59.79	70.00
	0:55:00	0.00	0.00	7.60	22.86	15.52	29.20	34.93	52.73	59.52
	1:00:00	0.00	0.00	6.52	20.78	13.55	24.05	28.95	47.77	51.66
	1:05:00	0.00	0.00	5.79	18.84	12.11	20.68	25.05	40.76	46.51
	1:10:00	0.00	0.00	4.81	16.55	10.75	16.99	20.66	33.68	37.61
	1:15:00	0.00	0.00	3.90	14.19	9.44	13.77	16.83	26.52	29.85
	1:20:00	0.00	0.00	3.08	12.64	7.58	10.57	12.86	20.51	21.91
	1:25:00	0.00	0.00	2.40	11.79	5.80	7.81	9.45	16.51	15.33
	1:30:00	0.00	0.00	2.00	11.26	4.76	5.55	6.78	14.04	10.88
	1:35:00	0.00	0.00	1.82	10.33	4.13	4.22	5.21	12.41	8.22
	1:40:00	0.00	0.00	1.74	9.38	3.70	3.41	4.23	11.29	6.50
	1:45:00	0.00	0.00	1.68	8.67	3.39	2.88	3.58	10.51	5.31
	1:50:00	0.00	0.00	1.64	8.14	3.18	2.53	3.16	9.96	4.49
	1:55:00	0.00	0.00	1.43	7.59	2.90	2.31	2.88	9.61	3.90
	2:00:00	0.00	0.00	1.25	6.09	2.51	2.16	2.68	7.83	3.53
	2:05:00	0.00	0.00	0.94	4.45	1.84	1.59	1.97	5.73	2.57
	2:10:00	0.00	0.00	0.69	3.20	1.32	1.15	1.42	4.16	1.84
	2:15:00	0.00	0.00	0.51	2.27	0.94	0.82	1.02	3.00	1.33
	2:20:00	0.00	0.00	0.37	1.57	0.68	0.59	0.73	2.12	0.96
	2:25:00	0.00	0.00	0.26	1.08	0.48	0.41	0.51	1.48	0.67
	2:30:00	0.00	0.00	0.18	0.73	0.33	0.29	0.36	1.02	0.47
	2:35:00	0.00	0.00	0.12	0.48	0.22	0.20	0.25	0.66	0.32
	2:40:00	0.00	0.00	0.08	0.28	0.14	0.13	0.16	0.39	0.20
	2:45:00	0.00	0.00	0.04	0.15	0.07	0.07	0.09	0.20	0.11
	2:50:00	0.00	0.00	0.02	0.07	0.03	0.03	0.04	0.09	0.04
	2:55:00	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.03	0.01
	3:00:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	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'.

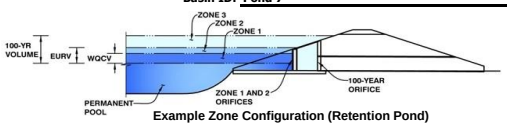
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 7**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**		**Note: L / W Ratio < 1**
Watershed Area =	114.73	acres	**L / W Ratio = 0.57**
Watershed Length =	1,683	ft	
Watershed Length to Centroid =	1,362	ft	
Watershed Slope =	0.040	ft/ft	
Watershed Imperviousness =	38.80%	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.

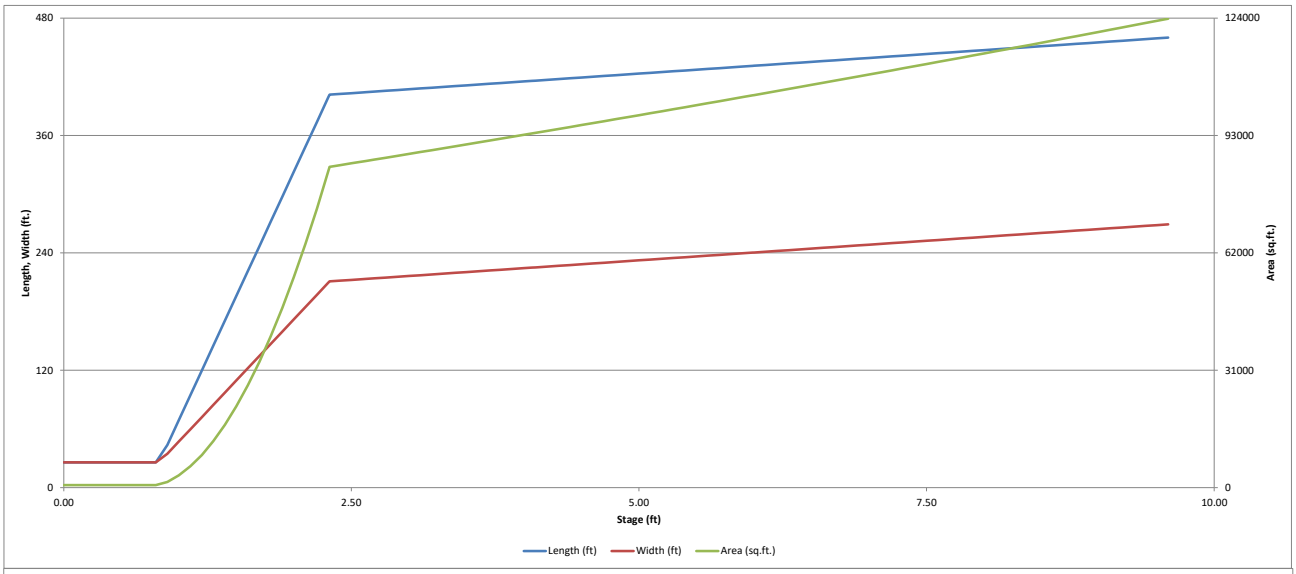
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.689	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.663	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.575	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.891	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	8.978	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	11.989	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	14.328	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	17.379	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	23.422	acre-feet		inches
Approximate 2-yr Detention Volume =	3.427	acre-feet		
Approximate 5-yr Detention Volume =	4.799	acre-feet		
Approximate 10-yr Detention Volume =	6.641	acre-feet		
Approximate 25-yr Detention Volume =	7.450	acre-feet		
Approximate 50-yr Detention Volume =	7.822	acre-feet		
Approximate 100-yr Detention Volume =	8.992	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.689	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.974	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.329	acre-feet
Total Detention Basin Volume =	8.992	acre-feet
Initial Surcharge Volume (ISV) =	221	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	669	ft^2
Surcharge Volume Length (L_{ISV}) =	25.9	ft
Surcharge Volume Width (W_{ISV}) =	25.9	ft
Depth of Basin Floor (H_{FLOOR}) =	1.48	ft
Length of Basin Floor (L_{FLOOR}) =	401.8	ft
Width of Basin Floor (W_{FLOOR}) =	210.9	ft
Area of Basin Floor (A_{FLOOR}) =	84,720	ft^2
Volume of Basin Floor (V_{FLOOR}) =	45,839	ft^3
Depth of Main Basin (H_{MAIN}) =	3.69	ft
Length of Main Basin (L_{MAIN}) =	431.3	ft
Width of Main Basin (W_{MAIN}) =	240.4	ft
Area of Main Basin (A_{MAIN}) =	103,677	ft^2
Volume of Main Basin (V_{MAIN}) =	347,004	ft^3
Calculated Total Basin Volume (V_{total}) =	**9.031**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		25.9	25.9	669		0.015		
ISV	0.33		25.9	25.9	669		0.015	221	0.005
	0.40		25.9	25.9	669		0.015	268	0.006
	0.50		25.9	25.9	669		0.015	334	0.008
	0.60		25.9	25.9	669		0.015	401	0.009
	0.70		25.9	25.9	669		0.015	468	0.011
	0.80		25.9	25.9	669		0.015	535	0.012
	0.90		43.6	34.6	1,510		0.035	630	0.014
	1.00		69.0	47.1	3,253		0.075	862	0.020
	1.10		94.4	59.6	5,630		0.129	1,301	0.030
	1.20		119.8	72.1	8,642		0.198	2,010	0.046
	1.30		145.2	84.6	12,289		0.282	3,051	0.070
	1.40		170.6	97.1	16,571		0.380	4,489	0.103
	1.50		196.0	109.6	21,488		0.493	6,386	0.147
	1.60		221.4	122.1	27,040		0.621	8,807	0.202
	1.70		246.8	134.6	33,228		0.763	11,815	0.271
	1.80		272.2	147.1	40,050		0.919	15,474	0.355
	1.90		297.6	159.6	47,507		1.091	19,847	0.456
	2.00		323.0	172.1	55,599		1.276	24,997	0.574
	2.10		348.4	184.6	64,326		1.477	30,988	0.711
	2.20		373.8	197.1	73,688		1.692	37,883	0.870
	2.30		399.2	209.6	83,685		1.921	45,746	1.050
Floor	2.31		401.8	210.9	84,720		1.945	46,588	1.070
	2.40		402.5	211.6	85,162		1.955	54,233	1.245
	2.50		403.3	212.4	85,654		1.966	62,774	1.441
	2.60		404.1	213.2	86,147		1.978	71,364	1.638
Zone 1 (WQCV)	2.63		404.3	213.4	86,295		1.981	73,950	1.698
	2.70		404.9	214.0	86,641		1.989	80,003	1.837
	2.80		405.7	214.8	87,137		2.000	88,692	2.036
	2.90		406.5	215.6	87,634		2.012	97,431	2.237
	3.00		407.3	216.4	88,132		2.023	106,219	2.438
	3.10		408.1	217.2	88,632		2.035	115,057	2.641
	3.20		408.9	218.0	89,133		2.046	123,945	2.845
	3.30		409.7	218.8	89,635		2.058	132,884	3.051
	3.40		410.5	219.6	90,138		2.069	141,872	3.257
	3.50		411.3	220.4	90,643		2.081	150,911	3.464
	3.60		412.1	221.2	91,149		2.092	160,001	3.673
	3.70		412.9	222.0	91,656		2.104	169,141	3.883
	3.80		413.7	222.8	92,165		2.116	178,332	4.094
	3.90		414.5	223.6	92,675		2.128	187,574	4.306
	4.00		415.3	224.4	93,186		2.139	196,867	4.519
Zone 2 (EURV)	4.07		415.9	224.9	93,544		2.147	203,403	4.669
	4.10		416.1	225.2	93,698		2.151	206,211	4.734
	4.20		416.9	226.0	94,212		2.163	215,607	4.950
	4.30		417.7	226.8	94,727		2.175	225,054	5.167
	4.40		418.5	227.6	95,243		2.186	234,552	5.385
	4.50		419.3	228.4	95,760		2.198	244,103	5.604
	4.60		420.1	229.2	96,279		2.210	253,705	5.824
	4.70		420.9	230.0	96,799		2.222	263,358	6.046
	4.80		421.7	230.8	97,321		2.234	273,064	6.269
	4.90		422.5	231.6	97,843		2.246	282,823	6.493
	5.00		423.3	232.4	98,367		2.258	292,633	6.718
	5.10		424.1	233.2	98,892		2.270	302,496	6.944
	5.20		424.9	234.0	99,419		2.282	312,412	7.172
	5.30		425.7	234.8	99,947		2.294	322,380	7.401
	5.40		426.5	235.6	100,476		2.307	332,401	7.631
	5.50		427.3	236.4	101,006		2.319	342,475	7.862
	5.60		428.1	237.2	101,538		2.331	352,602	8.095
	5.70		428.9	238.0	102,070		2.343	362,783	8.328
	5.80		429.7	238.8	102,605		2.355	373,016	8.563
	5.90		430.5	239.6	103,140		2.368	383,304	8.799
Zone 3 (100-year)	5.99		431.2	240.3	103,623		2.379	392,608	9.013
	6.00		431.3	240.4	103,677		2.380	393,644	9.037
	6.10		432.1	241.2	104,215		2.392	404,039	9.275
	6.20		432.9	242.0	104,754		2.405	414,487	9.515
	6.30		433.7	242.8	105,294		2.417	424,990	9.756
	6.40		434.5	243.6	105,836		2.430	435,546	9.999
	6.50		435.3	244.4	106,379		2.442	446,157	10.242
	6.60		436.1	245.2	106,924		2.455	456,822	10.487
	6.70		436.9	246.0	107,469		2.467	467,542	10.733
	6.80		437.7	246.8	108,016		2.480	478,316	10.981
	6.90		438.5	247.6	108,565		2.492	489,145	11.229
	7.00		439.3	248.4	109,114		2.505	500,029	11.479
	7.10		440.1	249.2	109,665		2.518	510,968	11.730
	7.20		440.9	250.0	110,217		2.530	521,962	11.983
	7.30		441.7	250.8	110,770		2.543	533,012	12.236
	7.40		442.5	251.6	111,325		2.556	544,116	12.491
	7.50		443.3	252.4	111,881		2.568	555,277	12.747
	7.60		444.1	253.2	112,438		2.581	566,493	13.005
	7.70		444.9	254.0	112,997		2.594	577,764	13.264
	7.80		445.7	254.8	113,556		2.607	589,092	13.524
	7.90		446.5	255.6	114,117		2.620	600,476	13.785
	8.00		447.3	256.4	114,680		2.633	611,915	14.048
	8.10		448.1	257.2	115,243		2.646	623,411	14.312
	8.20		448.9	258.0	115,808		2.659	634,964	14.577
	8.30		449.7	258.8	116,374		2.672	646,573	14.843
	8.40		450.5	259.6	116,942		2.685	658,239	15.111
	8.50		451.3	260.4	117,510		2.698	669,962	15.380
	8.60		452.1	261.2	118,080		2.711	681,741	15.651
	8.70		452.9	262.0	118,652		2.724	693,578	15.922
	8.80		453.7	262.8	119,224		2.737	705,471	16.195
	8.90		454.5	263.6	119,798		2.750	717,422	16.470
	9.00		455.3	264.4	120,373		2.763	729,431	16.745
	9.10		456.1	265.2	120,949		2.777	741,497	17.022
	9.20		456.9	266.0	121,527		2.790	753,621	17.301
	9.30		457.7	266.8	122,106		2.803	765,803	17.580
	9.40		458.5	267.6	122,686		2.816	778,042	17.861
	9.50		459.3	268.4	123,268		2.830	790,340	18.144
	9.60		460.1	269.2	123,851		2.843	802,696	18.427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240
120
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Length, Width (ft.)
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93000
62000
31000
0
Area (sq.ft.)
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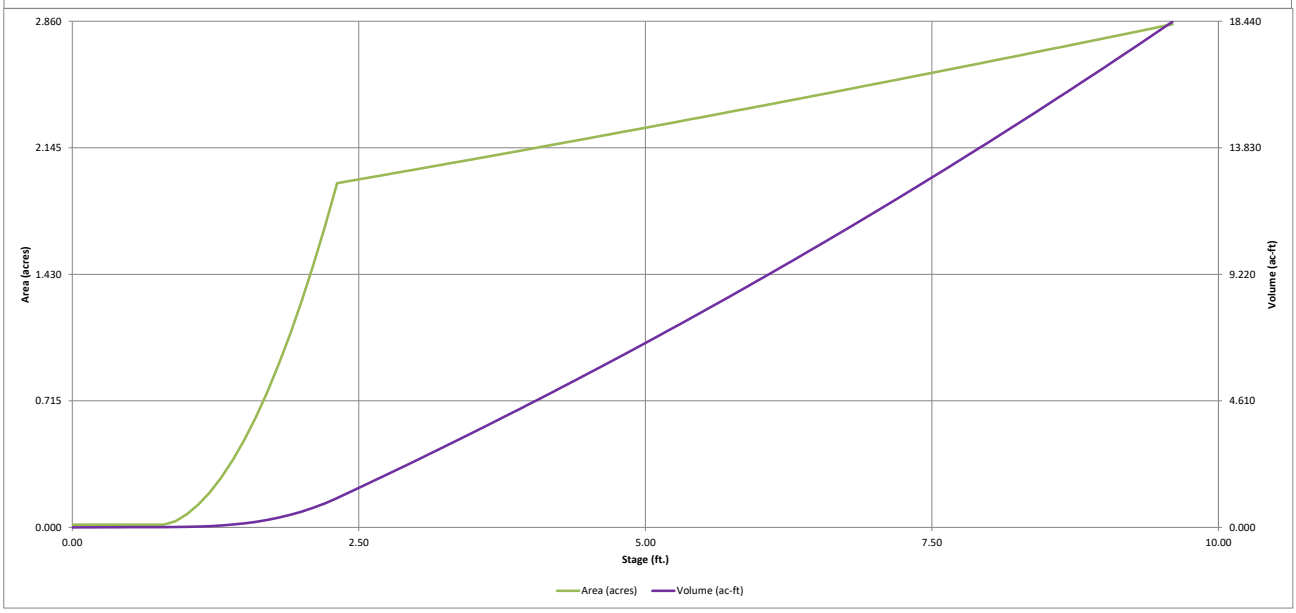
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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2.145
1.430
0.715
0.000
Area (acres)
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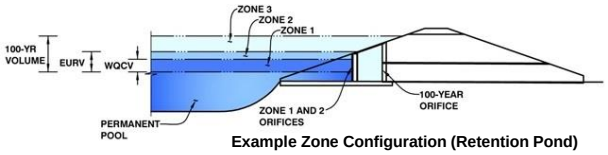
13.830
9.220
4.610
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 7**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.63	1.689	Orifice Plate
Zone 2 (EURV)	4.07	2.974	Weir&Pipe (Circular)
Zone 3 (100-year)	5.99	4.329	Weir&Pipe (Restrict)
Total (all zones)		8.992	

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 =	3.590E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.65	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	5.17	sq. inches (use rectangular openings)	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	0.88	1.77					
Orifice Area (sq. inches)	5.17	5.17	5.17					

	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 2 Weir	Zone 3 Weir			Zone 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	4.50	4.70	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50	7.70	feet
Overflow Weir Front Edge Length =	6.00	10.00	feet	Overflow Weir Slope Length =	6.00	12.37	feet
Overflow Weir Grate Slope =	0.00	4.00	H:V	Grate Open Area / 100-yr Orifice Area =	3.54	3.42	
Horiz. Length of Weir Sides =	6.00	12.00	feet	Overflow Grate Open Area w/o Debris =	25.06	86.09	ft^2
Overflow Grate Type =	Type C Grate	Type C Grate		Overflow Grate Open Area w/ Debris =	12.53	43.05	ft^2
Debris Clogging % =	50%	50%	%				

Calculated Parameters for Overflow Weir

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

	Zone 2 Circular	Zone 3 Restrictor			Zone 2 Circular	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.50	2.70	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	7.07	25.18	ft^2
Circular Orifice Diameter or Pipe Diameter =	36.00	72.00	inches	Outlet Orifice Centroid =	1.50	2.70	feet
Restrictor Plate Height Above Pipe Invert =		60.00	inches	Half-Central Angle of Restrictor Plate on Pipe =	N/A	2.30	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.98	feet
Spillway Crest Length =	119.00	feet	Stage at Top of Freeboard =	9.78	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.87	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	18.94	acre-ft

Calculated Parameters for Spillway

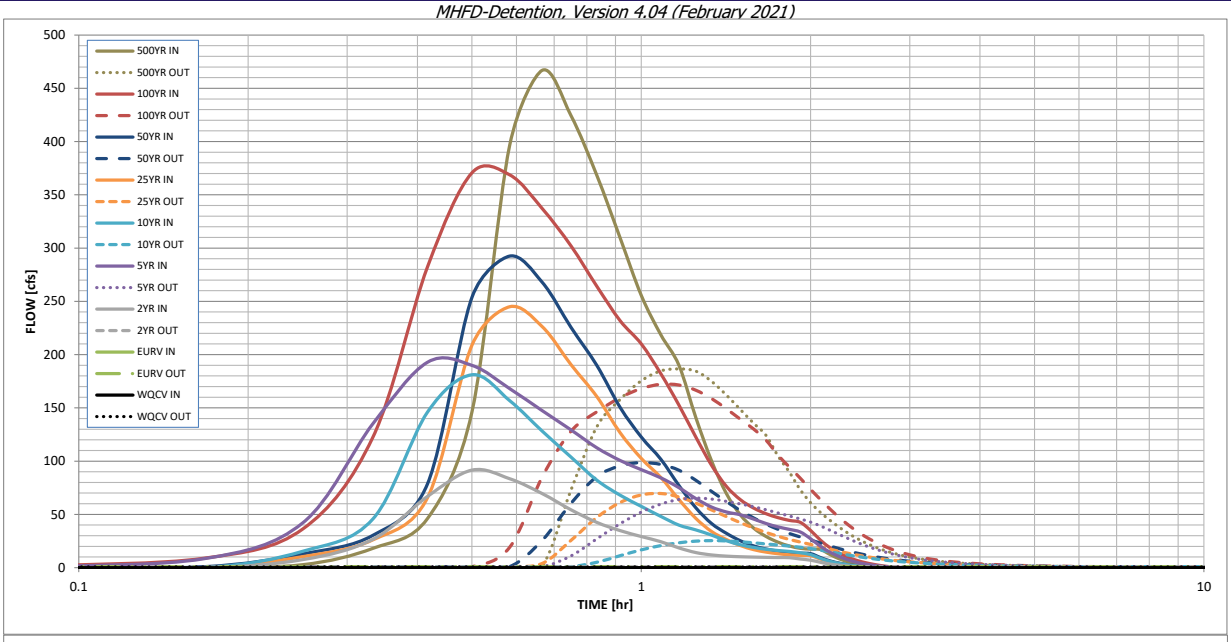
Routed Hydrograph Results

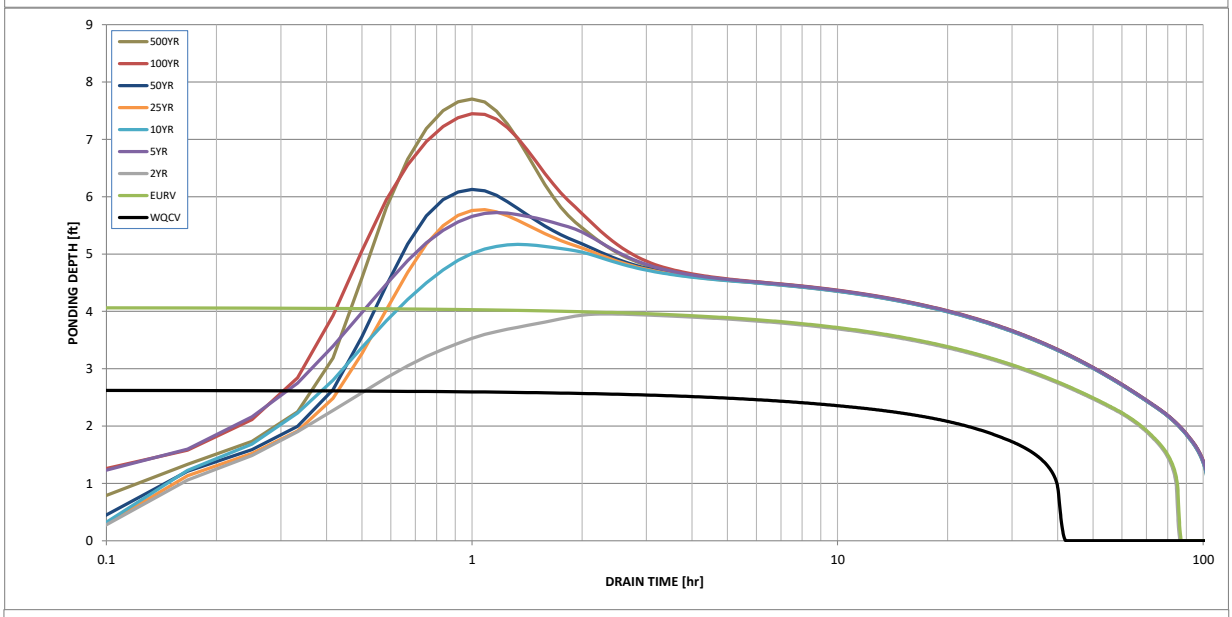
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

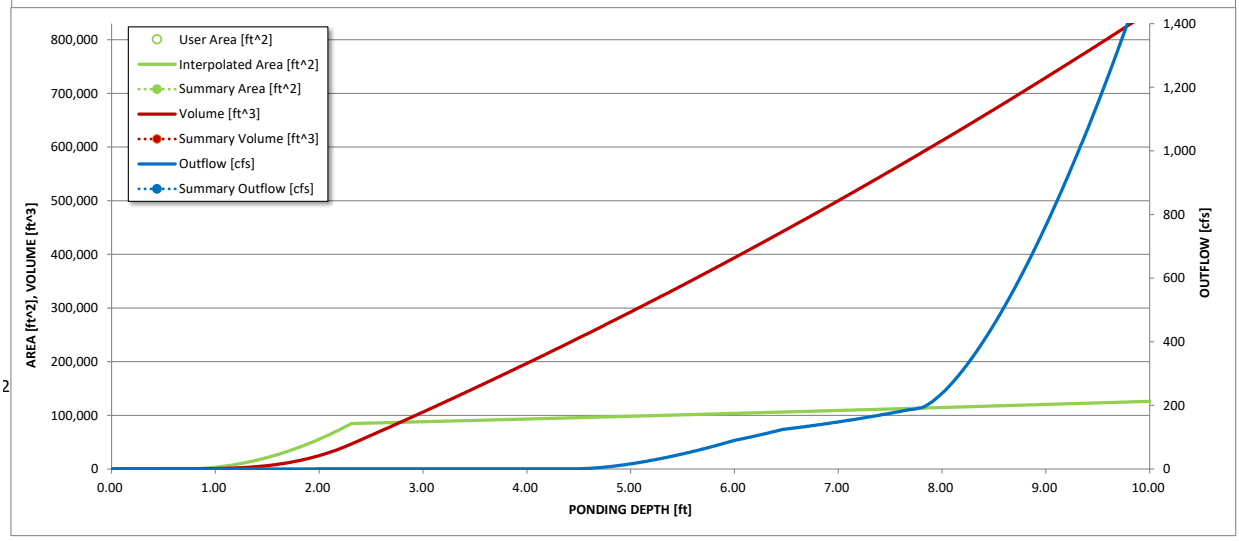
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.689	4.663	4.575	6.891	8.978	11.989	14.328	17.379	23.422
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.575	13.698	8.978	11.989	14.328	24.727	23.422
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	19.1	53.5	79.8	138.4	173.6	217.5	301.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		65.3				191.6	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.17	0.57	0.70	1.21	1.51	1.67	2.63
Peak Inflow Q (cfs) =	N/A	N/A	91.6	192.8	181.1	244.9	292.5	370.7	466.9
Peak Outflow Q (cfs) =	0.7	0.9	0.9	65.4	25.4	69.6	98.6	172.2	186.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.3	0.5	0.6	0.9	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	2.1	0.8	2.2	3.0	3.9	4.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	0.1	0.0	0.1	0.2	0.9	1.0
Time to Drain 97% of Inflow Volume (hours) =	38	80	80	90	94	91	89	82	83
Time to Drain 99% of Inflow Volume (hours) =	**40**	84	83	99	100	99	98	95	95
Maximum Ponding Depth (ft) =	2.63	4.07	3.95	5.73	5.17	5.77	6.13	7.45	7.70
Area at Maximum Ponding Depth (acres) =	1.98	2.15	2.13	2.35	2.28	2.35	2.39	2.56	2.59
Maximum Volume Stored (acre-ft) =	1.698	4.669	4.413	8.375	7.081	8.493	9.323	12.594	13.264

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.35	0.00	0.00	0.00	1.15	0.00
	0:10:00	0.00	0.00	0.00	8.35	0.00	0.00	0.87	8.80	2.79
	0:15:00	0.00	0.00	7.53	41.96	15.37	10.35	12.91	36.23	18.14
	0:20:00	0.00	0.00	26.66	135.18	45.76	26.13	30.39	122.53	46.04
	0:25:00	0.00	0.00	66.84	192.81	145.94	65.52	78.49	282.20	146.25
	0:30:00	0.00	0.00	91.59	189.89	181.09	208.88	253.77	370.69	396.24
	0:35:00	0.00	0.00	83.49	168.08	156.84	244.93	292.46	368.77	466.90
	0:40:00	0.00	0.00	69.51	147.36	128.13	226.22	267.84	337.06	424.31
	0:45:00	0.00	0.00	54.32	129.31	103.79	190.55	225.54	301.99	368.42
	0:50:00	0.00	0.00	42.53	112.57	82.17	160.69	189.97	264.23	309.75
	0:55:00	0.00	0.00	34.81	100.65	68.10	126.75	150.57	231.91	255.54
	1:00:00	0.00	0.00	29.24	91.99	57.54	102.55	122.63	210.05	218.61
	1:05:00	0.00	0.00	24.37	84.30	48.10	84.65	101.75	182.04	189.95
	1:10:00	0.00	0.00	18.53	75.10	39.94	63.92	77.12	152.54	140.96
	1:15:00	0.00	0.00	14.20	64.91	35.46	46.28	56.24	122.62	100.15
	1:20:00	0.00	0.00	11.95	56.89	30.57	33.94	41.44	96.04	69.57
	1:25:00	0.00	0.00	10.84	52.28	25.28	26.43	32.25	76.32	49.57
	1:30:00	0.00	0.00	10.26	49.65	21.53	20.77	25.24	63.82	37.19
	1:35:00	0.00	0.00	9.94	45.63	19.01	16.94	20.45	55.99	29.25
	1:40:00	0.00	0.00	9.68	41.44	17.27	14.62	17.52	50.64	23.93
	1:45:00	0.00	0.00	9.50	38.27	16.09	13.10	15.56	46.97	20.37
	1:50:00	0.00	0.00	9.40	35.96	15.24	12.09	14.28	44.36	18.18
	1:55:00	0.00	0.00	8.11	33.53	13.98	11.56	13.59	42.55	17.39
	2:00:00	0.00	0.00	7.01	27.14	12.28	11.24	13.17	34.89	17.03
	2:05:00	0.00	0.00	5.02	19.98	8.67	8.06	9.43	25.68	12.26
	2:10:00	0.00	0.00	3.38	14.45	5.83	5.40	6.30	18.63	8.24
	2:15:00	0.00	0.00	2.27	10.39	3.91	3.64	4.25	13.59	5.54
	2:20:00	0.00	0.00	1.48	7.28	2.54	2.37	2.76	9.71	3.59
	2:25:00	0.00	0.00	0.92	5.00	1.60	1.52	1.76	6.81	2.28
	2:30:00	0.00	0.00	0.53	3.43	0.95	0.94	1.09	4.77	1.39
	2:35:00	0.00	0.00	0.26	2.28	0.48	0.50	0.57	3.20	0.72
	2:40:00	0.00	0.00	0.10	1.39	0.18	0.20	0.22	1.96	0.26
	2:45:00	0.00	0.00	0.02	0.74	0.03	0.03	0.03	1.04	0.02
	2:50:00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.45	0.00
	2:55:00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.15	0.00
	3:00:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	3:05:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	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'.

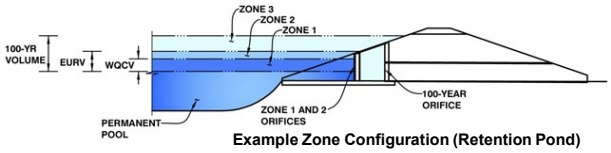
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 8**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.39	0.178	Orifice Plate
Zone 2 (EURV)	3.67	0.221	Circular Orifice
Zone 3 (100-year)	5.97	0.543	Weir&Pipe (Restrict)
Total (all zones)		0.942	

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

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

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

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	4.514E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.39	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.65	sq. inches (diameter = 7/8 inch)	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	0.80	1.59					
Orifice Area (sq. inches)	0.65	0.65	0.65					

	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)

	Zone 2 Circular	Not Selected		Calculated Parameters for Vertical Orif	Zone 2 Circular	Not Selected
Invert of Vertical Orifice =	2.39	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.05	N/A
Depth at top of Zone using Vertical Orifice =	3.67	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.12	N/A
Vertical Orifice Diameter =	2.88	N/A	inches			

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		Calculated Parameters for Overflow W	Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	5.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.00	N/A
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.22	N/A
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	13.92	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	6.96	N/A
Debris Clogging % =	50%	N/A	%			

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla	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 =	2.67	N/A
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.87	N/A
Restrictor Plate Height Above Pipe Invert =	19.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.19	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	6.30	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.85	feet
Spillway Crest Length =	11.00	feet	Stage at Top of Freeboard =	8.15	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.38	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.66	acre-ft

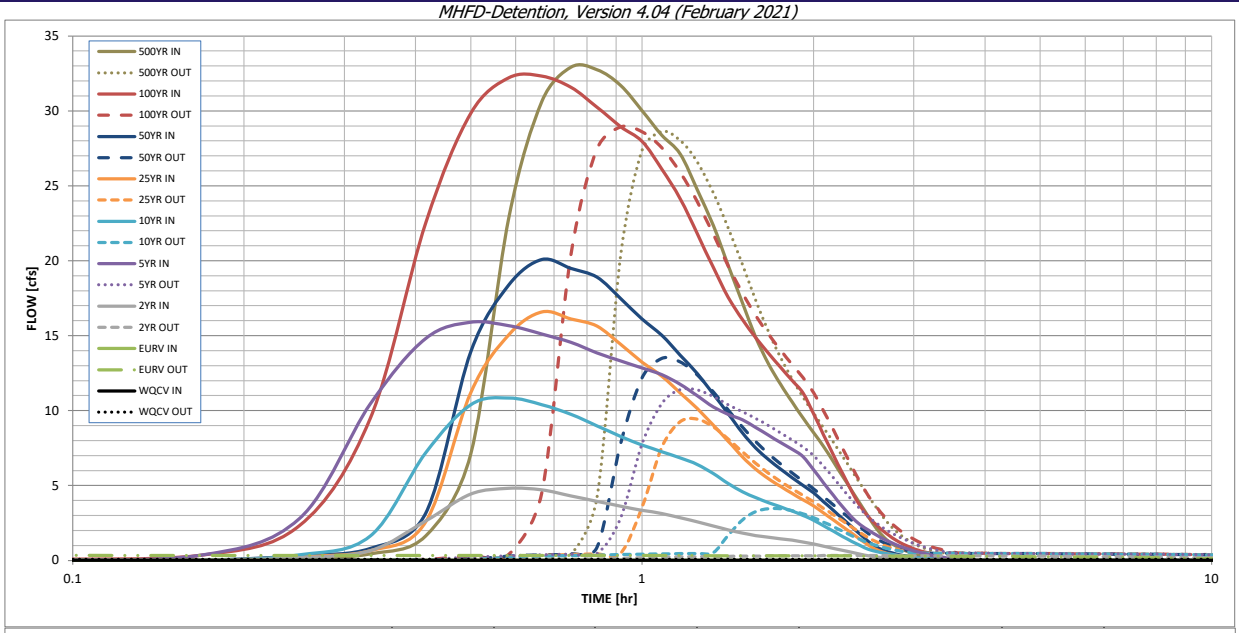
Routed Hydrograph Results

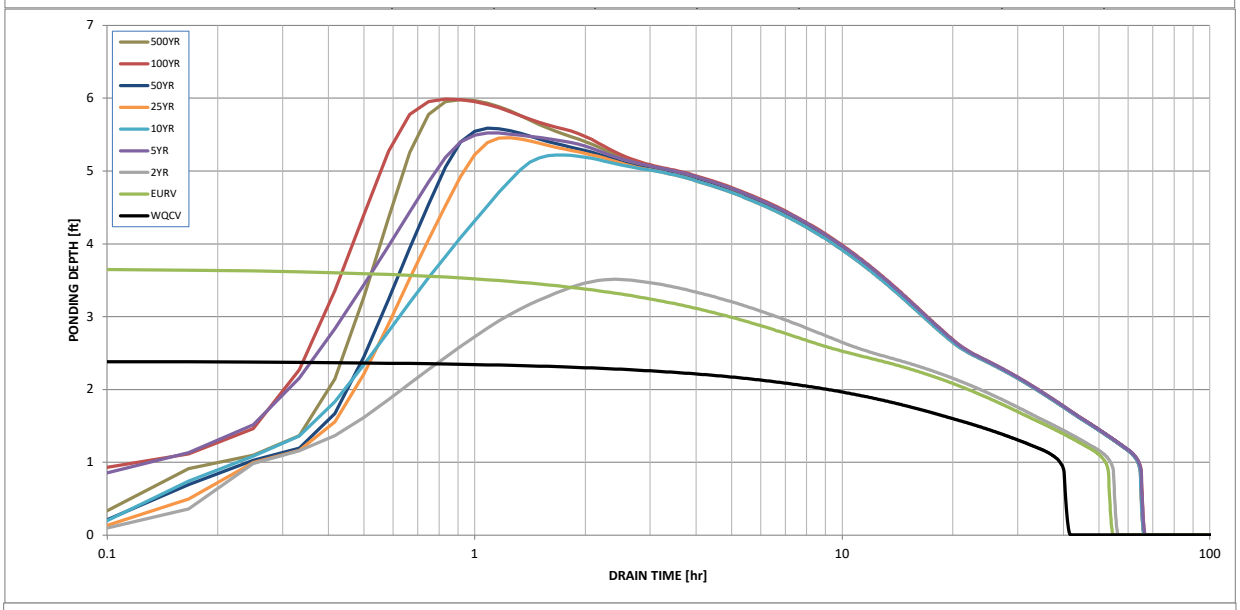
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through A

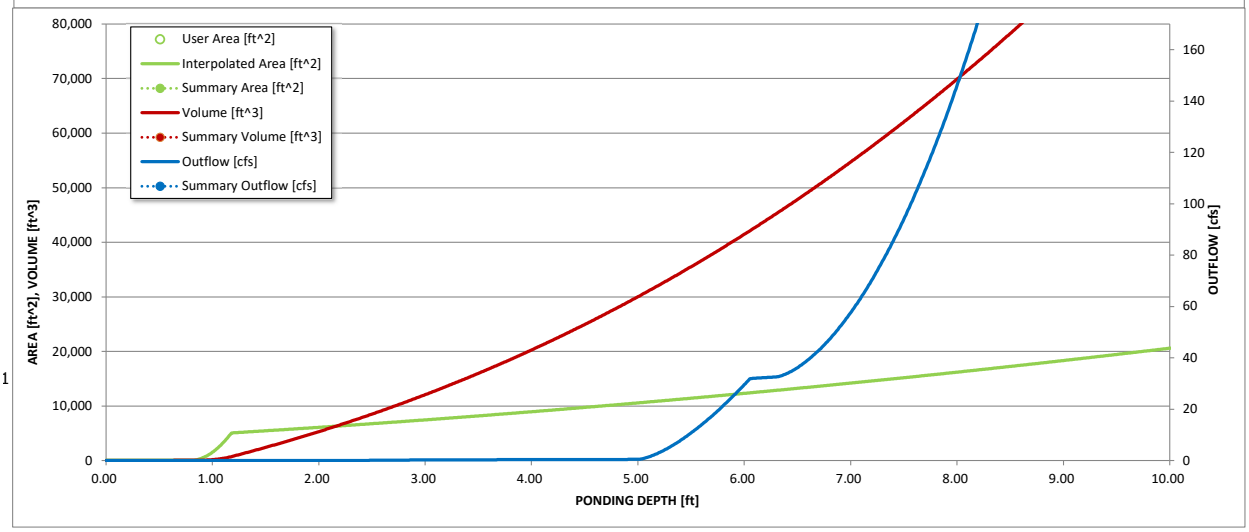
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.178	0.399	0.416	0.713	0.991	1.426	1.746	2.181
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.416	1.850	0.991	1.426	1.746	3.383
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.6	4.6	6.9	12.4	15.5	19.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		11.1				32.7
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.70	0.44	0.78	0.98	2.06
Peak Inflow Q (cfs) =	N/A	N/A	4.8	15.9	10.8	16.6	20.1	32.3
Peak Outflow Q (cfs) =	0.1	0.3	0.3	11.4	3.5	9.4	13.5	28.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.8	0.9	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.8	0.2	0.6	0.9	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	49	51	48	55	51	49	38
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	54	59	62	60	59	54
Maximum Ponding Depth (ft) =	2.39	3.67	3.51	5.52	5.22	5.46	5.58	5.99
Area at Maximum Ponding Depth (acres) =	0.15	0.19	0.19	0.26	0.25	0.26	0.27	0.28
Maximum Volume Stored (acre-ft) =	0.179	0.399	0.369	0.821	0.741	0.802	0.837	0.946

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.

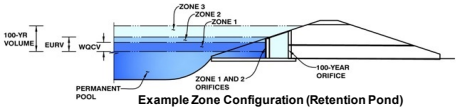
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.06	0.00
	0:10:00	0.00	0.00	0.00	0.34	0.00	0.00	0.02	0.34	0.07
	0:15:00	0.00	0.00	0.18	2.78	0.37	0.25	0.31	2.31	0.44
	0:20:00	0.00	0.00	0.66	10.46	1.64	0.65	0.80	9.50	1.64
	0:25:00	0.00	0.00	2.63	14.81	7.18	2.58	3.15	22.52	7.13
	0:30:00	0.00	0.00	4.43	15.89	10.39	11.21	13.94	29.84	22.90
	0:35:00	0.00	0.00	4.81	15.66	10.85	15.07	18.39	32.21	30.64
	0:40:00	0.00	0.00	4.71	15.11	10.40	16.58	20.07	32.32	32.92
	0:45:00	0.00	0.00	4.31	14.56	9.75	16.12	19.49	31.57	32.76
	0:50:00	0.00	0.00	3.95	13.85	8.98	15.64	18.90	30.25	31.70
	0:55:00	0.00	0.00	3.62	13.31	8.27	14.42	17.48	28.95	30.01
	1:00:00	0.00	0.00	3.35	12.85	7.71	13.24	16.11	27.97	28.37
	1:05:00	0.00	0.00	3.13	12.39	7.26	12.28	15.01	26.11	27.13
	1:10:00	0.00	0.00	2.85	11.75	6.83	11.17	13.71	24.14	24.72
	1:15:00	0.00	0.00	2.57	10.98	6.41	10.13	12.46	21.80	22.36
	1:20:00	0.00	0.00	2.30	10.25	5.80	9.02	11.10	19.55	19.70
	1:25:00	0.00	0.00	2.04	9.75	5.13	7.96	9.80	17.56	17.19
	1:30:00	0.00	0.00	1.82	9.39	4.59	6.91	8.50	16.06	14.90
	1:35:00	0.00	0.00	1.66	8.88	4.19	6.09	7.51	14.87	13.13
	1:40:00	0.00	0.00	1.55	8.36	3.86	5.46	6.74	13.83	11.76
	1:45:00	0.00	0.00	1.45	7.87	3.57	4.94	6.10	12.89	10.57
	1:50:00	0.00	0.00	1.35	7.42	3.30	4.47	5.53	12.01	9.51
	1:55:00	0.00	0.00	1.22	6.93	3.01	4.05	5.01	11.18	8.53
	2:00:00	0.00	0.00	1.10	6.06	2.68	3.65	4.51	9.79	7.61
	2:05:00	0.00	0.00	0.95	5.17	2.31	3.17	3.91	8.39	6.58
	2:10:00	0.00	0.00	0.81	4.34	1.94	2.70	3.34	7.04	5.61
	2:15:00	0.00	0.00	0.67	3.57	1.60	2.25	2.78	5.79	4.67
	2:20:00	0.00	0.00	0.53	2.90	1.28	1.82	2.25	4.63	3.76
	2:25:00	0.00	0.00	0.41	2.39	0.98	1.40	1.73	3.63	2.89
	2:30:00	0.00	0.00	0.30	2.01	0.74	1.01	1.25	2.90	2.09
	2:35:00	0.00	0.00	0.22	1.68	0.59	0.70	0.88	2.34	1.50
	2:40:00	0.00	0.00	0.18	1.40	0.48	0.51	0.65	1.89	1.11
	2:45:00	0.00	0.00	0.15	1.16	0.39	0.38	0.49	1.51	0.82
	2:50:00	0.00	0.00	0.12	0.96	0.32	0.29	0.37	1.21	0.60
	2:55:00	0.00	0.00	0.10	0.78	0.26	0.22	0.29	0.97	0.44
	3:00:00	0.00	0.00	0.08	0.64	0.21	0.17	0.22	0.78	0.32
	3:05:00	0.00	0.00	0.07	0.52	0.16	0.13	0.17	0.64	0.23
	3:10:00	0.00	0.00	0.05	0.42	0.13	0.10	0.13	0.52	0.17
	3:15:00	0.00	0.00	0.04	0.32	0.10	0.08	0.10	0.42	0.14
	3:20:00	0.00	0.00	0.03	0.25	0.08	0.06	0.08	0.32	0.11
	3:25:00	0.00	0.00	0.03	0.18	0.06	0.05	0.06	0.24	0.09
	3:30:00	0.00	0.00	0.02	0.13	0.04	0.04	0.05	0.18	0.06
	3:35:00	0.00	0.00	0.01	0.08	0.03	0.03	0.04	0.12	0.05
	3:40:00	0.00	0.00	0.01	0.05	0.02	0.02	0.02	0.07	0.03
	3:45:00	0.00	0.00	0.01	0.03	0.01	0.01	0.02	0.04	0.02
	3:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Flying Horse North MDDP

Basin ID: Pond 8



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	15.89	acres
Watershed Length =	1,507	ft
Watershed Length to Centroid =	741	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	24.82%	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.

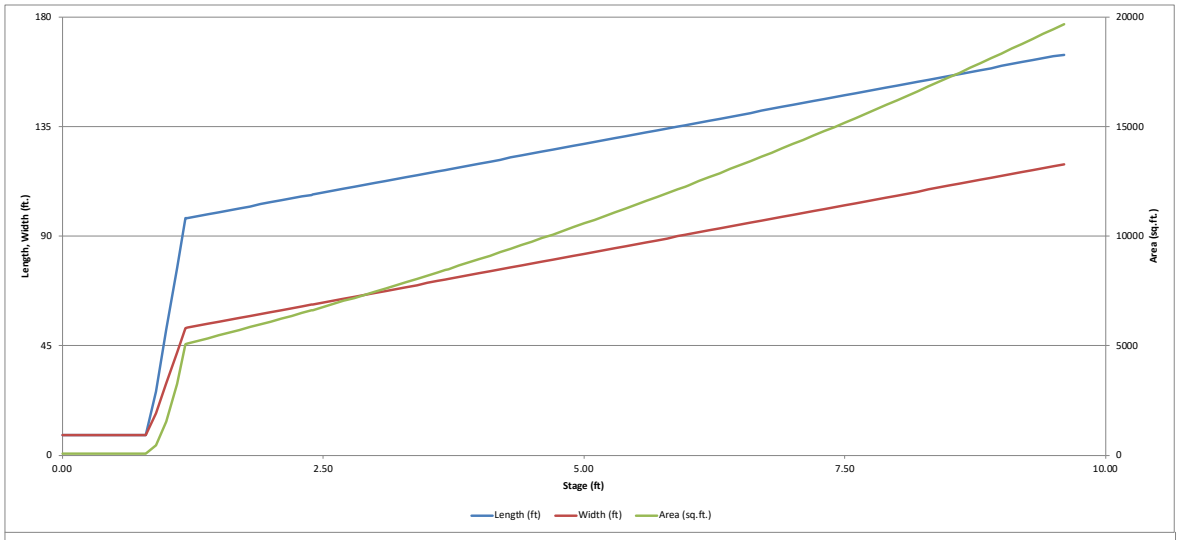
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.178	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.399	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.416	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.713	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.991	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.426	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.746	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.181	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.010	acre-feet		inches
Approximate 2-yr Detention Volume =	0.280	acre-feet		
Approximate 5-yr Detention Volume =	0.407	acre-feet		
Approximate 10-yr Detention Volume =	0.620	acre-feet		
Approximate 25-yr Detention Volume =	0.740	acre-feet		
Approximate 50-yr Detention Volume =	0.781	acre-feet		
Approximate 100-yr Detention Volume =	0.942	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.178	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.221	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.543	acre-feet
Total Detention Basin Volume =	0.942	acre-feet
Initial Surcharge Volume (ISV) =	23	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	70	ft^2
Surcharge Volume Length (L_{ISV}) =	8.4	ft
Surcharge Volume Width (W_{ISV}) =	8.4	ft
Depth of Basin Floor (H_{FLOOR}) =	0.35	ft
Length of Basin Floor (L_{FLOOR}) =	97.3	ft
Width of Basin Floor (W_{FLOOR}) =	52.1	ft
Area of Basin Floor (A_{FLOOR}) =	5,073	ft^2
Volume of Basin Floor (V_{FLOOR}) =	670	ft^3
Depth of Main Basin (H_{MAIN}) =	4.82	ft
Length of Main Basin (L_{MAIN}) =	135.8	ft
Width of Main Basin (W_{MAIN}) =	90.7	ft
Area of Main Basin (A_{MAIN}) =	12,321	ft^2
Volume of Main Basin (V_{MAIN}) =	40,648	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.950**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		8.4	8.4	70		0.002		
ISV	0.33		8.4	8.4	70		0.002	23	0.001
	0.40		8.4	8.4	70		0.002	28	0.001
	0.50		8.4	8.4	70		0.002	35	0.001
	0.60		8.4	8.4	70		0.002	42	0.001
	0.70		8.4	8.4	70		0.002	49	0.001
	0.80		8.4	8.4	70		0.002	56	0.001
	0.90		26.2	17.1	449		0.010	75	0.002
	1.00		51.6	29.6	1,528		0.035	168	0.004
	1.10		77.0	42.1	3,243		0.074	402	0.009
Floor	1.18		97.3	52.1	5,073		0.116	732	0.017
	1.20		97.4	52.3	5,096		0.117	833	0.019
	1.30		98.2	53.1	5,217		0.120	1,349	0.031
	1.40		99.0	53.9	5,339		0.123	1,877	0.043
	1.50		99.8	54.7	5,462		0.125	2,417	0.055
	1.60		100.6	55.5	5,586		0.128	2,969	0.068
	1.70		101.4	56.3	5,711		0.131	3,534	0.081
	1.80		102.2	57.1	5,838		0.134	4,111	0.094
	1.90		103.0	57.9	5,966		0.137	4,702	0.108
	2.00		103.8	58.7	6,096		0.140	5,305	0.122
	2.10		104.6	59.5	6,226		0.143	5,921	0.136
	2.20		105.4	60.3	6,358		0.146	6,550	0.150
	2.30		106.2	61.1	6,492		0.149	7,192	0.165
Zone 1 (WQCV)	2.39		107.0	61.8	6,613		0.152	7,782	0.179
	2.40		107.0	61.9	6,626		0.152	7,848	0.180
	2.50		107.8	62.7	6,762		0.155	8,518	0.196
	2.60		108.6	63.5	6,899		0.158	9,201	0.211
	2.70		109.4	64.3	7,037		0.162	9,898	0.227
	2.80		110.2	65.1	7,177		0.165	10,608	0.244
	2.90		111.0	65.9	7,318		0.168	11,333	0.260
	3.00		111.8	66.7	7,460		0.171	12,072	0.277
	3.10		112.6	67.5	7,604		0.175	12,825	0.294
	3.20		113.4	68.3	7,748		0.178	13,593	0.312
	3.30		114.2	69.1	7,894		0.181	14,375	0.330
	3.40		115.0	69.9	8,042		0.185	15,172	0.348
	3.50		115.8	70.7	8,190		0.188	15,983	0.367
	3.60		116.6	71.5	8,340		0.191	16,810	0.386
Zone 2 (EURV)	3.67		117.2	72.1	8,446		0.194	17,397	0.399
	3.70		117.4	72.3	8,491		0.195	17,651	0.405
	3.80		118.2	73.1	8,644		0.198	18,508	0.425
	3.90		119.0	73.9	8,798		0.202	19,380	0.445
	4.00		119.8	74.7	8,953		0.206	20,268	0.465
	4.10		120.6	75.5	9,109		0.209	21,171	0.486
	4.20		121.4	76.3	9,266		0.213	22,089	0.507
	4.30		122.2	77.1	9,425		0.216	23,024	0.529
	4.40		123.0	77.9	9,585		0.220	23,975	0.550
	4.50		123.8	78.7	9,747		0.224	24,941	0.573
	4.60		124.6	79.5	9,909		0.227	25,924	0.595
	4.70		125.4	80.3	10,073		0.231	26,923	0.618
	4.80		126.2	81.1	10,239		0.235	27,939	0.641
	4.90		127.0	81.9	10,405		0.239	28,971	0.665
	5.00		127.8	82.7	10,573		0.243	30,020	0.689
	5.10		128.6	83.5	10,742		0.247	31,085	0.714
	5.20		129.4	84.3	10,912		0.251	32,168	0.738
	5.30		130.2	85.1	11,084		0.254	33,268	0.764
	5.40		131.0	85.9	11,257		0.258	34,385	0.789
	5.50		131.8	86.7	11,431		0.262	35,519	0.815
	5.60		132.6	87.5	11,607		0.266	36,671	0.842
	5.70		133.4	88.3	11,783		0.271	37,841	0.869
	5.80		134.2	89.1	11,961		0.275	39,028	0.896
	5.90		135.0	89.9	12,141		0.279	40,233	0.924
Zone 3 (100-year)	5.97		135.6	90.5	12,267		0.282	41,087	0.943
	6.00		135.8	90.7	12,321		0.283	41,456	0.952
	6.10		136.6	91.5	12,503		0.287	42,697	0.980
	6.20		137.4	92.3	12,686		0.291	43,957	1.009
	6.30		138.2	93.1	12,871		0.295	45,235	1.038
	6.40		139.0	93.9	13,057		0.300	46,531	1.068
	6.50		139.8	94.7	13,244		0.304	47,846	1.098
	6.60		140.6	95.5	13,432		0.308	49,180	1.129
	6.70		141.4	96.3	13,621		0.313	50,532	1.160
	6.80		142.2	97.1	13,812		0.317	51,904	1.192
	6.90		143.0	97.9	14,004		0.321	53,295	1.223
	7.00		143.8	98.7	14,198		0.326	54,705	1.256
	7.10		144.6	99.5	14,392		0.330	56,135	1.289
	7.20		145.4	100.3	14,588		0.335	57,584	1.322
	7.30		146.2	101.1	14,786		0.339	59,052	1.356
	7.40		147.0	101.9	14,984		0.344	60,541	1.390
	7.50		147.8	102.7	15,184		0.349	62,049	1.424
	7.60		148.6	103.5	15,385		0.353	63,578	1.460
	7.70		149.4	104.3	15,587		0.358	65,126	1.495
	7.80		150.2	105.1	15,791		0.363	66,695	1.531
	7.90		151.0	105.9	15,996		0.367	68,284	1.568
	8.00		151.8	106.7	16,202		0.372	69,894	1.605
	8.10		152.6	107.5	16,410		0.377	71,525	1.642
	8.20		153.4	108.3	16,618		0.382	73,176	1.680
	8.30		154.2	109.1	16,828		0.386	74,849	1.718
	8.40		155.0	109.9	17,040		0.391	76,542	1.757
	8.50		155.8	110.7	17,252		0.396	78,257	1.797
	8.60		156.6	111.5	17,466		0.401	79,992	1.836
	8.70		157.4	112.3	17,681		0.406	81,750	1.877
	8.80		158.2	113.1	17,898		0.411	83,529	1.918
	8.90		159.0	113.9	18,115		0.416	85,329	1.959
	9.00		159.8	114.7	18,334		0.421	87,152	2.001
	9.10		160.6	115.5	18,555		0.426	88,996	2.043
	9.20		161.4	116.3	18,776		0.431	90,863	2.086
	9.30		162.2	117.1	18,999		0.436	92,752	2.129
	9.40		163.0	117.9	19,223		0.441	94,663	2.173
	9.50		163.8	118.7	19,449		0.446	96,596	2.218
	9.60		164.6	119.5	19,675		0.452	98,553	2.262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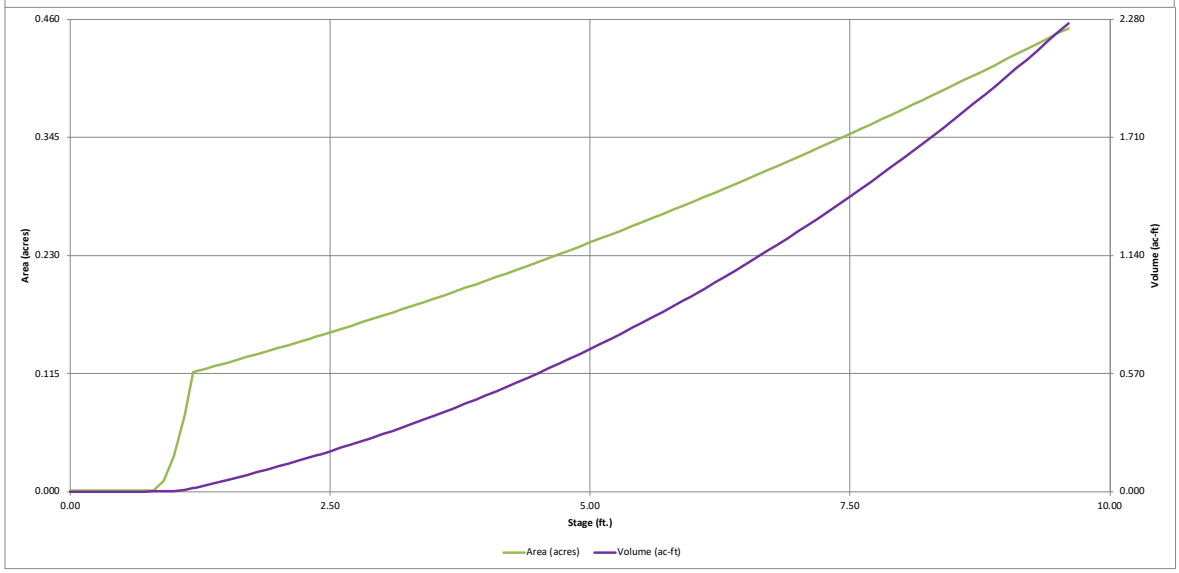
Length (ft)
Width (ft)
Area (sq.ft.)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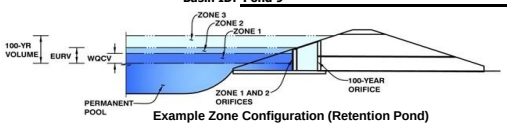
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 9**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	86.18	acres
Watershed Length =	2,354	ft
Watershed Length to Centroid =	1,434	ft
Watershed Slope =	0.039	ft/ft
Watershed Imperviousness =	21.81%	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.

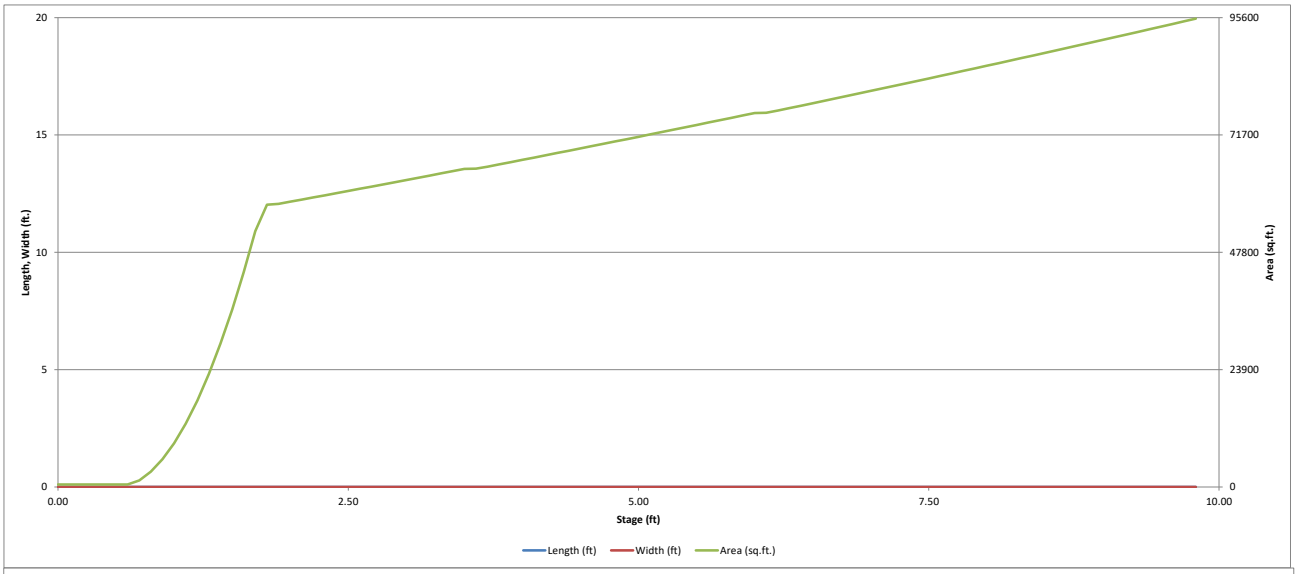
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.883	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.880	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.026	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.599	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.087	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.473	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	9.201	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	11.580	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	16.065	acre-feet		inches
Approximate 2-yr Detention Volume =	1.301	acre-feet		
Approximate 5-yr Detention Volume =	1.913	acre-feet		
Approximate 10-yr Detention Volume =	3.018	acre-feet		
Approximate 25-yr Detention Volume =	3.681	acre-feet		
Approximate 50-yr Detention Volume =	3.888	acre-feet		
Approximate 100-yr Detention Volume =	4.742	acre-feet		

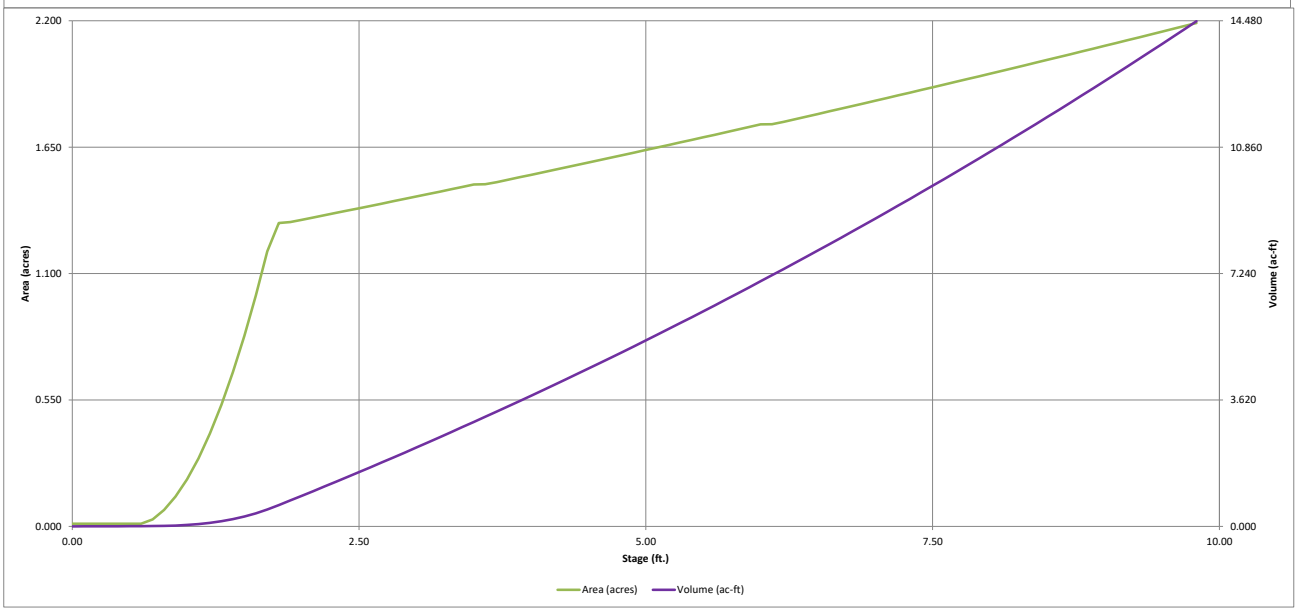
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.883	acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.030	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.829	acre-feet
Total Detention Basin Volume =	4.742	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	510	0.012		
	--	0.10	--	--	--	510	0.012	51	0.001
	--	0.20	--	--	--	510	0.012	102	0.002
	--	0.30	--	--	--	510	0.012	153	0.004
	--	0.40	--	--	--	510	0.012	204	0.005
	--	0.50	--	--	--	510	0.012	255	0.006
	--	0.60	--	--	--	510	0.012	306	0.007
	--	0.70	--	--	--	1,331	0.031	398	0.009
	--	0.80	--	--	--	3,124	0.072	620	0.014
	--	0.90	--	--	--	5,648	0.130	1,059	0.024
	--	1.00	--	--	--	8,903	0.204	1,786	0.041
	--	1.10	--	--	--	12,887	0.296	2,876	0.066
	--	1.20	--	--	--	17,602	0.404	4,400	0.101
	--	1.30	--	--	--	23,047	0.529	6,433	0.148
	--	1.40	--	--	--	29,222	0.671	9,046	0.208
	--	1.50	--	--	--	36,128	0.829	12,314	0.283
	--	1.60	--	--	--	43,764	1.005	16,308	0.374
	--	1.70	--	--	--	52,130	1.197	21,103	0.484
	--	1.80	--	--	--	57,500	1.320	26,584	0.610
	--	1.90	--	--	--	57,673	1.324	32,343	0.742
	--	2.00	--	--	--	58,107	1.334	38,132	0.875
	--	2.10	--	--	--	58,542	1.344	43,964	1.009
	--	2.20	--	--	--	58,979	1.354	49,840	1.144
	--	2.30	--	--	--	59,418	1.364	55,760	1.280
	--	2.40	--	--	--	59,858	1.374	61,724	1.417
	--	2.50	--	--	--	60,299	1.384	67,732	1.555
	--	2.60	--	--	--	60,742	1.394	73,784	1.694
	--	2.70	--	--	--	61,187	1.405	79,880	1.834
	--	2.80	--	--	--	61,632	1.415	86,021	1.975
	--	2.90	--	--	--	62,080	1.425	92,207	2.117
	--	3.00	--	--	--	62,529	1.435	98,437	2.260
	--	3.10	--	--	--	62,979	1.446	104,713	2.404
	--	3.20	--	--	--	63,431	1.456	111,033	2.549
	--	3.30	--	--	--	63,884	1.467	117,399	2.695
	--	3.40	--	--	--	64,338	1.477	123,810	2.842
	--	3.50	--	--	--	64,795	1.487	130,267	2.991
	--	3.60	--	--	--	64,840	1.489	136,748	3.139
	--	3.70	--	--	--	65,252	1.498	143,253	3.289
	--	3.80	--	--	--	65,711	1.509	149,801	3.439
	--	3.90	--	--	--	66,172	1.519	156,395	3.590
	--	4.00	--	--	--	66,634	1.530	163,036	3.743
	--	4.10	--	--	--	67,097	1.540	169,722	3.896
	--	4.20	--	--	--	67,562	1.551	176,455	4.051
	--	4.30	--	--	--	68,029	1.562	183,235	4.206
	--	4.40	--	--	--	68,497	1.572	190,061	4.363
	--	4.50	--	--	--	68,966	1.583	196,934	4.521
	--	4.60	--	--	--	69,437	1.594	203,854	4.680
	--	4.70	--	--	--	69,909	1.605	210,822	4.840
	--	4.80	--	--	--	70,383	1.616	217,836	5.001
	--	4.90	--	--	--	70,858	1.627	224,898	5.163
	--	5.00	--	--	--	71,335	1.638	232,008	5.326
	--	5.10	--	--	--	71,813	1.649	239,165	5.490
	--	5.20	--	--	--	72,293	1.660	246,371	5.656
	--	5.30	--	--	--	72,774	1.671	253,624	5.822
	--	5.40	--	--	--	73,257	1.682	260,926	5.990
	--	5.50	--	--	--	73,741	1.693	268,275	6.159
	--	5.60	--	--	--	74,227	1.704	275,674	6.329
	--	5.70	--	--	--	74,714	1.715	283,121	6.500
	--	5.80	--	--	--	75,202	1.726	290,617	6.672
	--	5.90	--	--	--	75,692	1.738	298,161	6.845
	--	6.00	--	--	--	76,184	1.749	305,755	7.019
	--	6.10	--	--	--	76,233	1.750	313,376	7.194
	--	6.20	--	--	--	76,677	1.760	321,021	7.370
	--	6.30	--	--	--	77,171	1.772	328,714	7.546
	--	6.40	--	--	--	77,667	1.783	336,456	7.724
	--	6.50	--	--	--	78,164	1.794	344,247	7.903
	--	6.60	--	--	--	78,663	1.806	352,089	8.083
	--	6.70	--	--	--	79,163	1.817	359,980	8.264
	--	6.80	--	--	--	79,665	1.829	367,921	8.446
	--	6.90	--	--	--	80,168	1.840	375,913	8.630
	--	7.00	--	--	--	80,673	1.852	383,955	8.814
	--	7.10	--	--	--	81,179	1.864	392,048	9.000
	--	7.20	--	--	--	81,687	1.875	400,191	9.187
	--	7.30	--	--	--	82,196	1.887	408,385	9.375
	--	7.40	--	--	--	82,707	1.899	416,630	9.565
	--	7.50	--	--	--	83,219	1.910	424,927	9.755
	--	7.60	--	--	--	83,732	1.922	433,274	9.947
	--	7.70	--	--	--	84,247	1.934	441,673	10.139
	--	7.80	--	--	--	84,764	1.946	450,124	10.333
	--	7.90	--	--	--	85,282	1.958	458,626	10.529
	--	8.00	--	--	--	85,801	1.970	467,180	10.725
	--	8.10	--	--	--	86,322	1.982	475,786	10.923
	--	8.20	--	--	--	86,845	1.994	484,445	11.121
	--	8.30	--	--	--	87,368	2.006	493,155	11.321
	--	8.40	--	--	--	87,894	2.018	501,918	11.522
	--	8.50	--	--	--	88,421	2.030	510,734	11.725
	--	8.60	--	--	--	88,949	2.042	519,603	11.928
	--	8.70	--	--	--	89,479	2.054	528,524	12.133
	--	8.80	--	--	--	90,010	2.066	537,498	12.339
	--	8.90	--	--	--	90,543	2.079	546,526	12.547
	--	9.00	--	--	--	91,077	2.091	555,607	12.755
	--	9.10	--	--	--	91,612	2.103	564,741	12.965
	--	9.20	--	--	--	92,149	2.115	573,930	13.176
	--	9.30	--	--	--	92,688	2.128	583,171	13.388
	--	9.40	--	--	--	93,228	2.140	592,467	13.601
	--	9.50	--	--	--	93,770	2.153	601,817	13.816
	--	9.60	--	--	--	94,313	2.165	611,221	14.032
	--	9.70	--	--	--	94,857	2.178	620,680	14.249
	--	9.80	--	--	--	95,403	2.190	630,193	14.467


20
15
10
5
0
Length, Width (ft.)
95600
71700
47800
23900
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

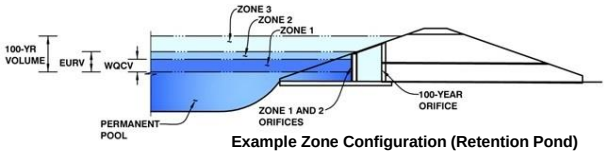

2.200
1.650
1.100
0.550
0.000
Area (acres)
14.480
10.860
7.240
3.620
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 9**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.01	0.883	Orifice Plate
Zone 2 (5-year)	2.76	1.030	Weir&Pipe (Restrict)
Zone 3 (100-year)	4.64	2.829	Weir&Pipe (Restrict)
Total (all zones)		4.742	

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 =	2.396E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.36	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.45	sq. inches (use rectangular openings)	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	0.79	1.57					
Orifice Area (sq. inches)	3.45	3.45	3.45					

	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 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	3.10	4.10	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	8.00	feet
Overflow Weir Grate Slope =	0.00	4.00	H:V
Horiz. Length of Weir Sides =	6.00	12.00	feet
Overflow Grate Type =	Type C Grate	Type C Grate	
Debris Clogging % =	50%	50%	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir	
Height of Grate Upper Edge, H_t =	3.10	7.10	feet
Overflow Weir Slope Length =	6.00	12.37	feet
Grate Open Area / 100-yr Orifice Area =	1.82	2.92	
Overflow Grate Open Area w/o Debris =	16.70	68.87	ft^2
Overflow Grate Open Area w/ Debris =	8.35	34.44	ft^2

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

	Zone 2 Restrictor	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.30	2.60	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	66.00	inches
Restrictor Plate Height Above Pipe Invert =	38.00	64.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Restrictor	Zone 3 Restrictor	
Outlet Orifice Area =	9.16	23.55	ft^2
Outlet Orifice Centroid =	1.67	2.73	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.51	2.79	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.98	feet
Spillway Crest Length =	113.00	feet	Stage at Top of Freeboard =	9.78	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.19	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	14.42	acre-ft

Calculated Parameters for Spillway

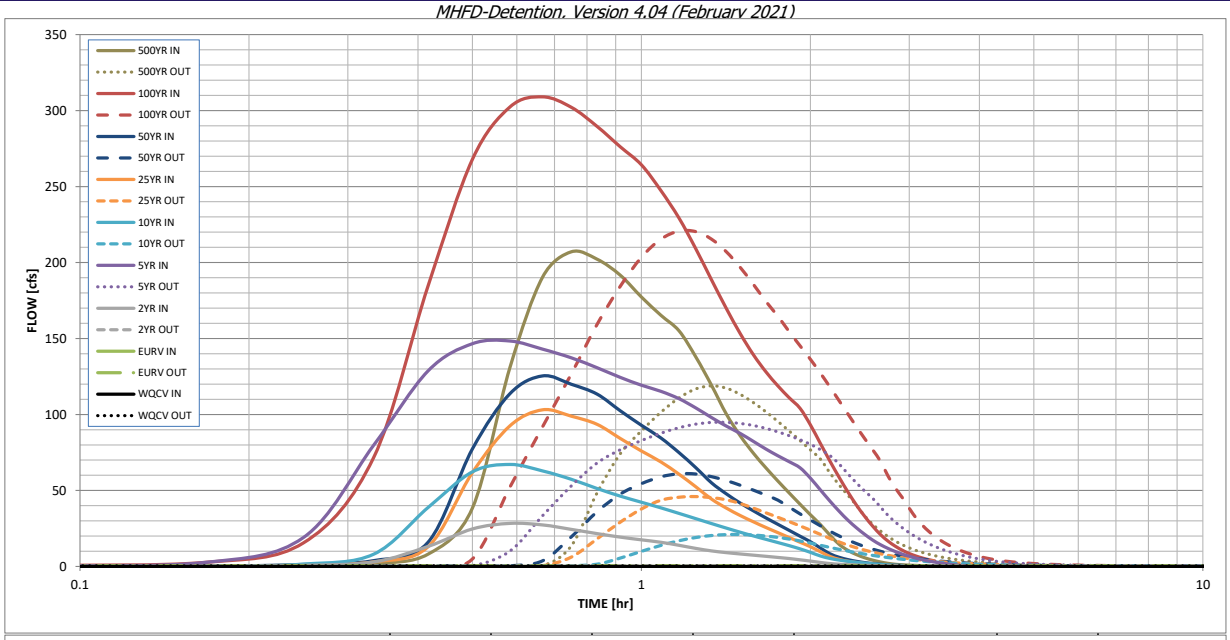
Routed Hydrograph Results

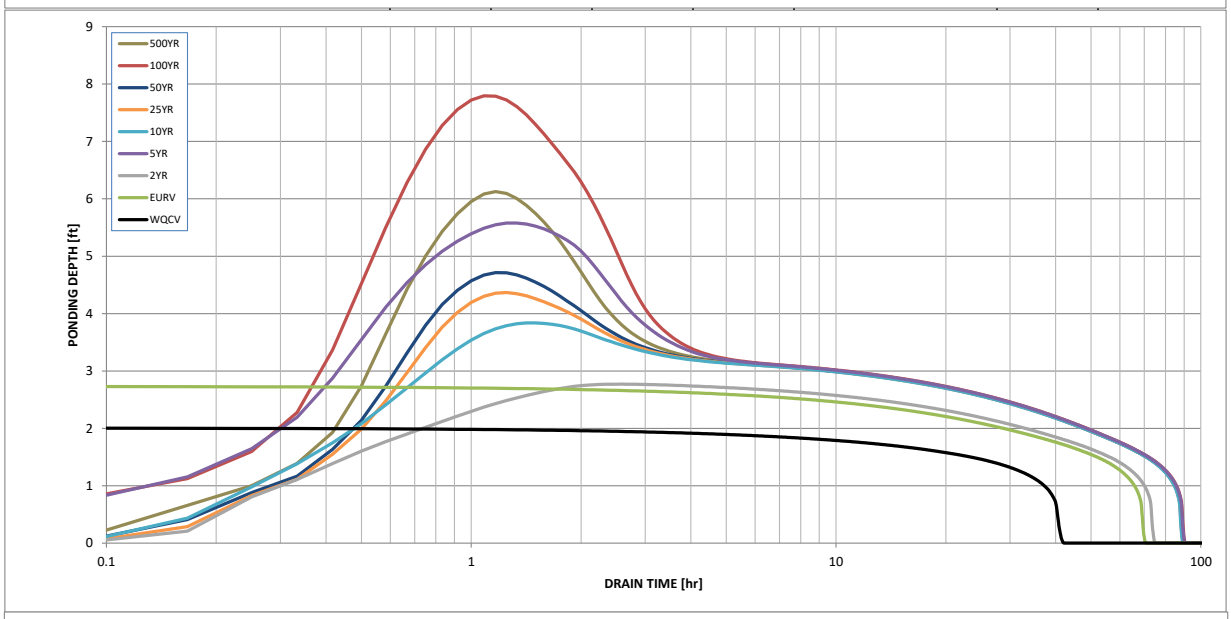
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

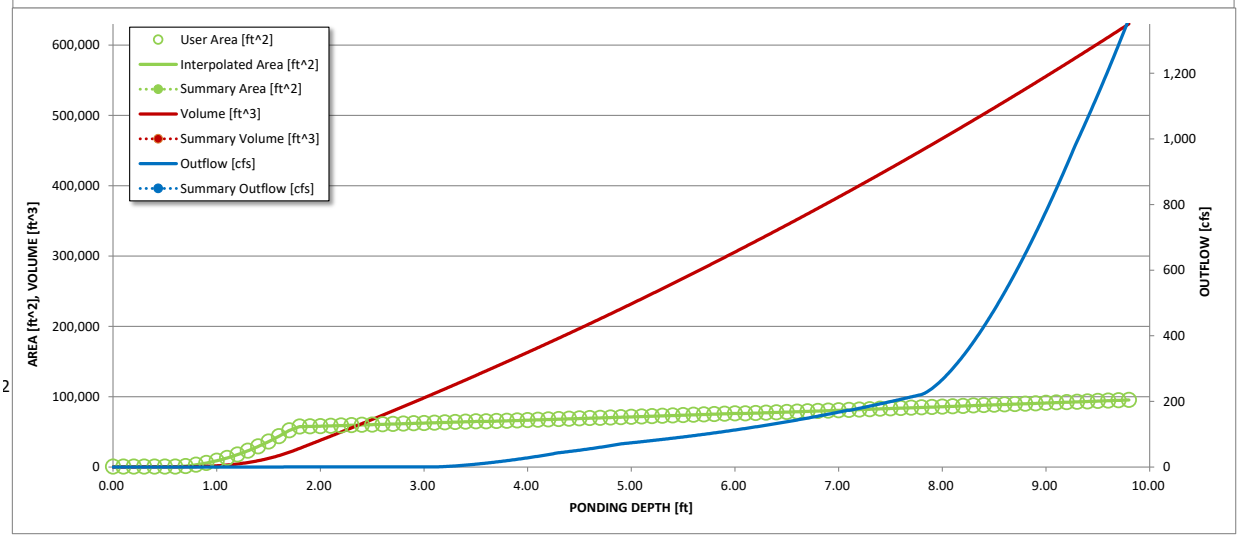
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.883	1.880	2.026	3.599	5.087	7.473	9.201	11.580	16.065
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.026	17.291	5.087	7.473	9.201	31.926	16.065
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	11.0	30.3	46.1	81.0	101.4	129.3	179.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		95.0				282.3	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	1.10	0.53	0.94	1.18	3.28	2.09
Peak Inflow Q (cfs) =	N/A	N/A	28.4	148.4	67.1	103.1	125.4	309.0	207.1
Peak Outflow Q (cfs) =	0.4	0.5	0.5	94.8	21.0	46.0	61.0	220.7	118.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.6	0.6	0.8	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 2	Overflow Weir 1	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	4.5	1.2	2.7	3.4	6.1	4.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	0.3	N/A	0.0	0.1	1.7	0.5
Time to Drain 97% of Inflow Volume (hours) =	38	65	69	61	78	74	71	46	62
Time to Drain 99% of Inflow Volume (hours) =	**40**	68	72	78	84	83	82	70	78
Maximum Ponding Depth (ft) =	2.01	2.74	2.77	5.58	3.84	4.37	4.71	7.79	6.13
Area at Maximum Ponding Depth (acres) =	1.33	1.41	1.41	1.70	1.51	1.57	1.61	1.94	1.75
Maximum Volume Stored (acre-ft) =	0.889	1.890	1.932	6.278	3.484	4.300	4.856	10.314	7.229

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.19	0.00	0.00	0.00	0.48	0.00
	0:10:00	0.00	0.00	0.00	2.62	0.00	0.00	0.09	2.67	0.28
	0:15:00	0.00	0.00	0.76	19.04	1.55	1.04	1.33	15.51	1.92
	0:20:00	0.00	0.00	2.95	79.68	8.04	2.99	3.82	71.52	8.06
	0:25:00	0.00	0.00	13.17	128.64	38.75	12.89	15.88	184.41	38.44
	0:30:00	0.00	0.00	24.71	146.60	62.28	61.82	77.38	267.93	131.08
	0:35:00	0.00	0.00	28.36	148.36	67.13	92.57	113.75	302.41	190.37
	0:40:00	0.00	0.00	27.34	143.02	62.88	103.09	125.40	309.03	207.06
	0:45:00	0.00	0.00	24.41	137.31	57.36	98.90	119.90	302.18	202.23
	0:50:00	0.00	0.00	21.63	130.82	51.33	93.57	113.46	289.65	191.70
	0:55:00	0.00	0.00	19.31	124.44	46.31	84.26	102.47	276.21	177.33
	1:00:00	0.00	0.00	17.53	119.29	42.27	75.99	92.91	264.30	165.28
	1:05:00	0.00	0.00	15.91	115.25	38.56	68.79	84.53	247.33	155.08
	1:10:00	0.00	0.00	13.92	110.41	34.92	60.71	74.92	229.27	137.88
	1:15:00	0.00	0.00	11.89	104.32	31.47	52.43	65.01	209.03	119.21
	1:20:00	0.00	0.00	10.24	97.99	28.23	44.33	55.03	188.58	100.29
	1:25:00	0.00	0.00	9.11	92.36	25.24	38.41	47.78	169.75	85.97
	1:30:00	0.00	0.00	8.22	87.52	22.52	33.51	41.71	153.19	74.48
	1:35:00	0.00	0.00	7.43	82.28	20.08	29.37	36.58	139.26	64.85
	1:40:00	0.00	0.00	6.68	77.25	17.85	25.63	31.93	128.04	56.24
	1:45:00	0.00	0.00	5.94	72.85	15.74	22.26	27.74	118.85	48.37
	1:50:00	0.00	0.00	5.22	68.94	13.70	19.04	23.75	111.03	40.97
	1:55:00	0.00	0.00	4.38	64.94	11.58	15.95	19.92	104.07	34.02
	2:00:00	0.00	0.00	3.55	58.11	9.29	13.00	16.27	93.16	27.58
	2:05:00	0.00	0.00	2.64	50.37	6.91	9.71	12.19	80.96	20.65
	2:10:00	0.00	0.00	1.92	43.04	5.27	6.60	8.35	69.34	14.54
	2:15:00	0.00	0.00	1.47	36.34	4.21	4.68	6.04	58.65	10.55
	2:20:00	0.00	0.00	1.17	30.41	3.40	3.43	4.48	48.94	7.79
	2:25:00	0.00	0.00	0.94	25.39	2.74	2.56	3.37	40.27	5.71
	2:30:00	0.00	0.00	0.75	21.07	2.19	1.91	2.52	32.86	4.14
	2:35:00	0.00	0.00	0.60	17.30	1.72	1.45	1.92	26.42	2.94
	2:40:00	0.00	0.00	0.47	14.29	1.33	1.08	1.43	20.94	2.04
	2:45:00	0.00	0.00	0.37	11.86	1.02	0.80	1.06	16.66	1.43
	2:50:00	0.00	0.00	0.30	9.83	0.77	0.62	0.81	13.31	1.09
	2:55:00	0.00	0.00	0.24	8.11	0.59	0.48	0.63	10.64	0.85
	3:00:00	0.00	0.00	0.19	6.68	0.45	0.37	0.49	8.52	0.68
	3:05:00	0.00	0.00	0.14	5.47	0.34	0.29	0.37	6.87	0.53
	3:10:00	0.00	0.00	0.11	4.47	0.25	0.21	0.28	5.54	0.39
	3:15:00	0.00	0.00	0.07	3.61	0.17	0.15	0.20	4.47	0.28
	3:20:00	0.00	0.00	0.05	2.87	0.11	0.10	0.13	3.60	0.18
	3:25:00	0.00	0.00	0.03	2.23	0.06	0.06	0.08	2.85	0.11
	3:30:00	0.00	0.00	0.01	1.69	0.03	0.03	0.04	2.21	0.05
	3:35:00	0.00	0.00	0.00	1.25	0.01	0.01	0.01	1.67	0.02
	3:40:00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	1.20	0.00
	3:45:00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.82	0.00
	3:50:00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.52	0.00
	3:55:00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.29	0.00
	4:00:00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.16	0.00
	4:05:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.06	0.00
	4:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	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'.

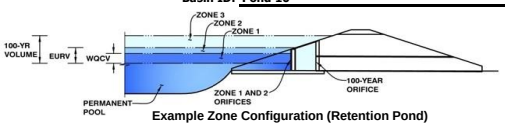
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 10**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	21.96	acres
Watershed Length =	1,715	ft
Watershed Length to Centroid =	1,346	ft
Watershed Slope =	0.056	ft/ft
Watershed Imperviousness =	10.00%	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.

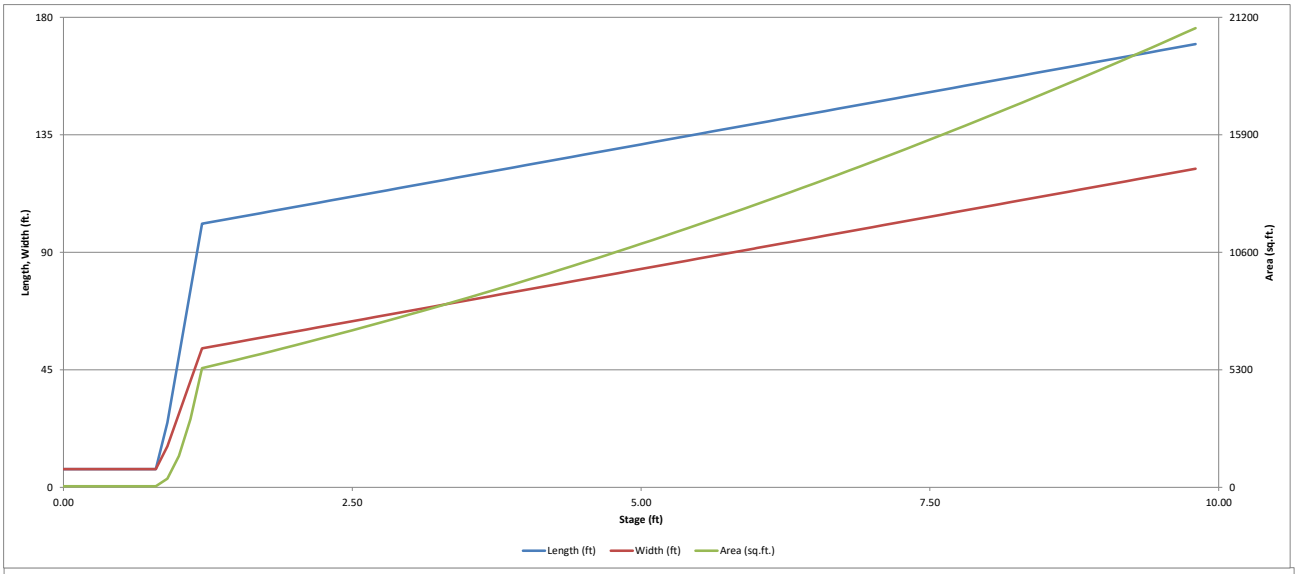
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.123	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.206	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.293	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.647	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.000	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.630	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.059	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.677	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.804	acre-feet		inches
Approximate 2-yr Detention Volume =	0.132	acre-feet		
Approximate 5-yr Detention Volume =	0.207	acre-feet		
Approximate 10-yr Detention Volume =	0.429	acre-feet		
Approximate 25-yr Detention Volume =	0.599	acre-feet		
Approximate 50-yr Detention Volume =	0.627	acre-feet		
Approximate 100-yr Detention Volume =	0.810	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.123	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.084	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.603	acre-feet
Total Detention Basin Volume =	0.810	acre-feet
Initial Surcharge Volume (ISV) =	16	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	49	ft^2
Surcharge Volume Length (L_{ISV}) =	7.0	ft
Surcharge Volume Width (W_{ISV}) =	7.0	ft
Depth of Basin Floor (H_{FLOOR}) =	0.37	ft
Length of Basin Floor (L_{FLOOR}) =	100.9	ft
Width of Basin Floor (W_{FLOOR}) =	53.2	ft
Area of Basin Floor (A_{FLOOR}) =	5,372	ft^2
Volume of Basin Floor (V_{FLOOR}) =	732	ft^3
Depth of Main Basin (H_{MAIN}) =	4.80	ft
Length of Main Basin (L_{MAIN}) =	139.3	ft
Width of Main Basin (W_{MAIN}) =	91.6	ft
Area of Main Basin (A_{MAIN}) =	12,767	ft^2
Volume of Main Basin (V_{MAIN}) =	42,274	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.988**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		7.0	7.0	49		0.001		
ISV	0.33		7.0	7.0	49		0.001	16	0.000
	0.40		7.0	7.0	49		0.001	19	0.000
	0.50		7.0	7.0	49		0.001	24	0.001
	0.60		7.0	7.0	49		0.001	29	0.001
	0.70		7.0	7.0	49		0.001	34	0.001
	0.80		7.0	7.0	49		0.001	39	0.001
	0.90		24.7	15.7	389		0.009	54	0.001
	1.00		50.1	28.2	1,415		0.032	139	0.003
	1.10		75.5	40.7	3,076		0.071	358	0.008
Floor	1.20		100.9	53.2	5,372		0.123	775	0.018
	1.30		101.7	54.0	5,496		0.126	1,319	0.030
	1.40		102.5	54.8	5,622		0.129	1,874	0.043
	1.50		103.3	55.6	5,748		0.132	2,443	0.056
	1.60		104.1	56.4	5,876		0.135	3,024	0.069
	1.70		104.9	57.2	6,005		0.138	3,618	0.083
	1.80		105.7	58.0	6,135		0.141	4,225	0.097
	1.90		106.5	58.8	6,267		0.144	4,845	0.111
	2.00		107.3	59.6	6,400		0.147	5,479	0.126
	2.10		108.1	60.4	6,534		0.150	6,125	0.141
	2.20		108.9	61.2	6,670		0.153	6,785	0.156
	2.30		109.7	62.0	6,806		0.156	7,459	0.171
Zone 1 (WQCV)	2.32		109.9	62.2	6,834		0.157	7,596	0.174
	2.40		110.5	62.8	6,945		0.159	8,147	0.187
	2.50		111.3	63.6	7,084		0.163	8,848	0.203
	2.60		112.1	64.4	7,224		0.166	9,564	0.220
	2.70		112.9	65.2	7,366		0.169	10,293	0.236
	2.80		113.7	66.0	7,510		0.172	11,037	0.253
Zone 2 (5-year)	2.90		114.5	66.8	7,654		0.176	11,795	0.271
	3.00		115.3	67.6	7,800		0.179	12,568	0.289
	3.10		116.1	68.4	7,947		0.182	13,355	0.307
	3.20		116.9	69.2	8,095		0.186	14,157	0.325
	3.30		117.7	70.0	8,245		0.189	14,974	0.344
	3.40		118.5	70.8	8,395		0.193	15,806	0.363
	3.50		119.3	71.6	8,548		0.196	16,653	0.382
	3.60		120.1	72.4	8,701		0.200	17,516	0.402
	3.70		120.9	73.2	8,856		0.203	18,393	0.422
	3.80		121.7	74.0	9,012		0.207	19,287	0.443
	3.90		122.5	74.8	9,169		0.210	20,196	0.464
	4.00		123.3	75.6	9,327		0.214	21,121	0.485
	4.10		124.1	76.4	9,487		0.218	22,061	0.506
	4.20		124.9	77.2	9,648		0.221	23,018	0.528
	4.30		125.7	78.0	9,811		0.225	23,991	0.551
	4.40		126.5	78.8	9,974		0.229	24,980	0.573
	4.50		127.3	79.6	10,139		0.233	25,986	0.597
	4.60		128.1	80.4	10,306		0.237	27,008	0.620
	4.70		128.9	81.2	10,473		0.240	28,047	0.644
	4.80		129.7	82.0	10,642		0.244	29,103	0.668
	4.90		130.5	82.8	10,812		0.248	30,176	0.693
	5.00		131.3	83.6	10,983		0.252	31,265	0.718
	5.10		132.1	84.4	11,156		0.256	32,372	0.743
	5.20		132.9	85.2	11,330		0.260	33,497	0.769
	5.30		133.7	86.0	11,505		0.264	34,638	0.795
	5.40		134.5	86.8	11,681		0.268	35,798	0.822
	5.50		135.3	87.6	11,859		0.272	36,975	0.849
	5.60		136.1	88.4	12,038		0.276	38,169	0.876
	5.70		136.9	89.2	12,218		0.280	39,382	0.904
	5.80		137.7	90.0	12,400		0.285	40,613	0.932
	5.90		138.5	90.8	12,583		0.289	41,862	0.961
Zone 3 (100-year)	5.98		139.2	91.5	12,730		0.292	42,875	0.984
	6.00		139.3	91.6	12,767		0.293	43,130	0.990
	6.10		140.1	92.4	12,952		0.297	44,416	1.020
	6.20		140.9	93.2	13,139		0.302	45,720	1.050
	6.30		141.7	94.0	13,327		0.306	47,043	1.080
	6.40		142.5	94.8	13,516		0.310	48,386	1.111
	6.50		143.3	95.6	13,707		0.315	49,747	1.142
	6.60		144.1	96.4	13,899		0.319	51,127	1.174
	6.70		144.9	97.2	14,092		0.324	52,527	1.206
	6.80		145.7	98.0	14,286		0.328	53,945	1.238
	6.90		146.5	98.8	14,482		0.332	55,384	1.271
	7.00		147.3	99.6	14,679		0.337	56,842	1.305
	7.10		148.1	100.4	14,877		0.342	58,320	1.339
	7.20		148.9	101.2	15,076		0.346	59,817	1.373
	7.30		149.7	102.0	15,277		0.351	61,335	1.408
	7.40		150.5	102.8	15,479		0.355	62,873	1.443
	7.50		151.3	103.6	15,683		0.360	64,431	1.479
	7.60		152.1	104.4	15,887		0.365	66,009	1.515
	7.70		152.9	105.2	16,093		0.369	67,608	1.552
	7.80		153.7	106.0	16,300		0.374	69,228	1.589
	7.90		154.5	106.8	16,509		0.379	70,868	1.627
	8.00		155.3	107.6	16,718		0.384	72,530	1.665
	8.10		156.1	108.4	16,929		0.389	74,212	1.704
	8.20		156.9	109.2	17,142		0.394	75,916	1.743
	8.30		157.7	110.0	17,355		0.398	77,640	1.782
	8.40		158.5	110.8	17,570		0.403	79,387	1.822
	8.50		159.3	111.6	17,786		0.408	81,154	1.863
	8.60		160.1	112.4	18,004		0.413	82,944	1.904
	8.70		160.9	113.2	18,222		0.418	84,755	1.946
	8.80		161.7	114.0	18,442		0.423	86,588	1.988
	8.90		162.5	114.8	18,664		0.428	88,444	2.030
	9.00		163.3	115.6	18,886		0.434	90,321	2.073
	9.10		164.1	116.4	19,110		0.439	92,221	2.117
	9.20		164.9	117.2	19,335		0.444	94,143	2.161
	9.30		165.7	118.0	19,561		0.449	96,088	2.206
	9.40		166.5	118.8	19,789		0.454	98,056	2.251
	9.50		167.3	119.6	20,018		0.460	100,046	2.297
	9.60		168.1	120.4	20,248		0.465	102,059	2.343
	9.70		168.9	121.2	20,480		0.470	104,096	2.390
	9.80		169.7	122.0	20,712		0.475	106,155	2.437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90
45
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Length, Width (ft.)
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15900
10600
5300
0
Area (sq.ft.)
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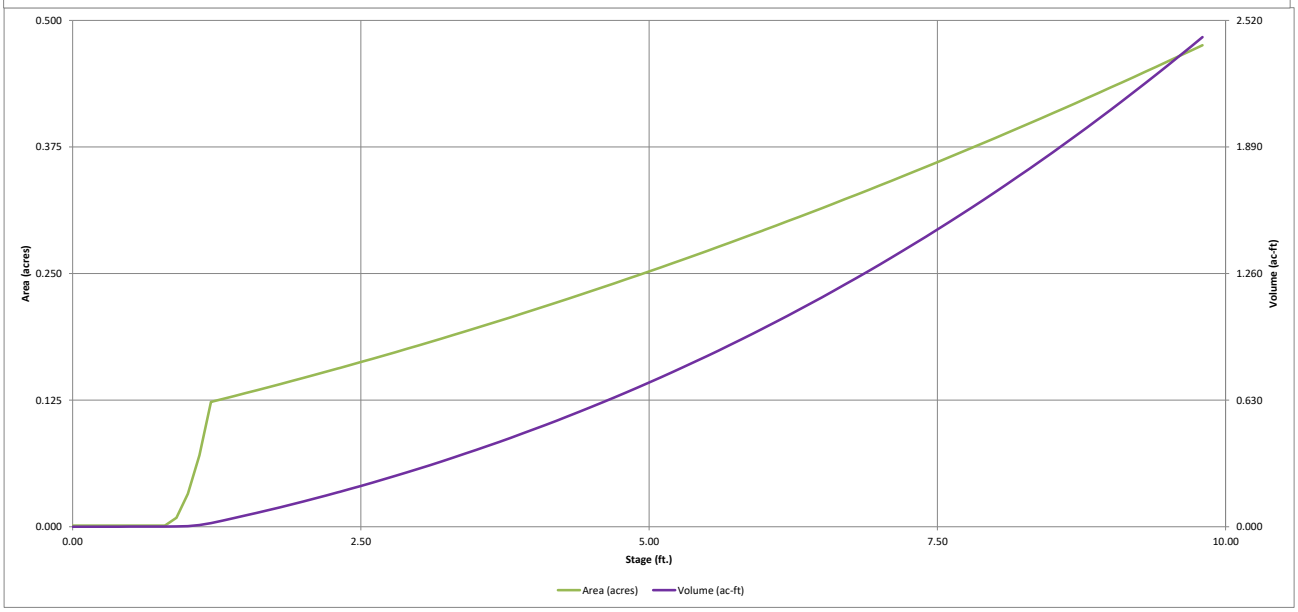
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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1.260
0.630
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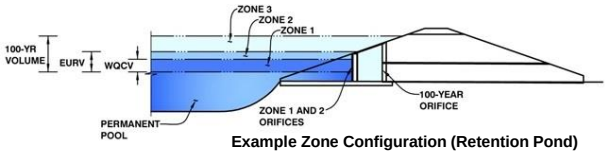
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 10**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.98	0.123	Orifice Plate
Zone 2 (5-year)	2.53	0.084	Circular Orifice
Zone 3 (100-year)	5.36	0.603	Weir&Pipe (Restrict)
Total (all zones)		0.810	

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 =	3.125E-03	ft^2
Depth at top of Zone using Orifice Plate =	1.98	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.80	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.45	sq. inches (diameter = 3/4 inch)	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	0.66	1.32					
Orifice Area (sq. inches)	0.45	0.45	0.45					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.98	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.53	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	18.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	1.77	N/A	ft^2
Vertical Orifice Centroid =	0.75	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 =	4.70	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C 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 =	4.70	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	1.55	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	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 =	1.00	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 =	20.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	4.03	N/A	ft^2
Outlet Orifice Centroid =	0.95	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.70	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.94	feet
Spillway Crest Length =	26.00	feet	Stage at Top of Freeboard =	8.64	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.42	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.92	acre-ft

Calculated Parameters for Spillway

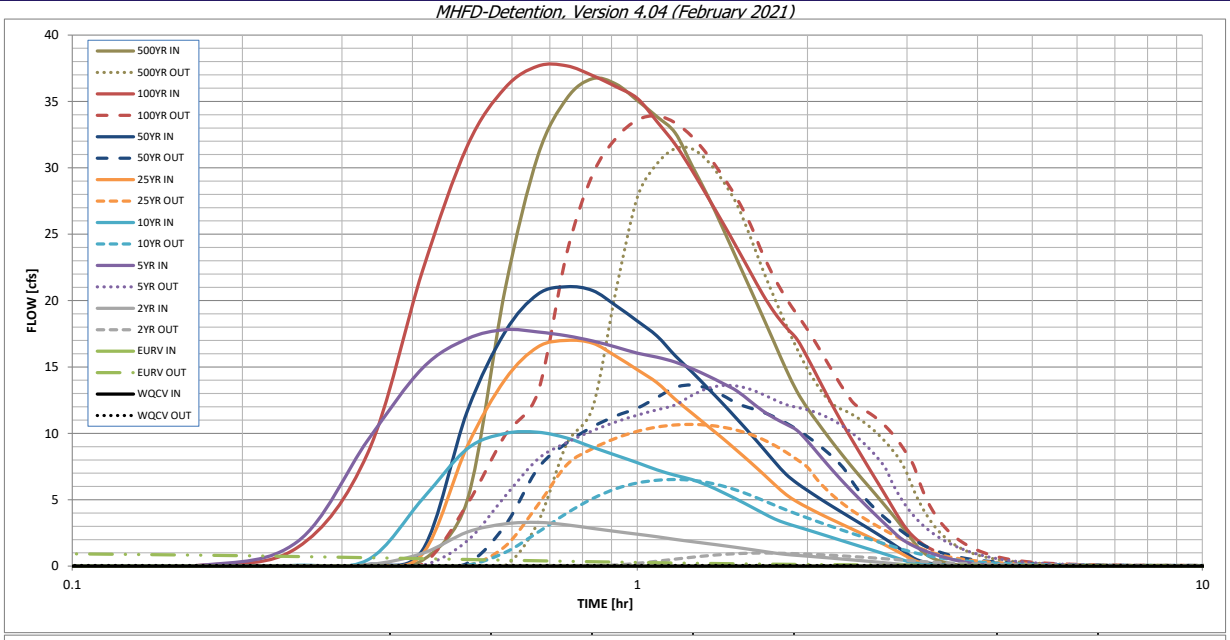
Routed Hydrograph Results

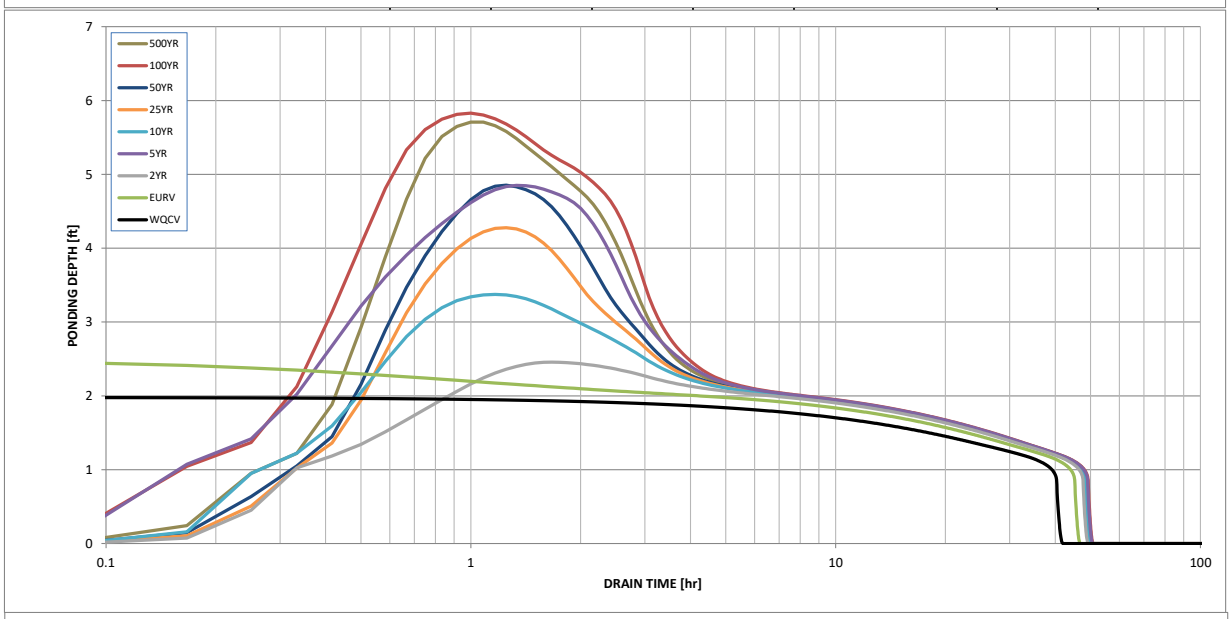
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

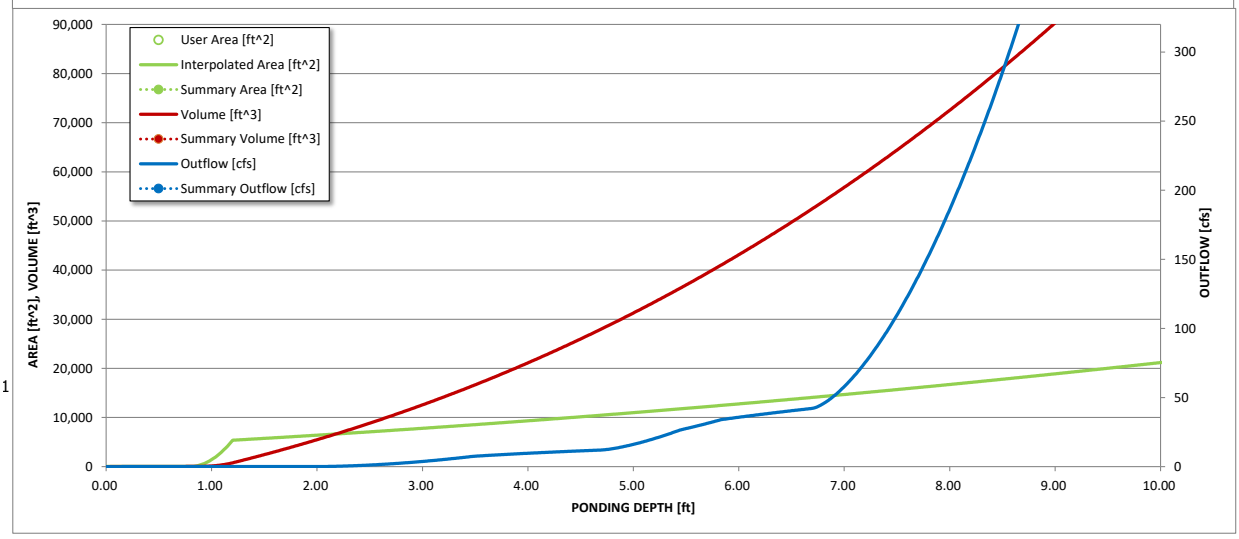
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.123	0.206	0.293	0.647	1.000	1.630	2.059	2.677	3.804
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.293	2.509	1.000	1.630	2.059	4.656	3.804
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.0	5.7	8.7	15.6	19.6	25.0	35.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		13.3				39.2	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.60	0.40	0.71	0.89	1.79	1.60
Peak Inflow Q (cfs) =	N/A	N/A	3.3	17.8	10.1	17.0	21.0	37.7	36.7
Peak Outflow Q (cfs) =	0.1	1.1	1.0	13.6	6.5	10.7	13.6	33.9	31.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.8	0.7	0.7	0.9	0.9
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	N/A	N/A	0.2	3.0	2.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	43	44	21	35	29	25	6	11
Time to Drain 99% of Inflow Volume (hours) =	**40**	45	47	38	44	41	40	30	33
Maximum Ponding Depth (ft) =	1.99	2.52	2.46	4.85	3.37	4.28	4.85	5.83	5.71
Area at Maximum Ponding Depth (acres) =	0.15	0.16	0.16	0.25	0.19	0.22	0.25	0.29	0.28
Maximum Volume Stored (acre-ft) =	0.124	0.206	0.195	0.680	0.357	0.544	0.680	0.938	0.904

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.01	0.00
	0:10:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.01
	0:15:00	0.00	0.00	0.03	1.83	0.06	0.04	0.05	1.39	0.07
	0:20:00	0.00	0.00	0.11	9.48	0.47	0.11	0.13	8.51	0.45
	0:25:00	0.00	0.00	0.97	14.91	5.06	0.92	1.21	22.24	4.95
	0:30:00	0.00	0.00	2.57	17.12	8.84	9.02	11.66	31.63	20.83
	0:35:00	0.00	0.00	3.18	17.81	9.99	14.05	17.64	36.02	30.90
	0:40:00	0.00	0.00	3.29	17.64	10.09	16.51	20.48	37.66	35.22
	0:45:00	0.00	0.00	3.11	17.35	9.65	17.00	21.04	37.68	36.71
	0:50:00	0.00	0.00	2.84	16.96	8.96	16.79	20.76	36.95	36.31
	0:55:00	0.00	0.00	2.61	16.50	8.35	15.81	19.62	36.11	35.07
	1:00:00	0.00	0.00	2.41	16.04	7.79	14.79	18.46	35.23	33.85
	1:05:00	0.00	0.00	2.22	15.74	7.25	13.82	17.33	33.48	32.63
	1:10:00	0.00	0.00	2.01	15.37	6.84	12.57	15.85	31.77	30.15
	1:15:00	0.00	0.00	1.85	14.87	6.52	11.51	14.62	29.79	27.86
	1:20:00	0.00	0.00	1.70	14.33	6.07	10.54	13.40	27.78	25.45
	1:25:00	0.00	0.00	1.55	13.77	5.55	9.62	12.24	25.86	23.11
	1:30:00	0.00	0.00	1.41	13.20	5.03	8.72	11.10	23.99	20.91
	1:35:00	0.00	0.00	1.26	12.43	4.51	7.84	9.99	22.18	18.81
	1:40:00	0.00	0.00	1.12	11.70	4.01	6.98	8.91	20.48	16.77
	1:45:00	0.00	0.00	0.99	11.14	3.55	6.14	7.85	19.08	14.83
	1:50:00	0.00	0.00	0.88	10.69	3.23	5.39	6.92	17.99	13.15
	1:55:00	0.00	0.00	0.81	10.23	2.98	4.85	6.25	17.09	11.89
	2:00:00	0.00	0.00	0.75	9.42	2.74	4.42	5.71	15.71	10.84
	2:05:00	0.00	0.00	0.69	8.54	2.50	4.03	5.21	14.26	9.85
	2:10:00	0.00	0.00	0.63	7.69	2.27	3.68	4.74	12.87	8.95
	2:15:00	0.00	0.00	0.57	6.90	2.05	3.35	4.31	11.57	8.10
	2:20:00	0.00	0.00	0.52	6.17	1.84	3.03	3.90	10.38	7.31
	2:25:00	0.00	0.00	0.46	5.49	1.64	2.73	3.51	9.28	6.57
	2:30:00	0.00	0.00	0.41	4.85	1.44	2.44	3.13	8.23	5.87
	2:35:00	0.00	0.00	0.35	4.25	1.25	2.15	2.76	7.22	5.19
	2:40:00	0.00	0.00	0.30	3.68	1.07	1.86	2.39	6.26	4.51
	2:45:00	0.00	0.00	0.25	3.14	0.89	1.58	2.03	5.32	3.84
	2:50:00	0.00	0.00	0.20	2.62	0.72	1.29	1.67	4.39	3.17
	2:55:00	0.00	0.00	0.15	2.14	0.54	1.01	1.31	3.51	2.50
	3:00:00	0.00	0.00	0.10	1.79	0.37	0.73	0.95	2.76	1.84
	3:05:00	0.00	0.00	0.06	1.52	0.25	0.45	0.61	2.21	1.24
	3:10:00	0.00	0.00	0.04	1.29	0.19	0.28	0.40	1.80	0.85
	3:15:00	0.00	0.00	0.03	1.10	0.15	0.18	0.27	1.47	0.60
	3:20:00	0.00	0.00	0.02	0.94	0.12	0.12	0.19	1.22	0.42
	3:25:00	0.00	0.00	0.02	0.79	0.10	0.08	0.13	1.00	0.28
	3:30:00	0.00	0.00	0.01	0.66	0.07	0.05	0.09	0.81	0.19
	3:35:00	0.00	0.00	0.01	0.54	0.06	0.04	0.06	0.66	0.12
	3:40:00	0.00	0.00	0.01	0.44	0.04	0.02	0.04	0.54	0.07
	3:45:00	0.00	0.00	0.01	0.35	0.03	0.02	0.03	0.44	0.05
	3:50:00	0.00	0.00	0.01	0.27	0.02	0.01	0.02	0.35	0.04
	3:55:00	0.00	0.00	0.00	0.21	0.02	0.01	0.02	0.27	0.03
	4:00:00	0.00	0.00	0.00	0.15	0.01	0.01	0.01	0.21	0.02
	4:05:00	0.00	0.00	0.00	0.11	0.01	0.00	0.01	0.15	0.02
	4:10:00	0.00	0.00	0.00	0.07	0.01	0.00	0.01	0.10	0.01
	4:15:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.06	0.01
	4:20:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.01
	4:25:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	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'.

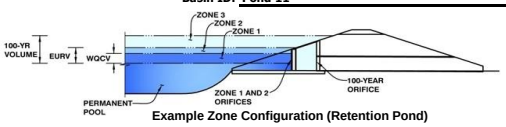
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 11**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	79.73	acres
Watershed Length =	2,715	ft
Watershed Length to Centroid =	1,530	ft
Watershed Slope =	0.037	ft/ft
Watershed Imperviousness =	28.50%	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.

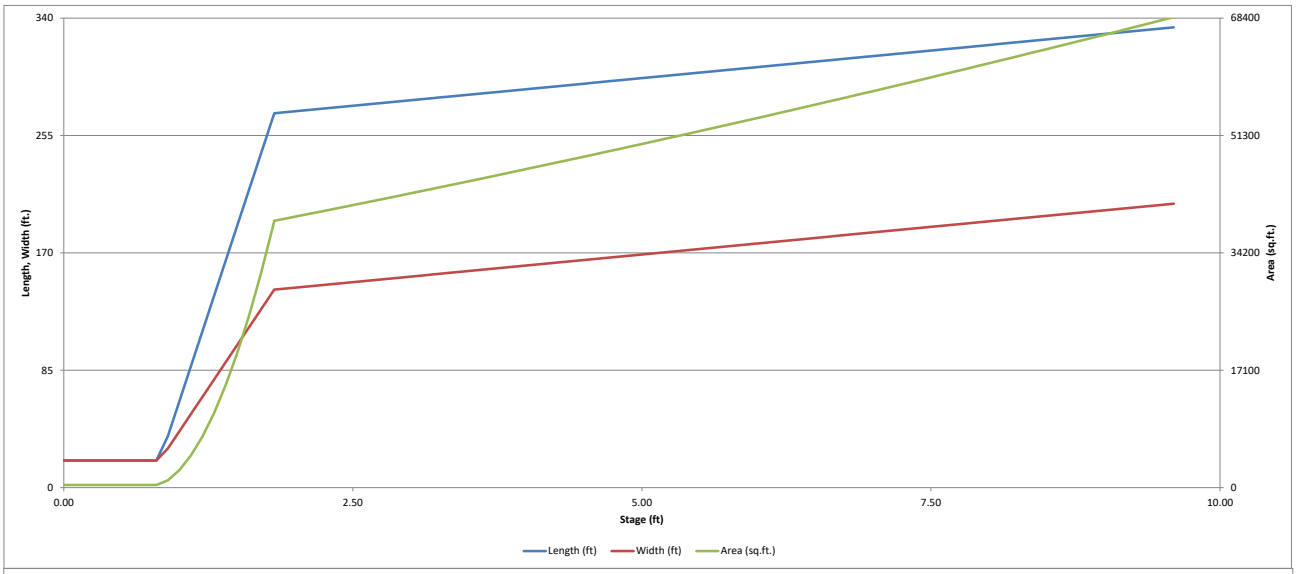
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.975	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.322	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.370	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.903	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.321	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.486	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	9.112	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	11.293	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.39 in.) =	17.208	acre-feet	3.39	inches
Approximate 2-yr Detention Volume =	1.653	acre-feet		
Approximate 5-yr Detention Volume =	2.375	acre-feet		
Approximate 10-yr Detention Volume =	3.504	acre-feet		
Approximate 25-yr Detention Volume =	4.095	acre-feet		
Approximate 50-yr Detention Volume =	4.317	acre-feet		
Approximate 100-yr Detention Volume =	5.132	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.975	acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.400	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.757	acre-feet
Total Detention Basin Volume =	5.132	acre-feet
Initial Surcharge Volume (ISV) =	127	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	386	ft^2
Surcharge Volume Length (L_{ISV}) =	19.6	ft
Surcharge Volume Width (W_{ISV}) =	19.6	ft
Depth of Basin Floor (H_{FLOOR}) =	0.99	ft
Length of Basin Floor (L_{FLOOR}) =	271.1	ft
Width of Basin Floor (W_{FLOOR}) =	143.4	ft
Area of Basin Floor (A_{FLOOR}) =	38,876	ft^2
Volume of Basin Floor (V_{FLOOR}) =	14,235	ft^3
Depth of Main Basin (H_{MAIN}) =	4.18	ft
Length of Main Basin (L_{MAIN}) =	304.5	ft
Width of Main Basin (W_{MAIN}) =	176.8	ft
Area of Main Basin (A_{MAIN}) =	53,855	ft^2
Volume of Main Basin (V_{MAIN}) =	192,959	ft^3
Calculated Total Basin Volume (V_{total}) =	**4.764**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		19.6	19.6	386		0.009		
ISV	0.33		19.6	19.6	386		0.009	127	0.003
	0.40		19.6	19.6	386		0.009	154	0.004
	0.50		19.6	19.6	386		0.009	193	0.004
	0.60		19.6	19.6	386		0.009	232	0.005
	0.70		19.6	19.6	386		0.009	270	0.006
	0.80		19.6	19.6	386		0.009	309	0.007
	0.90		37.4	28.4	1,063		0.024	369	0.008
	1.00		62.8	40.9	2,569		0.059	546	0.013
	1.10		88.2	53.4	4,711		0.108	904	0.021
	1.20		113.6	65.9	7,488		0.172	1,509	0.035
	1.30		139.0	78.4	10,899		0.250	2,423	0.056
	1.40		164.4	90.9	14,946		0.343	3,710	0.085
	1.50		189.8	103.4	19,628		0.451	5,433	0.125
	1.60		215.2	115.9	24,944		0.573	7,657	0.176
	1.70		240.6	128.4	30,896		0.709	10,443	0.240
	1.80		266.0	140.9	37,482		0.860	13,857	0.318
Floor	1.82		271.1	143.4	38,876		0.892	14,621	0.336
	1.90		271.7	144.0	39,142		0.899	17,741	0.407
	2.00		272.5	144.8	39,475		0.906	21,672	0.498
	2.10		273.3	145.6	39,809		0.914	25,636	0.589
	2.20		274.1	146.4	40,145		0.922	29,634	0.680
	2.30		274.9	147.2	40,482		0.929	33,665	0.773
	2.40		275.7	148.0	40,821		0.937	37,730	0.866
Zone 1 (WQCV)	2.45		276.1	148.4	40,990		0.941	39,776	0.913
	2.50		276.5	148.8	41,160		0.945	41,830	0.960
	2.60		277.3	149.6	41,501		0.953	45,963	1.055
	2.70		278.1	150.4	41,844		0.961	50,130	1.151
	2.80		278.9	151.2	42,187		0.968	54,331	1.247
	2.90		279.7	152.0	42,532		0.976	58,567	1.345
	3.00		280.5	152.8	42,878		0.984	62,838	1.443
	3.10		281.3	153.6	43,225		0.992	67,143	1.541
	3.20		282.1	154.4	43,574		1.000	71,483	1.641
Zone 2 (5-year)	3.23		282.4	154.7	43,679		1.003	72,792	1.671
	3.30		282.9	155.2	43,924		1.008	75,858	1.741
	3.40		283.7	156.0	44,275		1.016	80,268	1.843
	3.50		284.5	156.8	44,627		1.025	84,713	1.945
	3.60		285.3	157.6	44,981		1.033	89,193	2.048
	3.70		286.1	158.4	45,336		1.041	93,709	2.151
	3.80		286.9	159.2	45,693		1.049	98,260	2.256
	3.90		287.7	160.0	46,050		1.057	102,848	2.361
	4.00		288.5	160.8	46,409		1.065	107,471	2.467
	4.10		289.3	161.6	46,769		1.074	112,129	2.574
	4.20		290.1	162.4	47,131		1.082	116,824	2.682
	4.30		290.9	163.2	47,493		1.090	121,556	2.791
	4.40		291.7	164.0	47,857		1.099	126,323	2.900
	4.50		292.5	164.8	48,223		1.107	131,127	3.010
	4.60		293.3	165.6	48,589		1.115	135,968	3.121
	4.70		294.1	166.4	48,957		1.124	140,845	3.233
	4.80		294.9	167.2	49,326		1.132	145,759	3.346
	4.90		295.7	168.0	49,696		1.141	150,710	3.460
	5.00		296.5	168.8	50,068		1.149	155,698	3.574
	5.10		297.3	169.6	50,441		1.158	160,724	3.690
	5.20		298.1	170.4	50,815		1.167	165,787	3.806
	5.30		298.9	171.2	51,191		1.175	170,887	3.923
	5.40		299.7	172.0	51,568		1.184	176,025	4.041
	5.50		300.5	172.8	51,946		1.193	181,201	4.160
	5.60		301.3	173.6	52,325		1.201	186,414	4.279
	5.70		302.1	174.4	52,706		1.210	191,666	4.400
	5.80		302.9	175.2	53,087		1.219	196,955	4.521
	5.90		303.7	176.0	53,471		1.228	202,283	4.644
Zone 3 (100-year)	5.98		304.4	176.7	53,778		1.235	206,573	4.742
	6.00		304.5	176.8	53,855		1.236	207,649	4.767
	6.10		305.3	177.6	54,241		1.245	213,054	4.891
	6.20		306.1	178.4	54,628		1.254	218,498	5.016
	6.30		306.9	179.2	55,016		1.263	223,980	5.142
	6.40		307.7	180.0	55,406		1.272	229,501	5.269
	6.50		308.5	180.8	55,797		1.281	235,061	5.396
	6.60		309.3	181.6	56,189		1.290	240,660	5.525
	6.70		310.1	182.4	56,582		1.299	246,299	5.654
	6.80		310.9	183.2	56,977		1.308	251,977	5.785
	6.90		311.7	184.0	57,373		1.317	257,694	5.916
	7.00		312.5	184.8	57,770		1.326	263,451	6.048
	7.10		313.3	185.6	58,169		1.335	269,248	6.181
	7.20		314.1	186.4	58,569		1.345	275,085	6.315
	7.30		314.9	187.2	58,970		1.354	280,962	6.450
	7.40		315.7	188.0	59,372		1.363	286,879	6.586
	7.50		316.5	188.8	59,776		1.372	292,837	6.723
	7.60		317.3	189.6	60,181		1.382	298,834	6.860
	7.70		318.1	190.4	60,587		1.391	304,873	6.999
	7.80		318.9	191.2	60,994		1.400	310,952	7.138
	7.90		319.7	192.0	61,403		1.410	317,072	7.279
	8.00		320.5	192.8	61,813		1.419	323,232	7.420
	8.10		321.3	193.6	62,225		1.428	329,434	7.563
	8.20		322.1	194.4	62,637		1.438	335,677	7.706
	8.30		322.9	195.2	63,051		1.447	341,962	7.850
	8.40		323.7	196.0	63,466		1.457	348,288	7.996
	8.50		324.5	196.8	63,883		1.467	354,655	8.142
	8.60		325.3	197.6	64,301		1.476	361,064	8.289
	8.70		326.1	198.4	64,720		1.486	367,515	8.437
	8.80		326.9	199.2	65,140		1.495	374,008	8.586
	8.90		327.7	200.0	65,561		1.505	380,543	8.736
	9.00		328.5	200.8	65,984		1.515	387,121	8.887
	9.10		329.3	201.6	66,409		1.525	393,740	9.039
	9.20		330.1	202.4	66,834		1.534	400,402	9.192
	9.30		330.9	203.2	67,261		1.544	407,107	9.346
	9.40		331.7	204.0	67,689		1.554	413,855	9.501
	9.50		332.5	204.8	68,118		1.564	420,645	9.657
	9.60		333.3	205.6	68,548		1.574	427,478	9.814


340
255
170
85
0
Length, Width (ft.)
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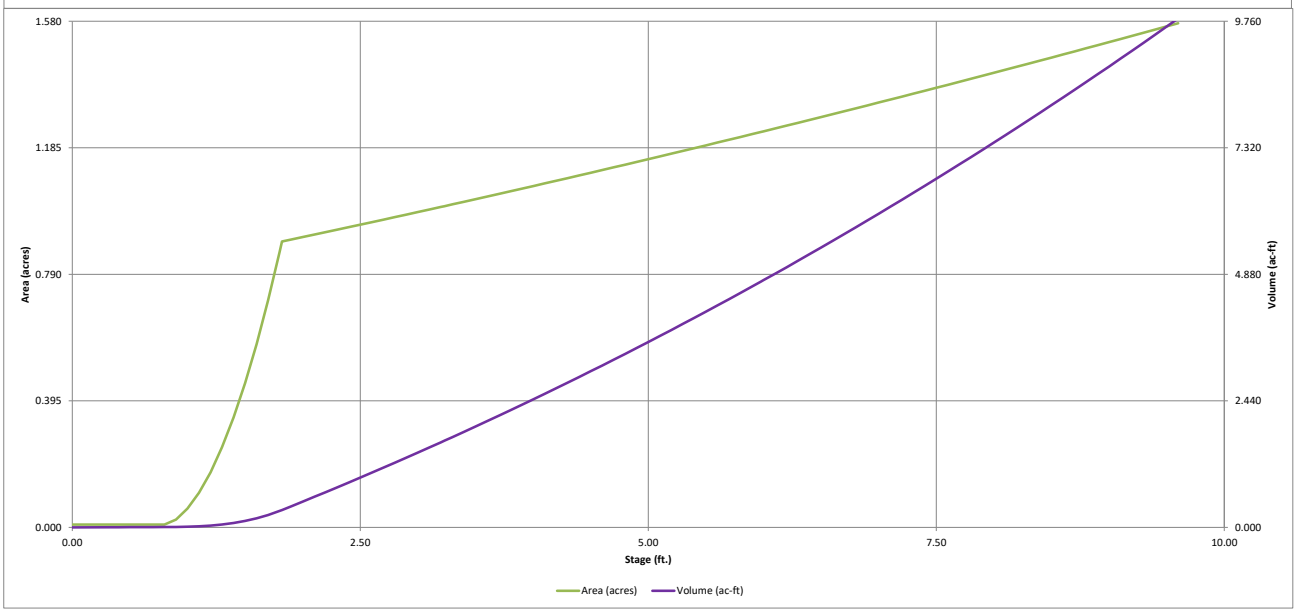
51300
34200
17100
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)


1.580
1.185
0.790
0.395
0.000
Area (acres)
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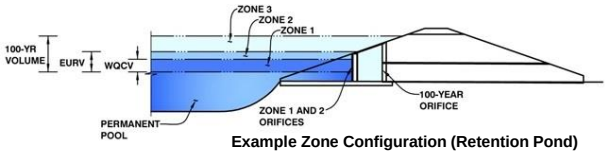
7.320
4.880
2.440
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 11**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.52	0.975	Orifice Plate
Zone 2 (5-year)	3.92	1.400	Weir&Pipe (Circular)
Zone 3 (100-year)	6.30	2.757	Weir&Pipe (Restrict)
Total (all zones)		5.132	

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 =	3.92	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)	3.57	3.57	3.57	10.00				

	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 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	2.52	3.92	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	10.00	10.00	feet
Overflow Weir Grate Slope =	0.00	4.00	H:V
Horiz. Length of Weir Sides =	10.00	18.00	feet
Overflow Grate Type =	Type C Grate	Type C Grate	
Debris Clogging % =	50%	50%	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir	
Height of Grate Upper Edge, H_t =	2.52	8.42	feet
Overflow Weir Slope Length =	10.00	18.55	feet
Grate Open Area / 100-yr Orifice Area =	9.85	7.39	
Overflow Grate Open Area w/o Debris =	69.60	129.14	ft^2
Overflow Grate Open Area w/ Debris =	34.80	64.57	ft^2

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

	Zone 2 Circular	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.50	2.80	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter or Pipe Diameter =	36.00	60.00	inches
Restrictor Plate Height Above Pipe Invert =		50.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Zone 3 Restrictor	
Outlet Orifice Area =	7.07	17.48	ft^2
Outlet Orifice Centroid =	1.50	2.25	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	2.30	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	15.30	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.97	feet
Spillway Crest Length =	96.00	feet	Stage at Top of Freeboard =	17.27	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.42	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	25.02	acre-ft

Calculated Parameters for Spillway

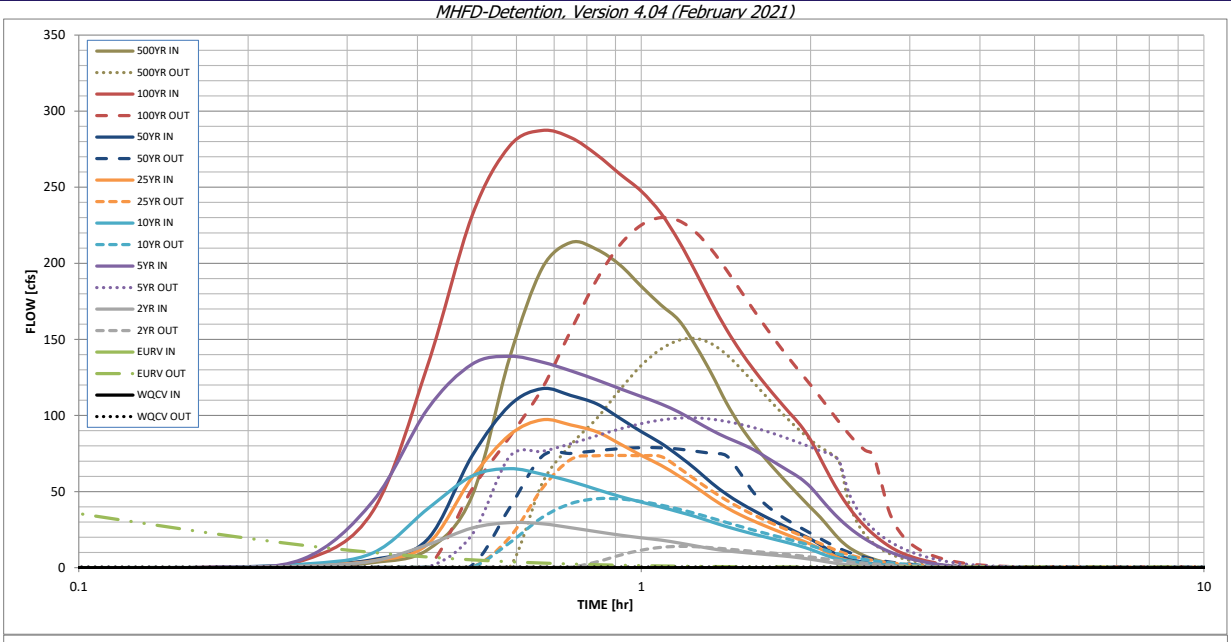
Routed Hydrograph Results

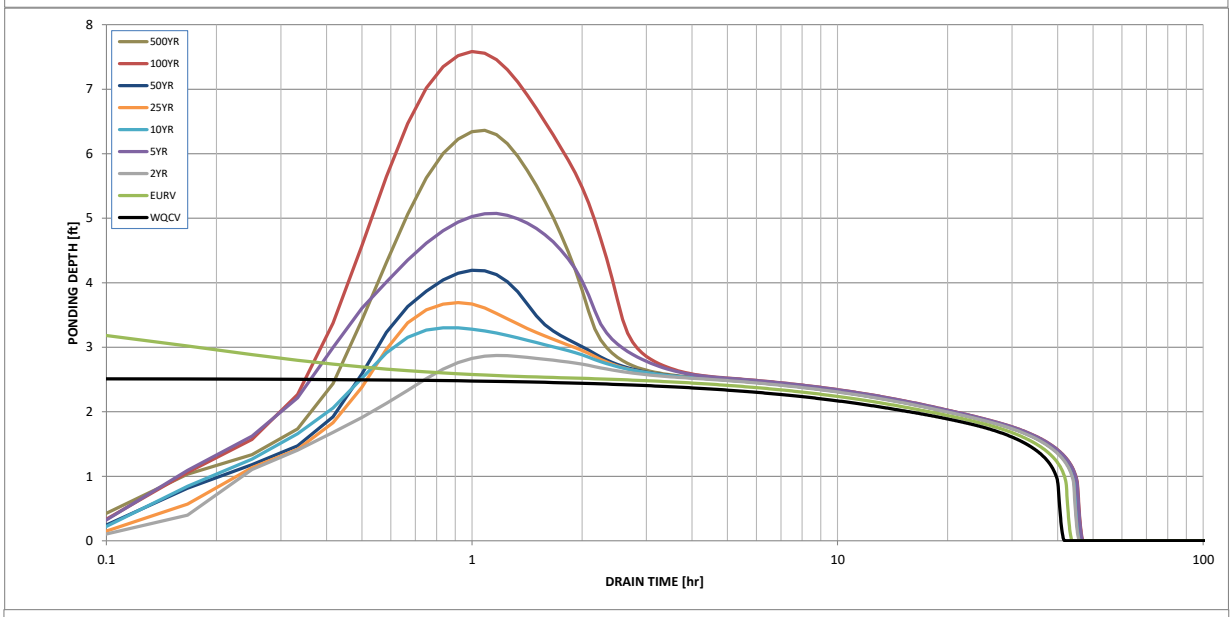
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

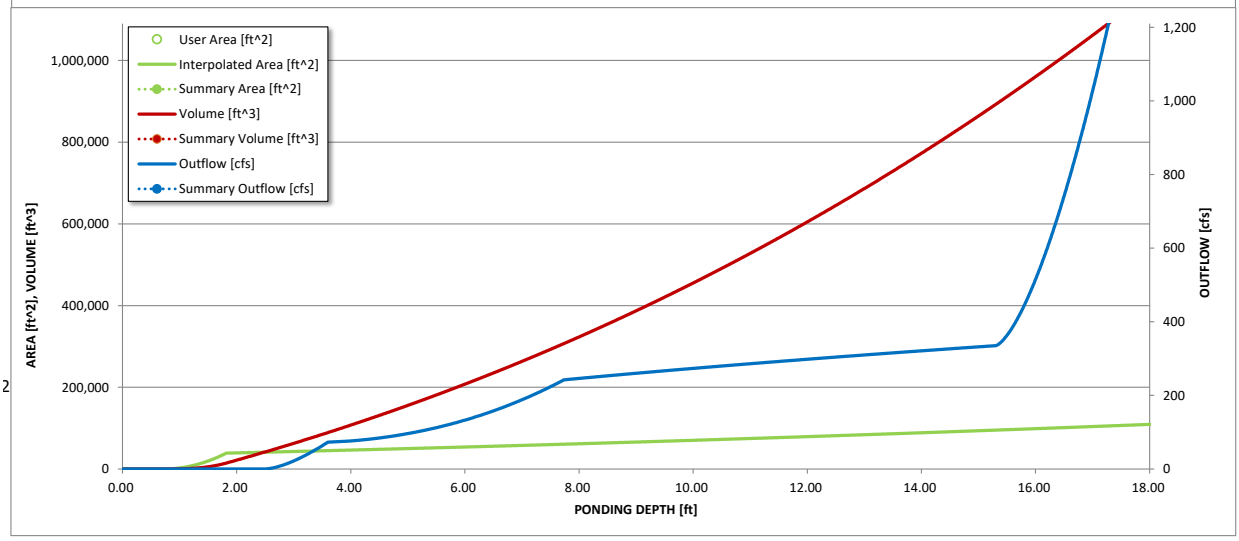
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.39
CUHP Runoff Volume (acre-ft) =	0.975	2.322	2.370	3.903	5.321	7.486	9.112	11.293	17.208
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.370	15.619	5.321	7.486	9.112	28.758	17.208
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	9.0	25.0	37.8	67.7	85.0	108.0	168.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		103.5				221.3	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	1.30	0.47	0.85	1.07	2.78	2.11
Peak Inflow Q (cfs) =	N/A	N/A	29.6	138.9	65.1	97.2	117.7	287.3	213.7
Peak Outflow Q (cfs) =	0.4	73.2	14.0	98.4	45.3	73.7	78.9	230.0	150.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.2	1.1	0.9	1.0	0.9
Structure Controlling Flow =	Overflow Weir 1	Outlet Plate 1	Overflow Weir 1	Overflow Weir 2	Overflow Weir 1	Outlet Plate 1	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2
Max Velocity through Grate 1 (fps) =	N/A	1.07	0.19	1.2	0.6	1.0	1.1	1.4	1.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	0.1	N/A	N/A	0.0	1.0	0.4
Time to Drain 97% of Inflow Volume (hours) =	38	38	40	22	36	32	30	9	20
Time to Drain 99% of Inflow Volume (hours) =	**40**	41	43	36	41	40	39	30	35
Maximum Ponding Depth (ft) =	2.52	3.87	2.87	5.07	3.30	3.69	4.19	7.58	6.36
Area at Maximum Ponding Depth (acres) =	0.95	1.05	0.97	1.16	1.01	1.04	1.08	1.38	1.27
Maximum Volume Stored (acre-ft) =	0.979	2.329	1.315	3.655	1.741	2.141	2.671	6.833	5.218

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.15	0.00	0.00	0.13	0.23	0.59
	0:15:00	0.00	0.00	1.10	5.66	2.29	1.55	1.99	4.66	3.32
	0:20:00	0.00	0.00	4.30	43.71	9.70	4.49	5.33	37.21	11.68
	0:25:00	0.00	0.00	15.06	104.14	38.56	15.22	18.54	132.57	46.97
	0:30:00	0.00	0.00	26.05	133.65	60.20	59.13	73.34	231.06	138.01
	0:35:00	0.00	0.00	29.62	138.88	65.06	87.24	106.62	277.06	196.91
	0:40:00	0.00	0.00	28.86	135.05	61.42	97.17	117.65	287.31	213.74
	0:45:00	0.00	0.00	26.23	129.30	56.65	93.75	113.10	282.54	209.10
	0:50:00	0.00	0.00	23.66	123.37	51.42	89.28	107.62	271.32	198.85
	0:55:00	0.00	0.00	21.40	117.59	46.77	81.30	98.15	258.59	184.87
	1:00:00	0.00	0.00	19.63	112.46	43.09	73.75	89.36	247.38	172.67
	1:05:00	0.00	0.00	18.13	107.62	39.83	67.32	81.86	232.96	162.45
	1:10:00	0.00	0.00	16.24	102.21	36.61	60.20	73.37	214.44	145.69
	1:15:00	0.00	0.00	14.28	96.08	33.50	52.93	64.66	194.13	127.38
	1:20:00	0.00	0.00	12.44	90.31	30.08	45.60	55.68	174.02	108.38
	1:25:00	0.00	0.00	11.10	85.56	27.02	39.51	48.32	156.65	93.15
	1:30:00	0.00	0.00	10.17	81.68	24.41	34.69	42.46	142.30	81.07
	1:35:00	0.00	0.00	9.39	77.51	22.10	30.68	37.56	130.26	71.10
	1:40:00	0.00	0.00	8.68	72.64	20.00	27.16	33.23	119.80	62.24
	1:45:00	0.00	0.00	7.98	67.83	18.03	23.98	29.32	110.45	54.17
	1:50:00	0.00	0.00	7.29	63.29	16.14	21.03	25.66	101.85	46.61
	1:55:00	0.00	0.00	6.43	58.80	14.16	18.18	22.15	93.77	39.51
	2:00:00	0.00	0.00	5.54	52.93	11.97	15.45	18.79	83.86	32.89
	2:05:00	0.00	0.00	4.50	45.41	9.47	12.30	14.90	71.47	25.53
	2:10:00	0.00	0.00	3.48	38.21	7.13	9.14	11.03	59.49	18.66
	2:15:00	0.00	0.00	2.60	32.02	5.56	6.40	7.83	49.02	13.63
	2:20:00	0.00	0.00	2.00	26.82	4.51	4.72	5.84	40.28	10.21
	2:25:00	0.00	0.00	1.61	22.47	3.68	3.56	4.44	33.01	7.66
	2:30:00	0.00	0.00	1.31	18.85	2.99	2.72	3.41	27.03	5.71
	2:35:00	0.00	0.00	1.07	15.76	2.41	2.08	2.62	22.10	4.21
	2:40:00	0.00	0.00	0.86	13.07	1.92	1.61	2.01	17.94	3.04
	2:45:00	0.00	0.00	0.69	10.76	1.50	1.22	1.53	14.43	2.18
	2:50:00	0.00	0.00	0.56	8.85	1.17	0.93	1.16	11.58	1.64
	2:55:00	0.00	0.00	0.45	7.28	0.90	0.73	0.91	9.35	1.28
	3:00:00	0.00	0.00	0.37	5.98	0.70	0.57	0.71	7.60	1.02
	3:05:00	0.00	0.00	0.29	4.89	0.54	0.45	0.55	6.19	0.80
	3:10:00	0.00	0.00	0.23	3.95	0.41	0.34	0.42	5.01	0.61
	3:15:00	0.00	0.00	0.17	3.16	0.30	0.25	0.31	4.01	0.44
	3:20:00	0.00	0.00	0.12	2.49	0.21	0.18	0.22	3.17	0.30
	3:25:00	0.00	0.00	0.08	1.93	0.13	0.12	0.14	2.46	0.19
	3:30:00	0.00	0.00	0.05	1.47	0.07	0.07	0.08	1.88	0.10
	3:35:00	0.00	0.00	0.03	1.11	0.03	0.03	0.04	1.41	0.04
	3:40:00	0.00	0.00	0.01	0.82	0.01	0.01	0.01	1.04	0.01
	3:45:00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.76	0.00
	3:50:00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.54	0.00
	3:55:00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.39	0.00
	4:00:00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.28	0.00
	4:05:00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.20	0.00
	4:10:00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.15	0.00
	4:15:00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.12	0.00
	4:20:00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.08	0.00
	4:25:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.00
	4:30:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00
	4:35:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03	0.00
	4:40:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	4:45:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	4:50:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:55:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:00:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:05:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:15:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	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'.

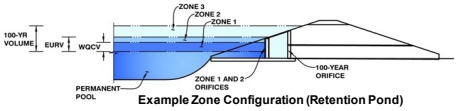
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Flying Horse North Master Drainage Plan

Basin ID: Pond 13



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	23.03	acres
Watershed Length =	1,258	ft
Watershed Length to Centroid =	783	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	65.00%	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.

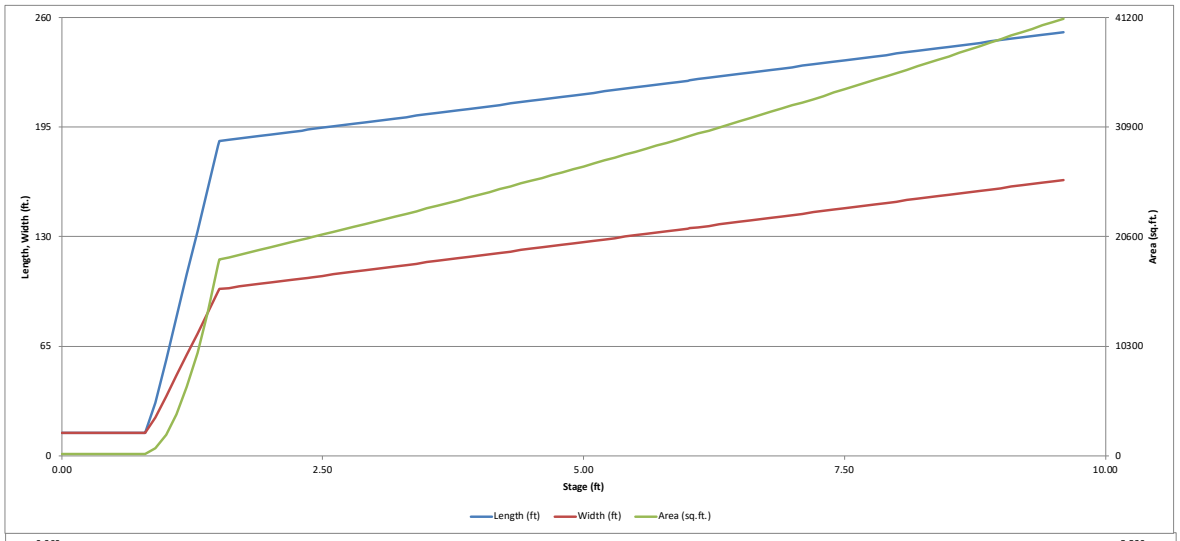
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.488	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.634	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.042	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.456	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.884	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.406	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.276	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.989	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.262	acre-feet		inches
Approximate 2-yr Detention Volume =	1.267	acre-feet		
Approximate 5-yr Detention Volume =	1.699	acre-feet		
Approximate 10-yr Detention Volume =	2.166	acre-feet		
Approximate 25-yr Detention Volume =	2.333	acre-feet		
Approximate 50-yr Detention Volume =	2.430	acre-feet		
Approximate 100-yr Detention Volume =	2.627	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.488	acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.211	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.927	acre-feet
Total Detention Basin Volume =	2.627	acre-feet
Initial Surcharge Volume (ISV) =	64	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	193	ft^2
Surcharge Volume Length (L_{ISV}) =	13.9	ft
Surcharge Volume Width (W_{ISV}) =	13.9	ft
Depth of Basin Floor (H_{FLOOR}) =	0.68	ft
Length of Basin Floor (L_{FLOOR}) =	186.6	ft
Width of Basin Floor (W_{FLOOR}) =	98.9	ft
Area of Basin Floor (A_{FLOOR}) =	18,456	ft^2
Volume of Basin Floor (V_{FLOOR}) =	4,655	ft^3
Depth of Main Basin (H_{MAIN}) =	4.49	ft
Length of Main Basin (L_{MAIN}) =	222.5	ft
Width of Main Basin (W_{MAIN}) =	134.8	ft
Area of Main Basin (A_{MAIN}) =	30,002	ft^2
Volume of Main Basin (V_{MAIN}) =	107,744	ft^3
Calculated Total Basin Volume (V_{total}) =	**2.584**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		13.9	13.9	193		0.004		
ISV	0.33		13.9	13.9	193		0.004	64	0.001
	0.40		13.9	13.9	193		0.004	77	0.002
	0.50		13.9	13.9	193		0.004	97	0.002
	0.60		13.9	13.9	193		0.004	116	0.003
	0.70		13.9	13.9	193		0.004	135	0.003
	0.80		13.9	13.9	193		0.004	155	0.004
	0.90		31.7	22.6	717		0.016	190	0.004
	1.00		57.1	35.1	2,006		0.046	321	0.007
	1.10		82.5	47.6	3,930		0.090	613	0.014
	1.20		107.9	60.1	6,489		0.149	1,128	0.026
	1.30		133.3	72.6	9,682		0.222	1,932	0.044
	1.40		158.7	85.1	13,511		0.310	3,086	0.071
	1.50		184.1	97.6	17,975		0.413	4,655	0.107
Floor	1.51		186.6	98.9	18,456		0.424	4,837	0.111
	1.60		187.3	99.6	18,662		0.428	6,507	0.149
	1.70		188.1	100.4	18,892		0.434	8,385	0.192
	1.80		188.9	101.2	19,124		0.439	10,286	0.236
	1.90		189.7	102.0	19,357		0.444	12,210	0.280
	2.00		190.5	102.8	19,591		0.450	14,157	0.325
	2.10		191.3	103.6	19,826		0.455	16,128	0.370
	2.20		192.1	104.4	20,063		0.461	18,123	0.416
	2.30		192.9	105.2	20,300		0.466	20,141	0.462
Zone 1 (WQCV)	2.36		193.4	105.7	20,444		0.469	21,363	0.490
	2.40		193.7	106.0	20,540		0.472	22,183	0.509
	2.50		194.5	106.8	20,780		0.477	24,249	0.557
	2.60		195.3	107.6	21,022		0.483	26,339	0.605
	2.70		196.1	108.4	21,265		0.488	28,453	0.653
	2.80		196.9	109.2	21,509		0.494	30,592	0.702
	2.90		197.7	110.0	21,755		0.499	32,755	0.752
	3.00		198.5	110.8	22,001		0.505	34,943	0.802
	3.10		199.3	111.6	22,250		0.511	37,155	0.853
	3.20		200.1	112.4	22,499		0.517	39,393	0.904
	3.30		200.9	113.2	22,750		0.522	41,655	0.956
	3.40		201.7	114.0	23,002		0.528	43,943	1.009
	3.50		202.5	114.8	23,255		0.534	46,255	1.062
	3.60		203.3	115.6	23,509		0.540	48,594	1.116
	3.70		204.1	116.4	23,765		0.546	50,957	1.170
	3.80		204.9	117.2	24,022		0.551	53,347	1.225
	3.90		205.7	118.0	24,281		0.557	55,762	1.280
	4.00		206.5	118.8	24,540		0.563	58,203	1.336
Zone 2 (5-year)	4.05		206.9	119.2	24,671		0.566	59,433	1.364
	4.10		207.3	119.6	24,801		0.569	60,670	1.393
	4.20		208.1	120.4	25,063		0.575	63,163	1.450
	4.30		208.9	121.2	25,327		0.581	65,683	1.508
	4.40		209.7	122.0	25,592		0.588	68,228	1.566
	4.50		210.5	122.8	25,858		0.594	70,801	1.625
	4.60		211.3	123.6	26,125		0.600	73,400	1.685
	4.70		212.1	124.4	26,394		0.606	76,026	1.745
	4.80		212.9	125.2	26,663		0.612	78,679	1.806
	4.90		213.7	126.0	26,935		0.618	81,359	1.868
	5.00		214.5	126.8	27,207		0.625	84,066	1.930
	5.10		215.3	127.6	27,481		0.631	86,800	1.993
	5.20		216.1	128.4	27,756		0.637	89,562	2.056
	5.30		216.9	129.2	28,032		0.644	92,351	2.120
	5.40		217.7	130.0	28,310		0.650	95,168	2.185
	5.50		218.5	130.8	28,589		0.656	98,013	2.250
	5.60		219.3	131.6	28,869		0.663	100,886	2.316
	5.70		220.1	132.4	29,150		0.669	103,787	2.383
	5.80		220.9	133.2	29,433		0.676	106,716	2.450
	5.90		221.7	134.0	29,717		0.682	109,674	2.518
	6.00		222.5	134.8	30,002		0.689	112,660	2.586
Zone 3 (100-year)	6.02		222.7	135.0	30,059		0.690	113,260	2.600
	6.10		223.3	135.6	30,288		0.695	115,674	2.656
	6.20		224.1	136.4	30,576		0.702	118,717	2.725
	6.30		224.9	137.2	30,865		0.709	121,789	2.796
	6.40		225.7	138.0	31,156		0.715	124,890	2.867
	6.50		226.5	138.8	31,447		0.722	128,021	2.939
	6.60		227.3	139.6	31,740		0.729	131,180	3.011
	6.70		228.1	140.4	32,034		0.735	134,369	3.085
	6.80		228.9	141.2	32,330		0.742	137,587	3.159
	6.90		229.7	142.0	32,627		0.749	140,835	3.233
	7.00		230.5	142.8	32,925		0.756	144,112	3.308
	7.10		231.3	143.6	33,224		0.763	147,420	3.384
	7.20		232.1	144.4	33,525		0.770	150,757	3.461
	7.30		232.9	145.2	33,827		0.777	154,125	3.538
	7.40		233.7	146.0	34,130		0.784	157,523	3.616
	7.50		234.5	146.8	34,434		0.791	160,951	3.695
	7.60		235.3	147.6	34,740		0.798	164,409	3.774
	7.70		236.1	148.4	35,047		0.805	167,899	3.854
	7.80		236.9	149.2	35,355		0.812	171,419	3.935
	7.90		237.7	150.0	35,665		0.819	174,970	4.017
	8.00		238.5	150.8	35,976		0.826	178,552	4.099
	8.10		239.3	151.6	36,288		0.833	182,165	4.182
	8.20		240.1	152.4	36,601		0.840	185,809	4.266
	8.30		240.9	153.2	36,916		0.847	189,485	4.350
	8.40		241.7	154.0	37,232		0.855	193,193	4.435
	8.50		242.5	154.8	37,549		0.862	196,932	4.521
	8.60		243.3	155.6	37,868		0.869	200,702	4.607
	8.70		244.1	156.4	38,187		0.877	204,505	4.695
	8.80		244.9	157.2	38,508		0.884	208,340	4.783
	8.90		245.7	158.0	38,831		0.891	212,207	4.872
	9.00		246.5	158.8	39,154		0.899	216,106	4.961
	9.10		247.3	159.6	39,479		0.906	220,038	5.051
	9.20		248.1	160.4	39,806		0.914	224,002	5.142
	9.30		248.9	161.2	40,133		0.921	227,999	5.234
	9.40		249.7	162.0	40,462		0.929	232,029	5.327
	9.50		250.5	162.8	40,792		0.936	236,091	5.420
	9.60		251.3	163.6	41,123		0.944	240,187	5.514


260
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130
65
0
41200
30900
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10300
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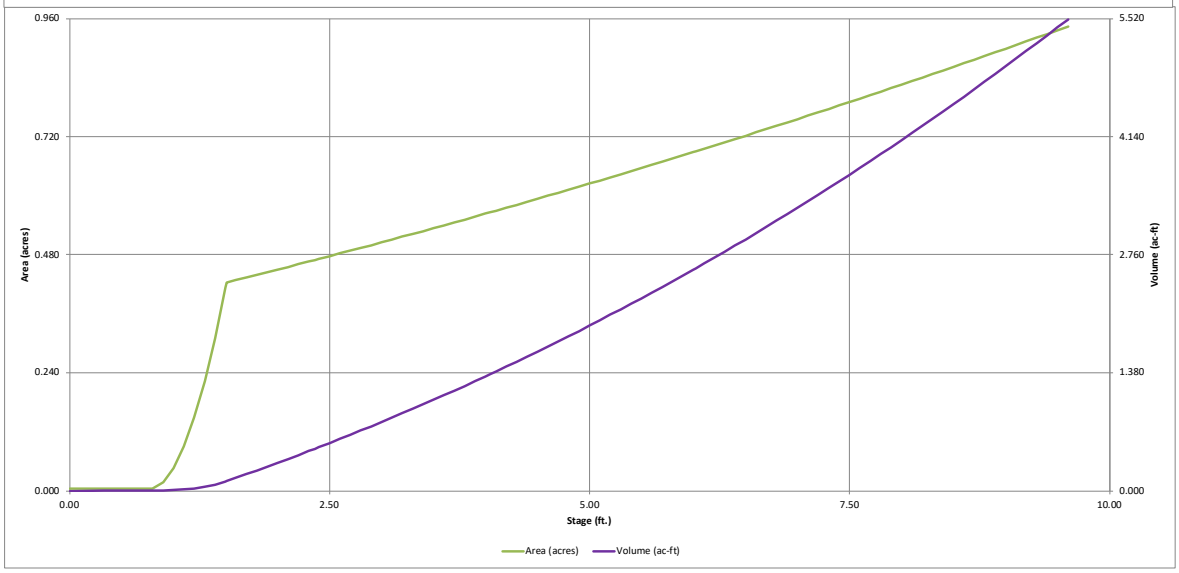
0.00
2.50
5.00
7.50
10.00
Length, Width (ft.)
Area (sq.ft.)
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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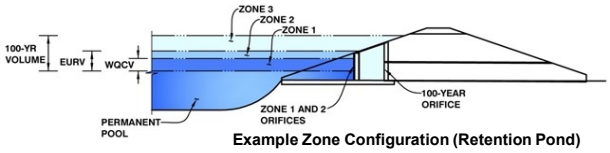
5.520
4.140
2.760
1.380
0.000
0.00
2.50
5.00
7.50
10.00
Area (acres)
Volume (ac-ft)
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 13**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.36	0.488	Orifice Plate
Zone 2 (5-year)	4.63	1.211	Circular Orifice
Zone 3 (100-year)	6.06	0.927	Weir&Pipe (Restrict)
Total (all zones)		2.627	

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 =	1.167E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.36	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.68	sq. inches (diameter = 1-7/16 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	0.79	1.57					
Orifice Area (sq. inches)	1.68	1.68	1.68					

	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)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected
Invert of Vertical Orifice =	2.36	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	12.57	N/A
Depth at top of Zone using Vertical Orifice =	4.04	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	2.00	N/A
Vertical Orifice Diameter =	48.00	N/A	inches			

Calculated Parameters for Vertical Orif

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 =	4.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.00	N/A
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	1.68	N/A
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	11.14	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.57	N/A
Debris Clogging % =	50%	N/A	%			

Calculated Parameters for Overflow W

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 =	6.62	N/A
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	1.20	N/A
Restrictor Plate Height Above Pipe Invert =	25.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.61	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.92	feet
Spillway Crest Length =	25.00	feet	Stage at Top of Freeboard =	7.92	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.82	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.03	acre-ft

Calculated Parameters for Spillway

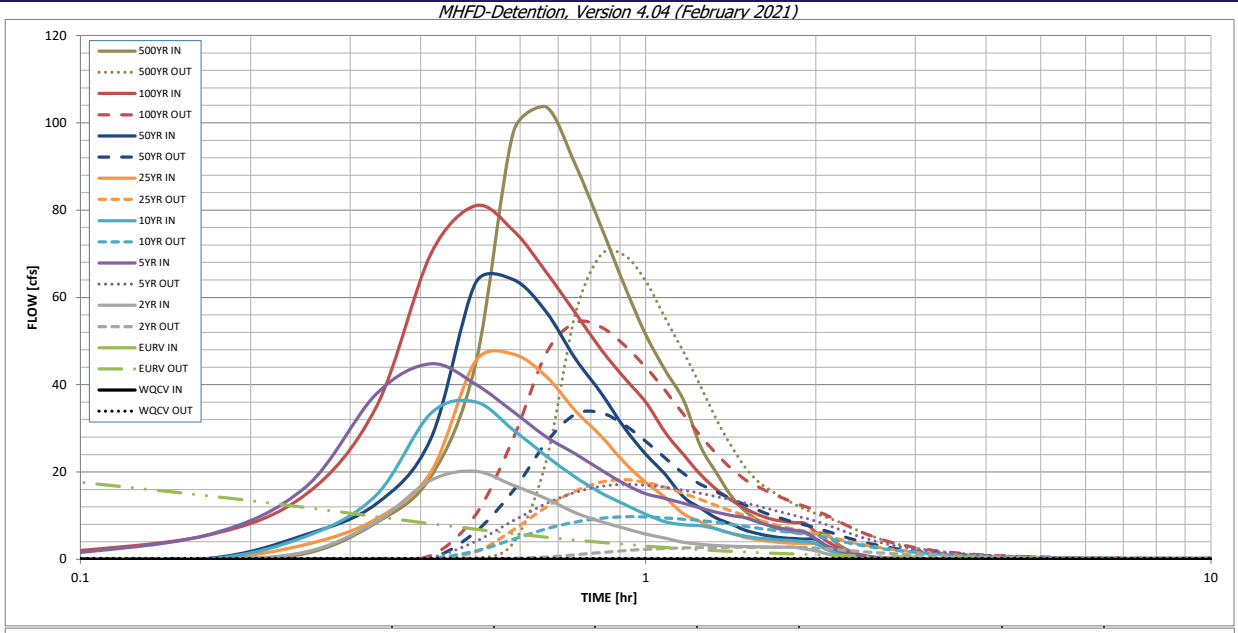
Routed Hydrograph Results

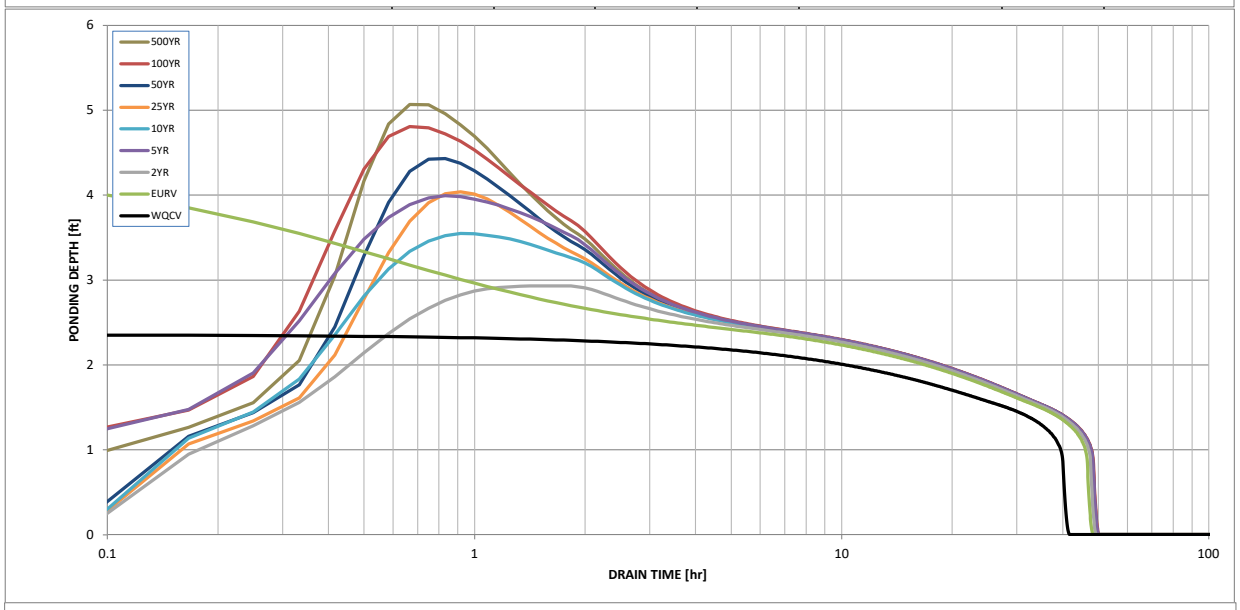
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through A

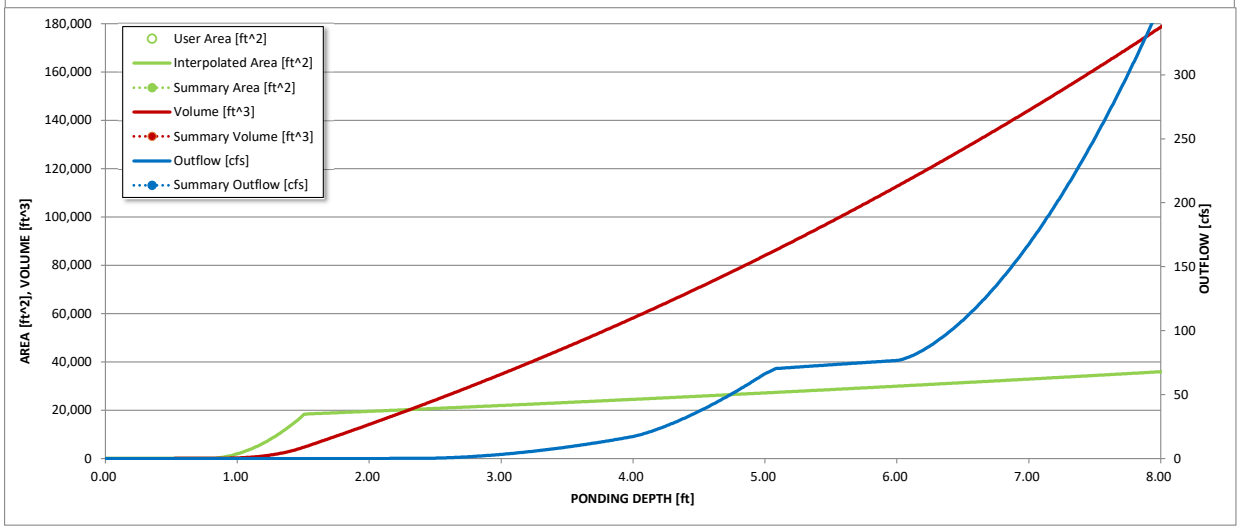
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.488	1.634	1.042	1.456	1.884	2.406	3.276	3.989
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.042	2.782	1.884	2.406	3.276	4.881
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.3	2.3	6.7	15.4	26.0	34.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		20.0				55.0
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.87	0.29	0.67	1.13	2.39
Peak Inflow Q (cfs) =	N/A	N/A	20.1	44.8	36.0	47.0	64.0	81.0
Peak Outflow Q (cfs) =	0.2	29.5	2.8	17.2	9.8	18.2	33.6	54.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	1.4	1.2	1.3	1.0
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	0.87	N/A	N/A	N/A	0.0	0.7	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	41	44	39	42	40	37	33
Time to Drain 99% of Inflow Volume (hours) =	**40**	45	47	45	46	46	45	43
Maximum Ponding Depth (ft) =	2.36	4.52	2.93	3.99	3.55	4.04	4.43	4.81
Area at Maximum Ponding Depth (acres) =	0.47	0.59	0.50	0.56	0.54	0.57	0.59	0.61
Maximum Volume Stored (acre-ft) =	0.490	1.637	0.767	1.331	1.083	1.353	1.584	1.806

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

Inflow Hydrographs

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

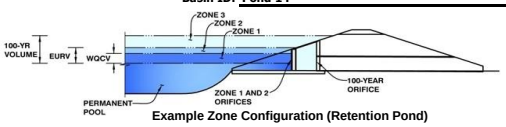
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	1.01	0.00
	0:10:00	0.00	0.00	0.00	5.50	0.00	0.00	0.16	5.44	1.32
	0:15:00	0.00	0.00	1.65	16.52	5.18	3.36	5.62	14.77	8.33
	0:20:00	0.00	0.00	8.60	37.83	14.67	9.22	12.68	34.79	18.87
	0:25:00	0.00	0.00	18.09	44.78	33.40	19.95	27.64	69.96	44.82
	0:30:00	0.00	0.00	20.15	40.12	36.04	45.48	63.36	81.03	97.91
	0:35:00	0.00	0.00	16.94	33.76	29.63	47.00	64.04	75.29	103.64
	0:40:00	0.00	0.00	13.89	28.06	23.69	41.94	56.72	65.86	90.52
	0:45:00	0.00	0.00	10.69	24.15	18.86	34.08	46.05	56.52	76.40
	0:50:00	0.00	0.00	8.62	20.52	15.26	28.31	38.19	48.17	62.76
	0:55:00	0.00	0.00	7.12	17.27	12.58	22.18	30.11	41.54	51.52
	1:00:00	0.00	0.00	5.79	15.04	10.31	17.65	24.11	36.06	43.26
	1:05:00	0.00	0.00	4.82	13.92	8.58	14.12	19.40	29.01	36.45
	1:10:00	0.00	0.00	3.89	12.85	7.88	10.43	14.27	23.97	25.86
	1:15:00	0.00	0.00	3.42	11.72	7.67	8.59	11.74	19.45	19.89
	1:20:00	0.00	0.00	3.15	10.79	6.93	6.94	9.44	16.03	14.49
	1:25:00	0.00	0.00	3.00	10.06	5.95	5.95	8.05	13.55	11.02
	1:30:00	0.00	0.00	2.90	9.51	5.30	5.01	6.68	11.61	8.96
	1:35:00	0.00	0.00	2.84	8.46	4.86	4.43	5.82	10.19	7.57
	1:40:00	0.00	0.00	2.79	7.61	4.57	4.06	5.27	9.21	6.69
	1:45:00	0.00	0.00	2.77	7.03	4.38	3.81	4.90	8.72	6.17
	1:50:00	0.00	0.00	2.77	6.64	4.25	3.69	4.72	8.40	5.99
	1:55:00	0.00	0.00	2.30	6.20	4.02	3.61	4.60	8.20	5.90
	2:00:00	0.00	0.00	1.98	4.66	3.60	3.58	4.55	6.18	5.90
	2:05:00	0.00	0.00	1.30	3.24	2.36	2.35	2.99	4.29	3.89
	2:10:00	0.00	0.00	0.82	2.25	1.52	1.52	1.93	3.00	2.50
	2:15:00	0.00	0.00	0.52	1.57	0.95	0.96	1.21	2.06	1.58
	2:20:00	0.00	0.00	0.30	1.09	0.56	0.57	0.73	1.43	0.94
	2:25:00	0.00	0.00	0.16	0.74	0.32	0.34	0.43	0.96	0.56
	2:30:00	0.00	0.00	0.07	0.48	0.15	0.17	0.21	0.62	0.28
	2:35:00	0.00	0.00	0.02	0.32	0.05	0.06	0.07	0.41	0.09
	2:40:00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.31	0.00
	2:45:00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.24	0.00
	2:50:00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.18	0.00
	2:55:00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.12	0.00
	3:00:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.08	0.00
	3:05:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.06	0.00
	3:10:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	3:15:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	3:20:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	3:25:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 14**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	97.53	acres
Watershed Length =	4,027	ft
Watershed Length to Centroid =	2,183	ft
Watershed Slope =	0.059	ft/ft
Watershed Imperviousness =	10.00%	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.

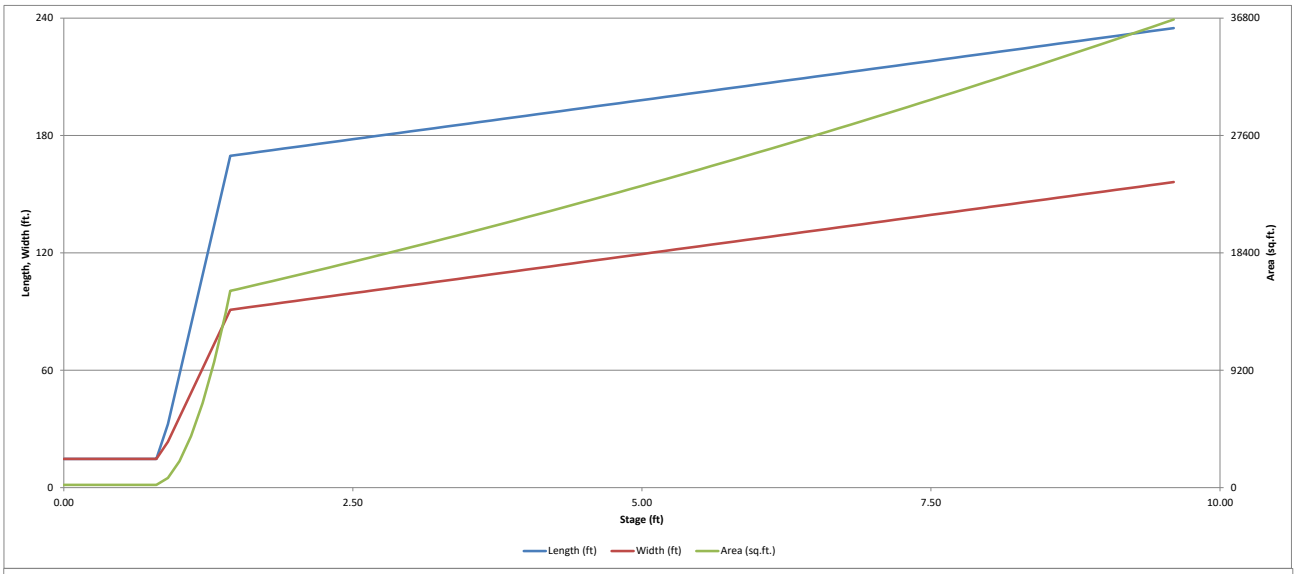
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.545	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.917	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.450	acre-feet	0.92	inches
5-yr Runoff Volume (P1 = 1.2 in.) =	1.153	acre-feet	1.20	inches
10-yr Runoff Volume (P1 = 1.45 in.) =	2.407	acre-feet	1.45	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	4.971	acre-feet		inches
50-yr Runoff Volume (P1 = 2.15 in.) =	8.392	acre-feet	2.15	inches
100-yr Runoff Volume (P1 = 2.49 in.) =	11.684	acre-feet	2.49	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	16.938	acre-feet		inches
Approximate 2-yr Detention Volume =	0.452	acre-feet		
Approximate 5-yr Detention Volume =	0.734	acre-feet		
Approximate 10-yr Detention Volume =	1.579	acre-feet		
Approximate 25-yr Detention Volume =	2.249	acre-feet		
Approximate 50-yr Detention Volume =	2.660	acre-feet		
Approximate 100-yr Detention Volume =	3.555	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.545	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.190	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.821	acre-feet
Total Detention Basin Volume =	3.555	acre-feet
Initial Surcharge Volume (ISV) =	71	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	8.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	216	ft^2
Surcharge Volume Length (L_{ISV}) =	14.7	ft
Surcharge Volume Width (W_{ISV}) =	14.7	ft
Depth of Basin Floor (H_{FLOOR}) =	0.61	ft
Length of Basin Floor (L_{FLOOR}) =	169.6	ft
Width of Basin Floor (W_{FLOOR}) =	90.9	ft
Area of Basin Floor (A_{FLOOR}) =	15,425	ft^2
Volume of Basin Floor (V_{FLOOR}) =	3,551	ft^3
Depth of Main Basin (H_{MAIN}) =	6.56	ft
Length of Main Basin (L_{MAIN}) =	222.1	ft
Width of Main Basin (W_{MAIN}) =	143.4	ft
Area of Main Basin (A_{MAIN}) =	31,853	ft^2
Volume of Main Basin (V_{MAIN}) =	151,852	ft^3
Calculated Total Basin Volume (V_{total}) =	**3.572**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		14.7	14.7	216		0.005		
ISV	0.33		14.7	14.7	216		0.005	71	0.002
	0.40		14.7	14.7	216		0.005	86	0.002
	0.50		14.7	14.7	216		0.005	108	0.002
	0.60		14.7	14.7	216		0.005	129	0.003
	0.70		14.7	14.7	216		0.005	151	0.003
	0.80		14.7	14.7	216		0.005	173	0.004
	0.90		32.5	23.4	761		0.017	211	0.005
	1.00		57.9	35.9	2,079		0.048	348	0.008
	1.10		83.3	48.4	4,033		0.093	648	0.015
	1.20		108.7	60.9	6,622		0.152	1,176	0.027
	1.30		134.1	73.4	9,845		0.226	1,994	0.046
	1.40		159.5	85.9	13,704		0.315	3,166	0.073
Floor	1.44		169.6	90.9	15,425		0.354	3,748	0.086
	1.50		170.1	91.4	15,550		0.357	4,678	0.107
	1.60		170.9	92.2	15,760		0.362	6,243	0.143
	1.70		171.7	93.0	15,971		0.367	7,830	0.180
	1.80		172.5	93.8	16,184		0.372	9,437	0.217
	1.90		173.3	94.6	16,397		0.376	11,066	0.254
	2.00		174.1	95.4	16,612		0.381	12,717	0.292
	2.10		174.9	96.2	16,829		0.386	14,389	0.330
	2.20		175.7	97.0	17,046		0.391	16,083	0.369
	2.30		176.5	97.8	17,265		0.396	17,798	0.409
	2.40		177.3	98.6	17,485		0.401	19,536	0.448
	2.50		178.1	99.4	17,707		0.406	21,295	0.489
	2.60		178.9	100.2	17,929		0.412	23,077	0.530
Zone 1 (WQCV)	2.64		179.2	100.5	18,019		0.414	23,796	0.546
	2.70		179.7	101.0	18,153		0.417	24,881	0.571
	2.80		180.5	101.8	18,378		0.422	26,708	0.613
	2.90		181.3	102.6	18,605		0.427	28,557	0.656
	3.00		182.1	103.4	18,833		0.432	30,429	0.699
Zone 2 (5-year)	3.09		182.8	104.1	19,039		0.437	32,133	0.738
	3.10		182.9	104.2	19,062		0.438	32,323	0.742
	3.20		183.7	105.0	19,292		0.443	34,241	0.786
	3.30		184.5	105.8	19,524		0.448	36,182	0.831
	3.40		185.3	106.6	19,757		0.454	38,146	0.876
	3.50		186.1	107.4	19,991		0.459	40,133	0.921
	3.60		186.9	108.2	20,226		0.464	42,144	0.967
	3.70		187.7	109.0	20,463		0.470	44,179	1.014
	3.80		188.5	109.8	20,701		0.475	46,237	1.061
	3.90		189.3	110.6	20,940		0.481	48,319	1.109
	4.00		190.1	111.4	21,181		0.486	50,425	1.158
	4.10		190.9	112.2	21,423		0.492	52,555	1.206
	4.20		191.7	113.0	21,666		0.497	54,709	1.256
	4.30		192.5	113.8	21,910		0.503	56,888	1.306
	4.40		193.3	114.6	22,156		0.509	59,091	1.357
	4.50		194.1	115.4	22,403		0.514	61,319	1.408
	4.60		194.9	116.2	22,651		0.520	63,572	1.459
	4.70		195.7	117.0	22,901		0.526	65,850	1.512
	4.80		196.5	117.8	23,151		0.531	68,152	1.565
	4.90		197.3	118.6	23,404		0.537	70,480	1.618
	5.00		198.1	119.4	23,657		0.543	72,833	1.672
	5.10		198.9	120.2	23,912		0.549	75,211	1.727
	5.20		199.7	121.0	24,168		0.555	77,615	1.782
	5.30		200.5	121.8	24,425		0.561	80,045	1.838
	5.40		201.3	122.6	24,683		0.567	82,500	1.894
	5.50		202.1	123.4	24,943		0.573	84,982	1.951
	5.60		202.9	124.2	25,204		0.579	87,489	2.008
	5.70		203.7	125.0	25,466		0.585	90,023	2.067
	5.80		204.5	125.8	25,730		0.591	92,582	2.125
	5.90		205.3	126.6	25,995		0.597	95,169	2.185
	6.00		206.1	127.4	26,261		0.603	97,781	2.245
	6.10		206.9	128.2	26,529		0.609	100,421	2.305
	6.20		207.7	129.0	26,797		0.615	103,087	2.367
	6.30		208.5	129.8	27,067		0.621	105,780	2.428
	6.40		209.3	130.6	27,339		0.628	108,501	2.491
	6.50		210.1	131.4	27,611		0.634	111,248	2.554
	6.60		210.9	132.2	27,885		0.640	114,023	2.618
	6.70		211.7	133.0	28,160		0.646	116,825	2.682
	6.80		212.5	133.8	28,437		0.653	119,655	2.747
	6.90		213.3	134.6	28,714		0.659	122,513	2.813
	7.00		214.1	135.4	28,993		0.666	125,398	2.879
	7.10		214.9	136.2	29,274		0.672	128,311	2.946
	7.20		215.7	137.0	29,555		0.678	131,253	3.013
	7.30		216.5	137.8	29,838		0.685	134,222	3.081
	7.40		217.3	138.6	30,122		0.692	137,220	3.150
	7.50		218.1	139.4	30,407		0.698	140,247	3.220
	7.60		218.9	140.2	30,694		0.705	143,302	3.290
	7.70		219.7	141.0	30,982		0.711	146,386	3.361
	7.80		220.5	141.8	31,271		0.718	149,498	3.432
	7.90		221.3	142.6	31,562		0.725	152,640	3.504
Zone 3 (100-year)	7.98		221.9	143.3	31,795		0.730	155,174	3.562
	8.00		222.1	143.4	31,853		0.731	155,811	3.577
	8.10		222.9	144.2	32,147		0.738	159,011	3.650
	8.20		223.7	145.0	32,441		0.745	162,240	3.725
	8.30		224.5	145.8	32,736		0.752	165,499	3.799
	8.40		225.3	146.6	33,033		0.758	168,787	3.875
	8.50		226.1	147.4	33,332		0.765	172,106	3.951
	8.60		226.9	148.2	33,631		0.772	175,454	4.028
	8.70		227.7	149.0	33,932		0.779	178,832	4.105
	8.80		228.5	149.8	34,234		0.786	182,240	4.184
	8.90		229.3	150.6	34,537		0.793	185,679	4.263
	9.00		230.1	151.4	34,842		0.800	189,147	4.342
	9.10		230.9	152.2	35,147		0.807	192,647	4.423
	9.20		231.7	153.0	35,455		0.814	196,177	4.504
	9.30		232.5	153.8	35,763		0.821	199,738	4.585
	9.40		233.3	154.6	36,073		0.828	203,330	4.668
	9.50		234.1	155.4	36,384		0.835	206,952	4.751
	9.60		234.9	156.2	36,696		0.842	210,606	4.835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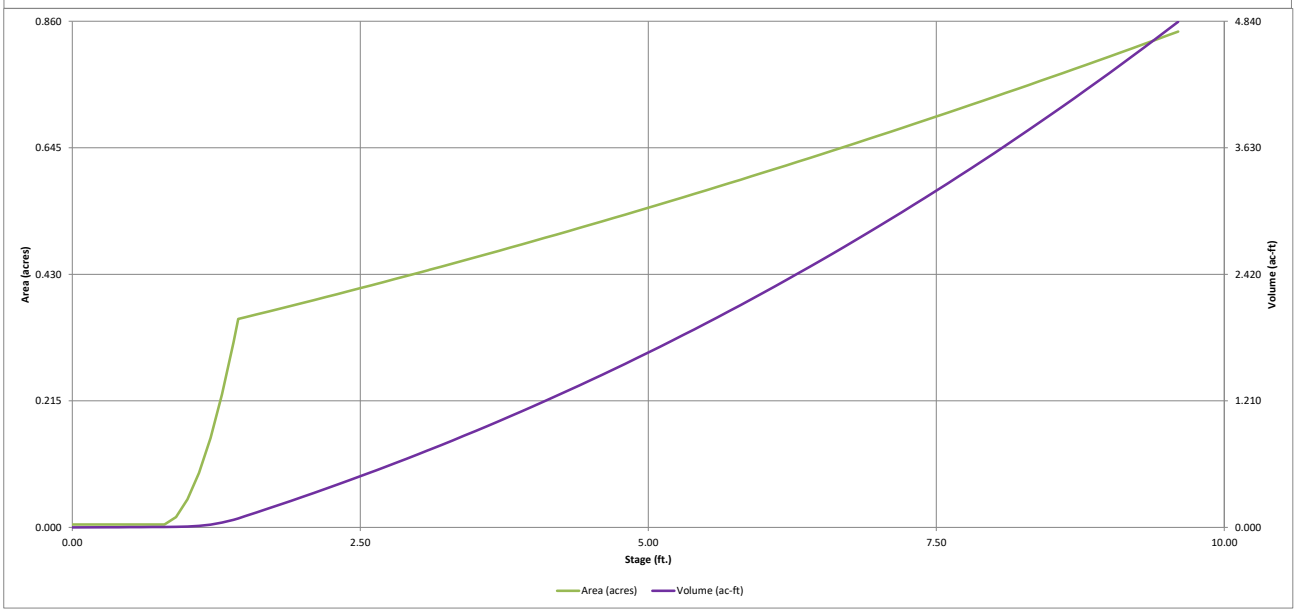
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

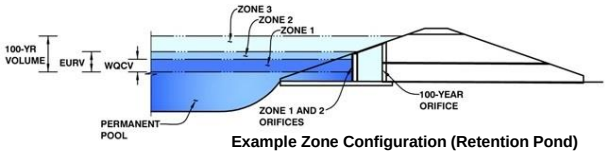

0.860
0.645
0.430
0.215
0.000
Area (acres)
4.840
3.630
2.420
1.210
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 14**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.64	0.545	Orifice Plate
Zone 2 (5-year)	3.09	0.190	Weir&Pipe (Circular)
Zone 3 (100-year)	7.98	2.821	Weir&Pipe (Restrict)
Total (all zones)		3.555	

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 =	1.229E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.36	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.77	sq. inches (diameter = 1-1/2 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	0.79	1.57					
Orifice Area (sq. inches)	1.77	1.77	1.77					

	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 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	2.64	3.09	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	8.00	feet
Overflow Weir Grate Slope =	0.00	4.00	H:V
Horiz. Length of Weir Sides =	8.00	16.00	feet
Overflow Grate Type =	Type C Grate	Type C Grate	
Debris Clogging % =	50%	50%	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir	
Height of Grate Upper Edge, H_t =	2.64	7.09	feet
Overflow Weir Slope Length =	8.00	16.49	feet
Grate Open Area / 100-yr Orifice Area =	9.07	12.49	
Overflow Grate Open Area w/o Debris =	44.54	91.83	ft^2
Overflow Grate Open Area w/ Debris =	22.27	45.91	ft^2

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

	Zone 2 Circular	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.64	3.09	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter or Pipe Diameter =	30.00	42.00	inches
Restrictor Plate Height Above Pipe Invert =		30.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Zone 3 Restrictor	
Outlet Orifice Area =	4.91	7.35	ft^2
Outlet Orifice Centroid =	1.25	1.39	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	2.01	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.93	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	9.93	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.87	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	5.12	acre-ft

Calculated Parameters for Spillway

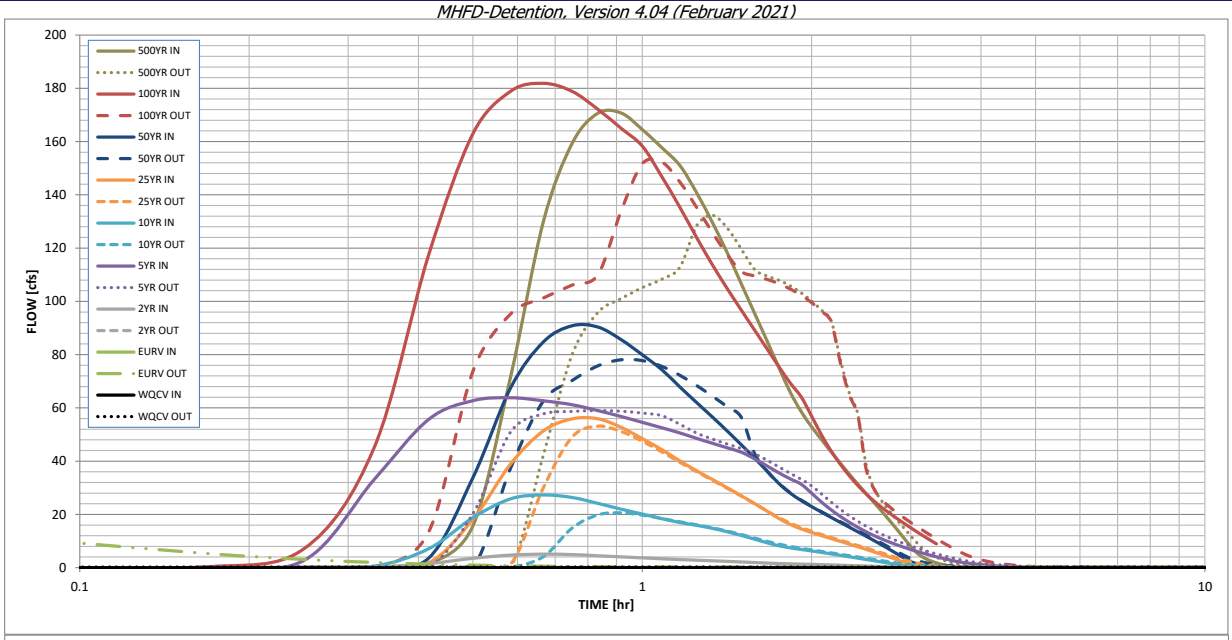
Routed Hydrograph Results

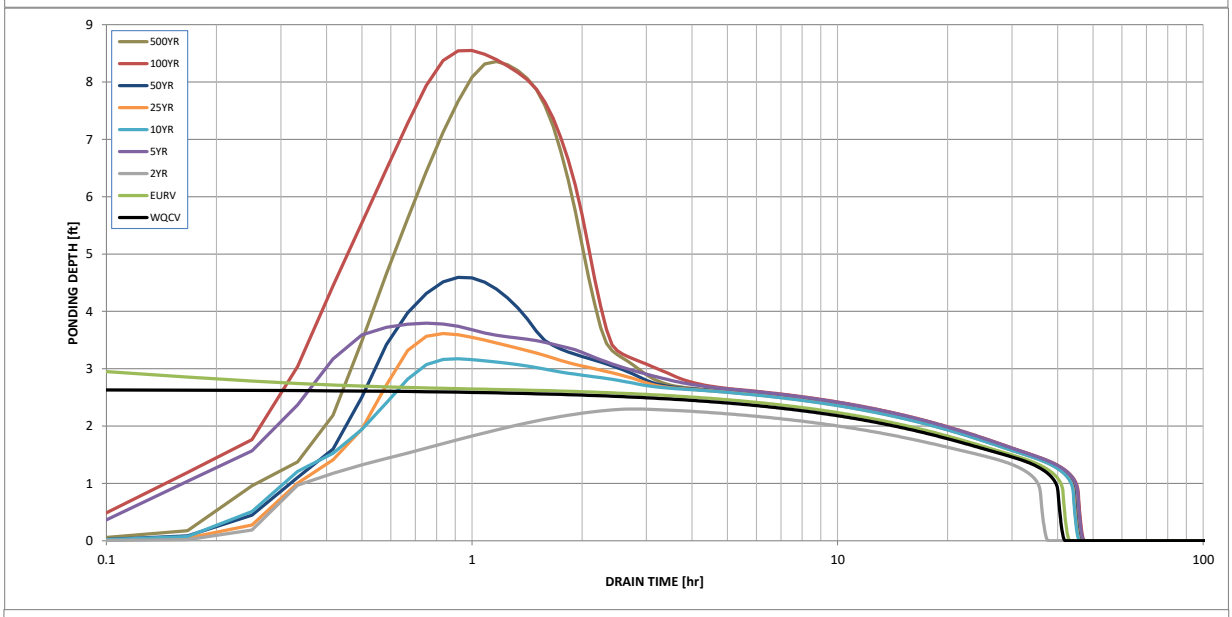
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

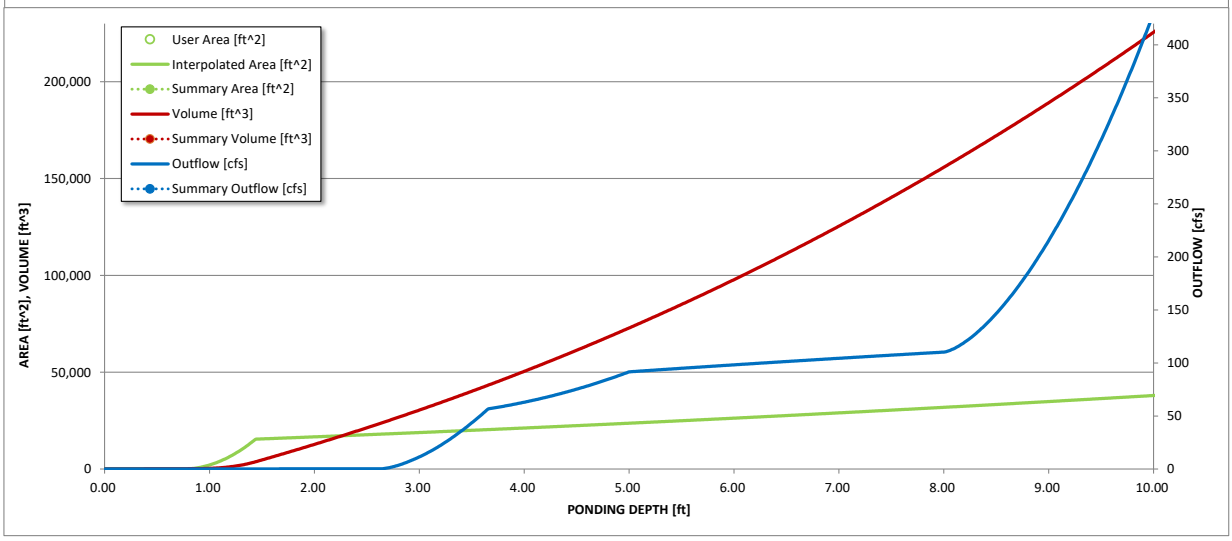
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
CUHP Runoff Volume (acre-ft) =	0.545	0.917	0.450	1.153	2.407	4.971	8.392	11.684	16.938
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.450	8.367	2.407	4.971	8.392	20.351	16.938
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.0	7.0	20.9	50.3	84.7	115.8	164.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		59.5				173.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.61	0.21	0.52	0.87	1.77	1.69
Peak Inflow Q (cfs) =	N/A	N/A	5.1	63.8	27.3	55.9	90.8	181.9	170.7
Peak Outflow Q (cfs) =	0.2	27.4	0.2	59.0	20.6	53.1	78.1	152.3	132.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.0	1.1	0.9	0.9	0.8
Structure Controlling Flow =	Overflow Weir 1	Overflow Weir 2	Plate	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.92	N/A	1.2	0.4	1.1	1.3	1.7	1.6
Max Velocity through Grate 2 (fps) =	N/A	0.02	N/A	0.1	0.0	0.0	0.2	0.4	0.4
Time to Drain 97% of Inflow Volume (hours) =	39	39	35	22	36	29	21	4	6
Time to Drain 99% of Inflow Volume (hours) =	**40**	41	36	36	42	39	35	26	28
Maximum Ponding Depth (ft) =	2.64	3.50	2.30	3.79	3.17	3.62	4.59	8.55	8.36
Area at Maximum Ponding Depth (acres) =	0.41	0.46	0.40	0.47	0.44	0.46	0.52	0.77	0.75
Maximum Volume Stored (acre-ft) =	0.546	0.921	0.405	1.057	0.773	0.972	1.454	3.989	3.837

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.05	0.00
	0:10:00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.29	0.03
	0:15:00	0.00	0.00	0.04	2.68	0.12	0.08	0.14	7.02	0.23
	0:20:00	0.00	0.00	0.24	32.98	0.57	0.30	0.44	44.87	1.48
	0:25:00	0.00	0.00	1.54	55.61	7.07	1.79	3.51	117.19	15.75
	0:30:00	0.00	0.00	3.53	62.71	18.79	18.19	33.86	163.00	71.73
	0:35:00	0.00	0.00	4.73	63.81	25.86	38.97	67.52	178.88	129.78
	0:40:00	0.00	0.00	5.08	62.67	27.30	51.32	84.73	181.87	159.22
	0:45:00	0.00	0.00	4.92	61.19	26.36	55.87	90.83	178.86	170.61
	0:50:00	0.00	0.00	4.49	58.99	24.17	55.91	90.37	172.14	170.73
	0:55:00	0.00	0.00	4.06	56.77	21.97	52.72	85.64	164.98	164.50
	1:00:00	0.00	0.00	3.69	54.57	20.15	48.45	79.93	158.30	157.70
	1:05:00	0.00	0.00	3.34	52.53	18.39	44.34	74.33	146.80	150.98
	1:10:00	0.00	0.00	3.05	50.58	16.96	40.05	67.83	135.25	140.66
	1:15:00	0.00	0.00	2.81	48.53	15.88	36.34	61.94	123.84	129.49
	1:20:00	0.00	0.00	2.58	46.69	14.77	33.08	56.51	113.61	118.13
	1:25:00	0.00	0.00	2.37	44.99	13.47	29.99	51.25	104.70	106.53
	1:30:00	0.00	0.00	2.15	43.36	12.09	26.98	46.11	96.67	95.52
	1:35:00	0.00	0.00	1.94	40.87	10.71	24.08	41.15	89.22	85.10
	1:40:00	0.00	0.00	1.72	38.18	9.35	21.22	36.26	82.14	75.03
	1:45:00	0.00	0.00	1.55	35.58	8.22	18.43	31.56	75.42	65.77
	1:50:00	0.00	0.00	1.43	33.33	7.45	16.21	27.95	69.27	58.57
	1:55:00	0.00	0.00	1.34	31.33	6.84	14.55	25.21	64.11	52.89
	2:00:00	0.00	0.00	1.24	27.96	6.29	13.23	22.93	56.89	48.02
	2:05:00	0.00	0.00	1.14	24.60	5.73	12.03	20.83	49.77	43.47
	2:10:00	0.00	0.00	1.03	21.71	5.18	10.93	18.86	43.80	39.17
	2:15:00	0.00	0.00	0.92	19.22	4.63	9.88	16.99	38.80	35.13
	2:20:00	0.00	0.00	0.82	17.06	4.10	8.85	15.19	34.54	31.34
	2:25:00	0.00	0.00	0.72	15.15	3.58	7.85	13.48	30.86	27.81
	2:30:00	0.00	0.00	0.62	13.49	3.08	6.87	11.80	27.71	24.41
	2:35:00	0.00	0.00	0.53	12.02	2.60	5.90	10.15	24.97	21.07
	2:40:00	0.00	0.00	0.43	10.74	2.12	4.94	8.51	22.58	17.76
	2:45:00	0.00	0.00	0.34	9.62	1.66	3.99	6.88	20.48	14.46
	2:50:00	0.00	0.00	0.25	8.60	1.19	3.03	5.27	18.53	11.19
	2:55:00	0.00	0.00	0.17	7.68	0.76	2.09	3.67	16.71	8.01
	3:00:00	0.00	0.00	0.11	6.83	0.48	1.24	2.26	14.99	5.37
	3:05:00	0.00	0.00	0.09	6.05	0.36	0.74	1.48	13.35	3.73
	3:10:00	0.00	0.00	0.07	5.34	0.28	0.45	0.99	11.80	2.62
	3:15:00	0.00	0.00	0.06	4.69	0.23	0.29	0.67	10.34	1.81
	3:20:00	0.00	0.00	0.05	4.09	0.18	0.19	0.45	8.96	1.22
	3:25:00	0.00	0.00	0.04	3.54	0.14	0.13	0.31	7.68	0.79
	3:30:00	0.00	0.00	0.04	3.03	0.10	0.09	0.21	6.45	0.48
	3:35:00	0.00	0.00	0.03	2.54	0.08	0.06	0.14	5.28	0.30
	3:40:00	0.00	0.00	0.02	2.14	0.05	0.05	0.11	4.22	0.22
	3:45:00	0.00	0.00	0.02	1.84	0.04	0.03	0.08	3.39	0.16
	3:50:00	0.00	0.00	0.02	1.59	0.03	0.03	0.06	2.78	0.13
	3:55:00	0.00	0.00	0.01	1.37	0.02	0.02	0.04	2.30	0.10
	4:00:00	0.00	0.00	0.01	1.17	0.02	0.01	0.03	1.90	0.08
	4:05:00	0.00	0.00	0.01	0.99	0.01	0.01	0.02	1.56	0.05
	4:10:00	0.00	0.00	0.00	0.83	0.01	0.01	0.02	1.28	0.03
	4:15:00	0.00	0.00	0.00	0.69	0.00	0.00	0.01	1.04	0.02
	4:20:00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.85	0.01
	4:25:00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.69	0.00
	4:30:00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.56	0.00
	4:35:00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.44	0.00
	4:40:00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.34	0.00
	4:45:00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.25	0.00
	4:50:00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.17	0.00
	4:55:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.11	0.00
	5:00:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.06	0.00
	5:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	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
					0	5:50:00	0			

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'.

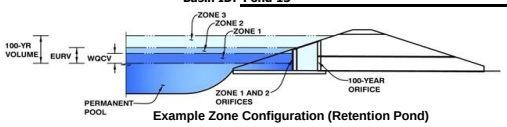
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 15**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	40.87	acres
Watershed Length =	1,765	ft
Watershed Length to Centroid =	1,089	ft
Watershed Slope =	0.036	ft/ft
Watershed Imperviousness =	37.20%	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.

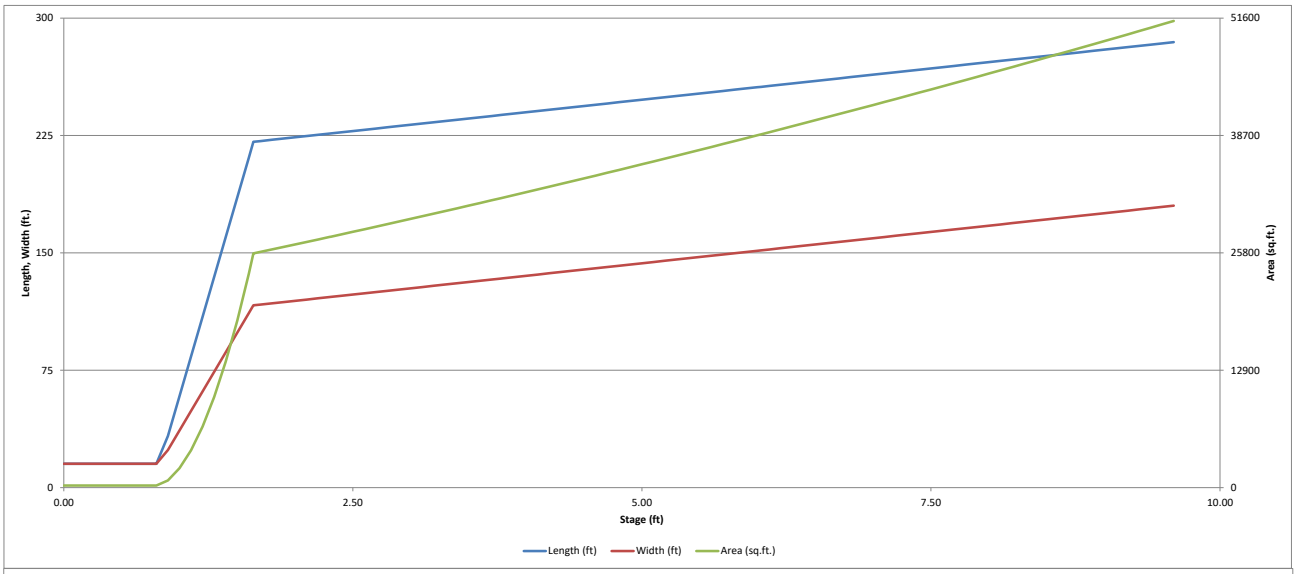
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.587	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.587	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.565	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.388	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.133	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	4.211	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.054	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	6.152	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.39 in.) =	9.210	acre-feet	3.39	inches
Approximate 2-yr Detention Volume =	1.161	acre-feet		
Approximate 5-yr Detention Volume =	1.632	acre-feet		
Approximate 10-yr Detention Volume =	2.277	acre-feet		
Approximate 25-yr Detention Volume =	2.567	acre-feet		
Approximate 50-yr Detention Volume =	2.696	acre-feet		
Approximate 100-yr Detention Volume =	3.115	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.587	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.000	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	1.821	acre-feet
Total Detention Basin Volume =	3.408	acre-feet
Initial Surcharge Volume (ISV) =	77	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	232	ft^2
Surcharge Volume Length (L_{ISV}) =	15.2	ft
Surcharge Volume Width (W_{ISV}) =	15.2	ft
Depth of Basin Floor (H_{FLOOR}) =	0.81	ft
Length of Basin Floor (L_{FLOOR}) =	221.0	ft
Width of Basin Floor (W_{FLOOR}) =	116.5	ft
Area of Basin Floor (A_{FLOOR}) =	25,744	ft^2
Volume of Basin Floor (V_{FLOOR}) =	7,674	ft^3
Depth of Main Basin (H_{MAIN}) =	4.36	ft
Length of Main Basin (L_{MAIN}) =	255.9	ft
Width of Main Basin (W_{MAIN}) =	151.4	ft
Area of Main Basin (A_{MAIN}) =	38,732	ft^2
Volume of Main Basin (V_{MAIN}) =	139,596	ft^3
Calculated Total Basin Volume (V_{total}) =	**3.385**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		15.2	15.2	232		0.005		
ISV	0.33		15.2	15.2	232		0.005	77	0.002
	0.40		15.2	15.2	232		0.005	93	0.002
	0.50		15.2	15.2	232		0.005	116	0.003
	0.60		15.2	15.2	232		0.005	139	0.003
	0.70		15.2	15.2	232		0.005	163	0.004
	0.80		15.2	15.2	232		0.005	186	0.004
	0.90		33.0	24.0	792		0.018	227	0.005
	1.00		58.4	36.5	2,132		0.049	368	0.008
	1.10		83.8	49.0	4,107		0.094	675	0.015
	1.20		109.2	61.5	6,717		0.154	1,210	0.028
	1.30		134.6	74.0	9,962		0.229	2,039	0.047
	1.40		160.0	86.5	13,841		0.318	3,224	0.074
	1.50		185.4	99.0	18,356		0.421	4,829	0.111
	1.60		210.8	111.5	23,506		0.540	6,916	0.159
Floor	1.64		221.0	116.5	25,744		0.591	7,901	0.181
	1.70		221.5	117.0	25,906		0.595	9,451	0.217
	1.80		222.3	117.8	26,177		0.601	12,055	0.277
	1.90		223.1	118.6	26,450		0.607	14,686	0.337
	2.00		223.9	119.4	26,724		0.613	17,345	0.398
	2.10		224.7	120.2	26,999		0.620	20,031	0.460
	2.20		225.5	121.0	27,276		0.626	22,745	0.522
	2.30		226.3	121.8	27,554		0.633	25,486	0.585
Zone 1 (WQCV)	2.31		226.3	121.9	27,581		0.633	25,762	0.591
	2.40		227.1	122.6	27,833		0.639	28,255	0.649
	2.50		227.9	123.4	28,113		0.645	31,053	0.713
	2.60		228.7	124.2	28,395		0.652	33,878	0.778
	2.70		229.5	125.0	28,678		0.658	36,732	0.843
	2.80		230.3	125.8	28,962		0.665	39,614	0.909
	2.90		231.1	126.6	29,247		0.671	42,524	0.976
	3.00		231.9	127.4	29,534		0.678	45,463	1.044
	3.10		232.7	128.2	29,822		0.685	48,431	1.112
	3.20		233.5	129.0	30,111		0.691	51,428	1.181
	3.30		234.3	129.8	30,402		0.698	54,453	1.250
	3.40		235.1	130.6	30,694		0.705	57,508	1.320
	3.50		235.9	131.4	30,987		0.711	60,592	1.391
	3.60		236.7	132.2	31,281		0.718	63,705	1.462
	3.70		237.5	133.0	31,577		0.725	66,848	1.535
Zone 2 (EURV)	3.78		238.1	133.6	31,815		0.730	69,384	1.593
	3.80		238.3	133.8	31,874		0.732	70,021	1.607
	3.90		239.1	134.6	32,172		0.739	73,223	1.681
	4.00		239.9	135.4	32,472		0.745	76,455	1.755
	4.10		240.7	136.2	32,773		0.752	79,718	1.830
	4.20		241.5	137.0	33,075		0.759	83,010	1.906
	4.30		242.3	137.8	33,378		0.766	86,333	1.982
	4.40		243.1	138.6	33,683		0.773	89,686	2.059
	4.50		243.9	139.4	33,989		0.780	93,069	2.137
	4.60		244.7	140.2	34,296		0.787	96,483	2.215
	4.70		245.5	141.0	34,605		0.794	99,928	2.294
	4.80		246.3	141.8	34,914		0.802	103,404	2.374
	4.90		247.1	142.6	35,225		0.809	106,911	2.454
	5.00		247.9	143.4	35,538		0.816	110,449	2.536
	5.10		248.7	144.2	35,851		0.823	114,019	2.618
	5.20		249.5	145.0	36,166		0.830	117,620	2.700
	5.30		250.3	145.8	36,483		0.838	121,252	2.784
	5.40		251.1	146.6	36,800		0.845	124,916	2.868
	5.50		251.9	147.4	37,119		0.852	128,612	2.953
	5.60		252.7	148.2	37,439		0.859	132,340	3.038
	5.70		253.5	149.0	37,760		0.867	136,100	3.124
	5.80		254.3	149.8	38,083		0.874	139,892	3.211
	5.90		255.1	150.6	38,407		0.882	143,717	3.299
	6.00		255.9	151.4	38,732		0.889	147,574	3.388
Z3 (100+1/2WQCV	6.03		256.1	151.6	38,830		0.891	148,737	3.415
	6.10		256.7	152.2	39,058		0.897	151,463	3.477
	6.20		257.5	153.0	39,386		0.904	155,385	3.567
	6.30		258.3	153.8	39,715		0.912	159,340	3.658
	6.40		259.1	154.6	40,045		0.919	163,328	3.750
	6.50		259.9	155.4	40,377		0.927	167,349	3.842
	6.60		260.7	156.2	40,710		0.935	171,404	3.935
	6.70		261.5	157.0	41,044		0.942	175,491	4.029
	6.80		262.3	157.8	41,379		0.950	179,612	4.123
	6.90		263.1	158.6	41,716		0.958	183,767	4.219
	7.00		263.9	159.4	42,054		0.965	187,956	4.315
	7.10		264.7	160.2	42,393		0.973	192,178	4.412
	7.20		265.5	161.0	42,733		0.981	196,434	4.510
	7.30		266.3	161.8	43,075		0.989	200,725	4.608
	7.40		267.1	162.6	43,418		0.997	205,049	4.707
	7.50		267.9	163.4	43,763		1.005	209,408	4.807
	7.60		268.7	164.2	44,108		1.013	213,802	4.908
	7.70		269.5	165.0	44,455		1.021	218,230	5.010
	7.80		270.3	165.8	44,803		1.029	222,693	5.112
	7.90		271.1	166.6	45,153		1.037	227,191	5.216
	8.00		271.9	167.4	45,504		1.045	231,724	5.320
	8.10		272.7	168.2	45,856		1.053	236,291	5.425
	8.20		273.5	169.0	46,209		1.061	240,895	5.530
	8.30		274.3	169.8	46,564		1.069	245,533	5.637
	8.40		275.1	170.6	46,919		1.077	250,207	5.744
	8.50		275.9	171.4	47,277		1.085	254,917	5.852
	8.60		276.7	172.2	47,635		1.094	259,663	5.961
	8.70		277.5	173.0	47,995		1.102	264,444	6.071
	8.80		278.3	173.8	48,356		1.110	269,262	6.181
	8.90		279.1	174.6	48,718		1.118	274,115	6.293
	9.00		279.9	175.4	49,081		1.127	279,005	6.405
	9.10		280.7	176.2	49,446		1.135	283,932	6.518
	9.20		281.5	177.0	49,812		1.144	288,895	6.632
	9.30		282.3	177.8	50,180		1.152	293,894	6.747
	9.40		283.1	178.6	50,549		1.160	298,931	6.863
	9.50		283.9	179.4	50,918		1.169	304,004	6.979
	9.60		284.7	180.2	51,290		1.177	309,114	7.096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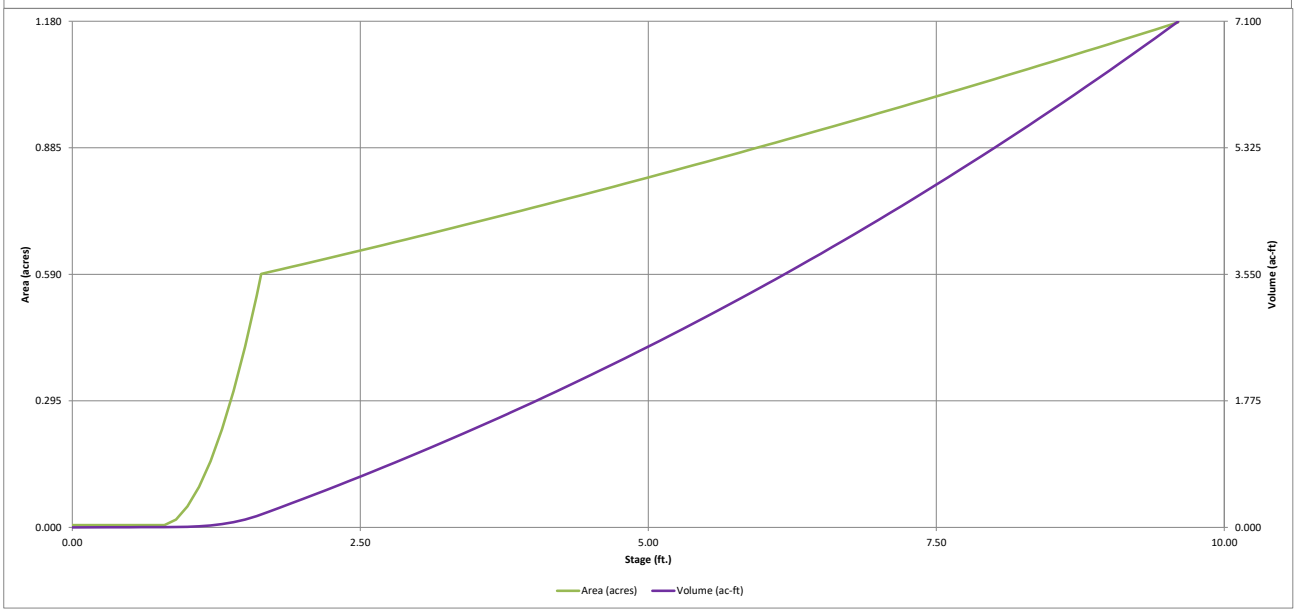
7.50
10.00
Length, Width (ft.)
Area (sq.ft.)
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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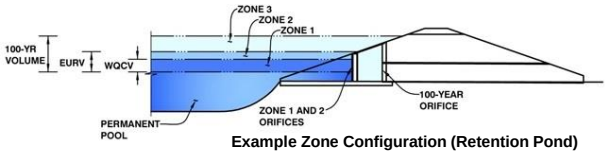
2.50
5.00
7.50
10.00
Area (acres)
Volume (ac-ft)
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 15**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.31	0.587	Orifice Plate
Zone 2 (EURV)	3.78	1.000	Weir&Pipe (Circular)
Zone 3 (100+1/2WQCV)	6.03	1.821	Weir&Pipe (Restrict)
Total (all zones)		3.408	

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 =	1.382E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.36	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.99	sq. inches (diameter = 1-9/16 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	0.79	1.57					
Orifice Area (sq. inches)	1.99	1.99	1.99					

	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 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	2.39	2.49	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	5.00	feet
Overflow Weir Grate Slope =	0.00	4.00	H:V
Horiz. Length of Weir Sides =	5.00	10.00	feet
Overflow Grate Type =	Type C Grate	Type C Grate	
Debris Clogging % =	50%	50%	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir	
Height of Grate Upper Edge, H_t =	2.39	4.99	feet
Overflow Weir Slope Length =	5.00	10.31	feet
Grate Open Area / 100-yr Orifice Area =	22.15	6.85	
Overflow Grate Open Area w/o Debris =	17.40	35.87	ft^2
Overflow Grate Open Area w/ Debris =	8.70	17.94	ft^2

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

	Zone 2 Circular	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.50	2.70	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter or Pipe Diameter =	12.00	36.00	inches
Restrictor Plate Height Above Pipe Invert =		25.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Zone 3 Restrictor	
Outlet Orifice Area =	0.79	5.24	ft^2
Outlet Orifice Centroid =	0.50	1.16	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	1.97	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.93	feet
Spillway Crest Length =	31.00	feet	Stage at Top of Freeboard =	8.93	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.12	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.33	acre-ft

Calculated Parameters for Spillway

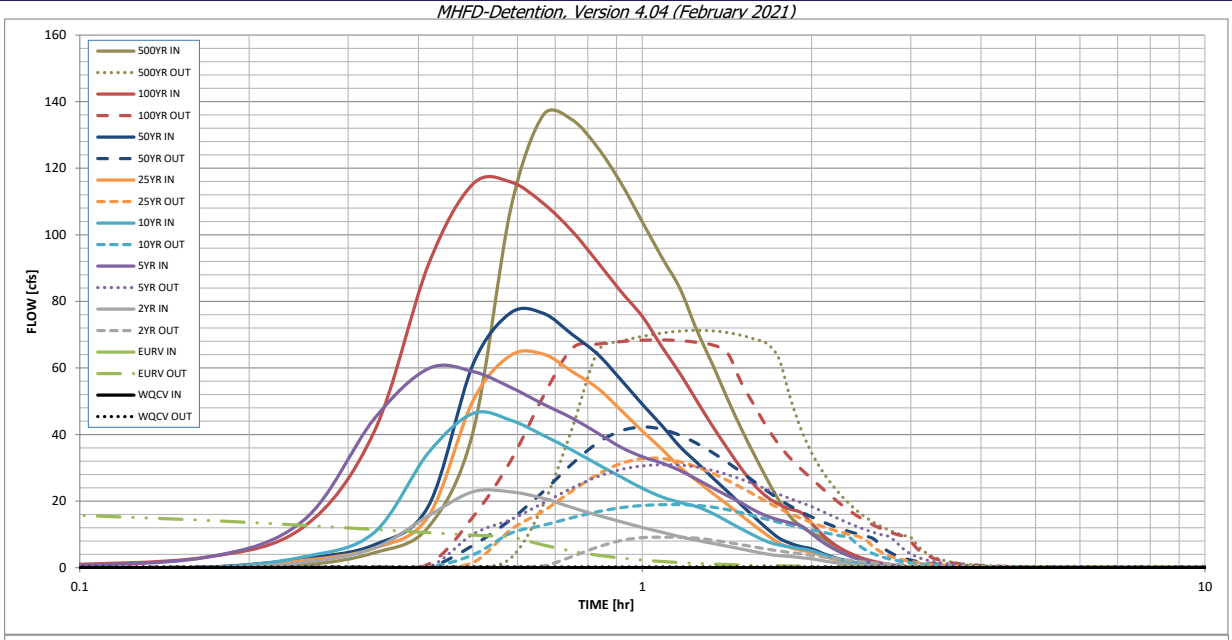
Routed Hydrograph Results

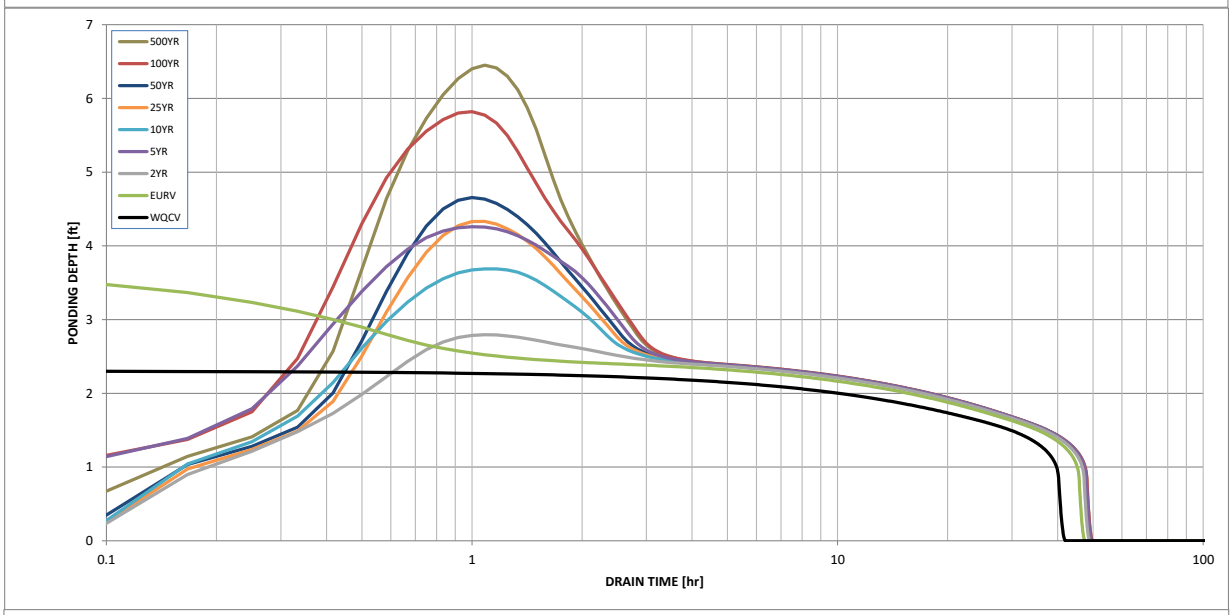
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

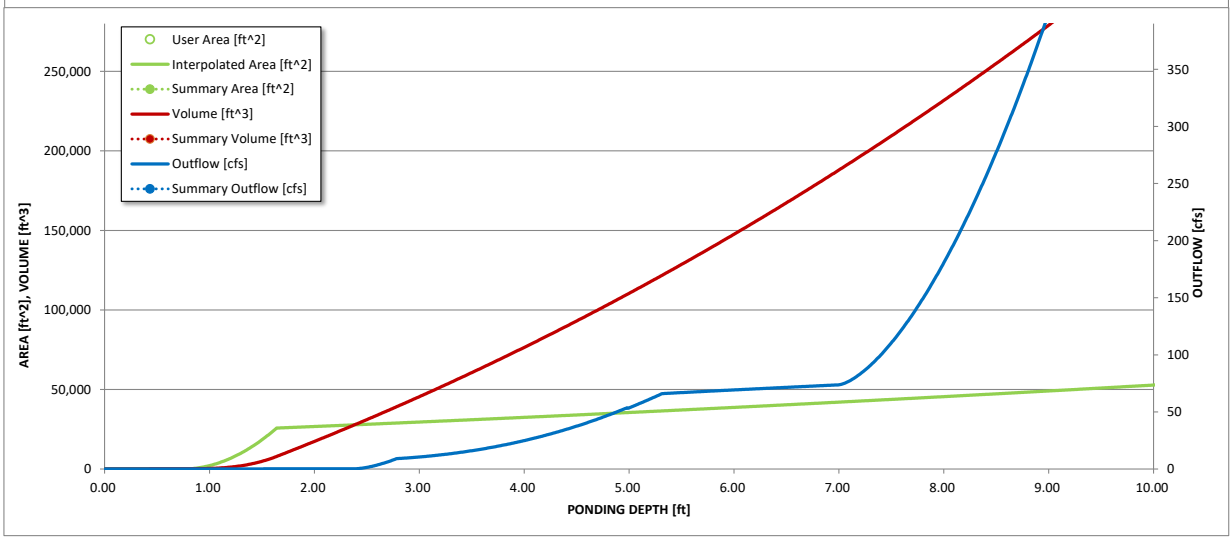
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.39
CUHP Runoff Volume (acre-ft) =	0.587	1.587	1.565	2.388	3.133	4.211	5.054	6.152	9.210
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.565	4.857	3.133	4.211	5.054	8.775	9.210
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	4.8	13.3	20.2	35.6	44.6	57.0	88.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		31.6				67.8	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.12	0.77	0.49	0.87	1.09	1.66	2.17
Peak Inflow Q (cfs) =	N/A	N/A	22.8	59.8	46.3	64.1	76.5	115.9	136.0
Peak Outflow Q (cfs) =	0.2	18.8	9.1	30.9	18.9	32.8	42.3	68.4	71.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.9	0.9	0.9	1.0	0.8
Structure Controlling Flow =	Plate	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Outlet Plate 2	Outlet Plate 2
Max Velocity through Grate 1 (fps) =	N/A	0.50	0.46	0.5	0.5	0.5	0.5	0.6	0.6
Max Velocity through Grate 2 (fps) =	N/A	0.32	0.02	0.6	0.3	0.6	0.9	1.6	1.7
Time to Drain 97% of Inflow Volume (hours) =	39	41	43	34	39	36	34	26	25
Time to Drain 99% of Inflow Volume (hours) =	**40**	45	46	43	45	44	43	40	39
Maximum Ponding Depth (ft) =	2.31	3.78	2.80	4.26	3.69	4.33	4.65	5.82	6.45
Area at Maximum Ponding Depth (acres) =	0.63	0.73	0.66	0.76	0.72	0.77	0.79	0.88	0.92
Maximum Volume Stored (acre-ft) =	0.591	1.593	0.903	1.944	1.520	2.005	2.254	3.229	3.786

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: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

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	USER	CUHP	CUHP	CUHP	USER	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	0.23	0.00	0.00	0.00	0.55	0.00
	0:10:00	0.00	0.00	0.00	3.05	0.00	0.00	0.18	3.10	0.83
	0:15:00	0.00	0.00	1.60	14.26	3.27	2.20	2.77	12.25	4.45
	0:20:00	0.00	0.00	5.84	44.61	10.48	5.83	6.83	40.67	12.21
	0:25:00	0.00	0.00	15.59	59.80	34.54	15.42	18.52	91.07	40.72
	0:30:00	0.00	0.00	22.81	58.93	46.32	50.11	61.06	115.27	107.68
	0:35:00	0.00	0.00	22.79	54.19	44.31	63.75	76.55	115.87	135.98
	0:40:00	0.00	0.00	20.82	49.14	39.76	64.15	76.41	109.44	134.56
	0:45:00	0.00	0.00	18.07	44.94	35.32	58.91	70.09	101.12	126.16
	0:50:00	0.00	0.00	15.72	40.41	31.03	53.88	64.09	91.75	115.49
	0:55:00	0.00	0.00	13.81	36.16	27.25	47.29	56.41	82.92	103.88
	1:00:00	0.00	0.00	12.08	33.34	23.85	41.04	49.09	75.47	93.21
	1:05:00	0.00	0.00	10.66	31.42	21.25	35.60	42.69	66.36	83.86
	1:10:00	0.00	0.00	9.30	29.19	19.60	30.17	36.36	58.34	71.33
	1:15:00	0.00	0.00	8.22	26.56	18.32	26.11	31.60	50.09	61.02
	1:20:00	0.00	0.00	7.29	24.00	16.33	22.35	27.02	42.51	50.81
	1:25:00	0.00	0.00	6.44	21.60	13.93	19.00	22.91	35.82	41.70
	1:30:00	0.00	0.00	5.60	19.48	11.66	15.68	18.87	29.78	33.76
	1:35:00	0.00	0.00	4.80	17.20	9.61	12.60	15.14	24.73	26.53
	1:40:00	0.00	0.00	4.10	15.51	7.86	9.79	11.74	21.24	20.15
	1:45:00	0.00	0.00	3.61	14.34	6.81	7.38	8.89	19.03	15.30
	1:50:00	0.00	0.00	3.38	13.48	6.22	6.03	7.31	17.57	12.38
	1:55:00	0.00	0.00	2.99	12.56	5.69	5.19	6.31	16.52	10.47
	2:00:00	0.00	0.00	2.67	10.20	5.09	4.65	5.66	13.33	9.11
	2:05:00	0.00	0.00	2.15	7.89	4.08	3.63	4.42	10.15	6.95
	2:10:00	0.00	0.00	1.68	6.09	3.16	2.77	3.36	7.70	5.08
	2:15:00	0.00	0.00	1.32	4.66	2.43	2.10	2.54	5.86	3.70
	2:20:00	0.00	0.00	1.02	3.53	1.85	1.58	1.91	4.46	2.71
	2:25:00	0.00	0.00	0.79	2.62	1.39	1.20	1.44	3.35	2.04
	2:30:00	0.00	0.00	0.61	1.92	1.03	0.89	1.07	2.50	1.52
	2:35:00	0.00	0.00	0.46	1.41	0.77	0.66	0.80	1.89	1.14
	2:40:00	0.00	0.00	0.35	1.00	0.58	0.50	0.60	1.38	0.87
	2:45:00	0.00	0.00	0.25	0.68	0.43	0.37	0.45	0.96	0.64
	2:50:00	0.00	0.00	0.18	0.43	0.30	0.27	0.32	0.61	0.45
	2:55:00	0.00	0.00	0.11	0.24	0.19	0.18	0.21	0.35	0.30
	3:00:00	0.00	0.00	0.07	0.10	0.11	0.11	0.13	0.15	0.17
	3:05:00	0.00	0.00	0.03	0.03	0.05	0.05	0.06	0.04	0.08
	3:10:00	0.00	0.00	0.01	0.00	0.02	0.02	0.02	0.00	0.02
	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'.

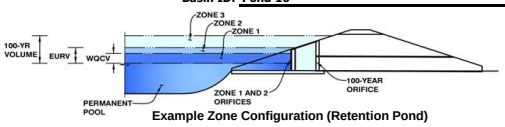
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 16**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	28.99	acres
Watershed Length =	1,505	ft
Watershed Length to Centroid =	954	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	34.66%	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 =	Denver - Capitol Building	

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

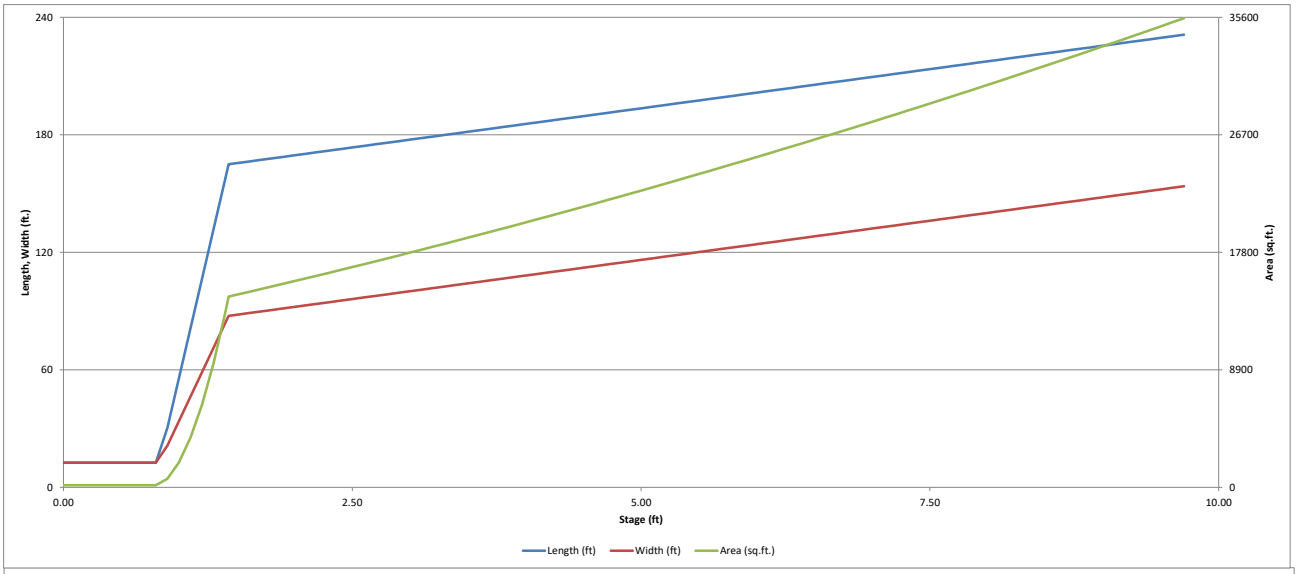
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.399	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.043	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.034	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.610	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.133	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.899	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.492	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.270	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.793	acre-feet		inches
Approximate 2-yr Detention Volume =	0.758	acre-feet		
Approximate 5-yr Detention Volume =	1.071	acre-feet		
Approximate 10-yr Detention Volume =	1.515	acre-feet		
Approximate 25-yr Detention Volume =	1.723	acre-feet		
Approximate 50-yr Detention Volume =	1.812	acre-feet		
Approximate 100-yr Detention Volume =	2.110	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.399	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.644	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.067	acre-feet
Total Detention Basin Volume =	2.110	acre-feet
Initial Surcharge Volume (ISV) =	52	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	158	ft^2
Surcharge Volume Length (L_{ISV}) =	12.6	ft
Surcharge Volume Width (W_{ISV}) =	12.6	ft
Depth of Basin Floor (H_{FLOOR}) =	0.60	ft
Length of Basin Floor (L_{FLOOR}) =	165.0	ft
Width of Basin Floor (W_{FLOOR}) =	87.6	ft
Area of Basin Floor (A_{FLOOR}) =	14,448	ft^2
Volume of Basin Floor (V_{FLOOR}) =	3,223	ft^3
Depth of Main Basin (H_{MAIN}) =	4.57	ft
Length of Main Basin (L_{MAIN}) =	201.5	ft
Width of Main Basin (W_{MAIN}) =	124.1	ft
Area of Main Basin (A_{MAIN}) =	25,017	ft^2
Volume of Main Basin (V_{MAIN}) =	89,079	ft^3
Calculated Total Basin Volume (V_{total}) =	**2.122**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		12.6	12.6	158		0.004		
ISV	0.33		12.6	12.6	158		0.004	52	0.001
	0.40		12.6	12.6	158		0.004	63	0.001
	0.50		12.6	12.6	158		0.004	79	0.002
	0.60		12.6	12.6	158		0.004	95	0.002
	0.70		12.6	12.6	158		0.004	111	0.003
	0.80		12.6	12.6	158		0.004	126	0.003
	0.90		30.4	21.3	647		0.015	158	0.004
	1.00		55.8	33.8	1,886		0.043	279	0.006
	1.10		81.2	46.3	3,759		0.086	556	0.013
	1.20		106.6	58.8	6,268		0.144	1,052	0.024
	1.30		132.0	71.3	9,412		0.216	1,831	0.042
	1.40		157.4	83.8	13,190		0.303	2,956	0.068
Floor	1.43		165.0	87.6	14,448		0.332	3,370	0.077
	1.50		165.5	88.1	14,589		0.335	4,386	0.101
	1.60		166.3	88.9	14,793		0.340	5,855	0.134
	1.70		167.1	89.7	14,998		0.344	7,345	0.169
	1.80		167.9	90.5	15,204		0.349	8,855	0.203
	1.90		168.7	91.3	15,411		0.354	10,386	0.238
	2.00		169.5	92.1	15,620		0.359	11,937	0.274
	2.10		170.3	92.9	15,830		0.363	13,510	0.310
	2.20		171.1	93.7	16,041		0.368	15,103	0.347
	2.30		171.9	94.5	16,254		0.373	16,718	0.384
Zone 1 (WQCV)	2.35		172.3	94.9	16,361		0.376	17,533	0.403
	2.40		172.7	95.3	16,468		0.378	18,354	0.421
	2.50		173.5	96.1	16,683		0.383	20,012	0.459
	2.60		174.3	96.9	16,899		0.388	21,691	0.498
	2.70		175.1	97.7	17,117		0.393	23,391	0.537
	2.80		175.9	98.5	17,336		0.398	25,114	0.577
	2.90		176.7	99.3	17,556		0.403	26,859	0.617
	3.00		177.5	100.1	17,777		0.408	28,625	0.657
	3.10		178.3	100.9	18,000		0.413	30,414	0.698
	3.20		179.1	101.7	18,224		0.418	32,225	0.740
	3.30		179.9	102.5	18,450		0.424	34,059	0.782
	3.40		180.7	103.3	18,676		0.429	35,915	0.825
	3.50		181.5	104.1	18,904		0.434	37,794	0.868
	3.60		182.3	104.9	19,133		0.439	39,696	0.911
	3.70		183.1	105.7	19,364		0.445	41,621	0.955
	3.80		183.9	106.5	19,595		0.450	43,569	1.000
Zone 2 (EURV)	3.90		184.7	107.3	19,828		0.455	45,540	1.045
	4.00		185.5	108.1	20,063		0.461	47,535	1.091
	4.10		186.3	108.9	20,298		0.466	49,553	1.138
	4.20		187.1	109.7	20,535		0.471	51,594	1.184
	4.30		187.9	110.5	20,773		0.477	53,660	1.232
	4.40		188.7	111.3	21,013		0.482	55,749	1.280
	4.50		189.5	112.1	21,253		0.488	57,862	1.328
	4.60		190.3	112.9	21,495		0.493	60,000	1.377
	4.70		191.1	113.7	21,739		0.499	62,161	1.427
	4.80		191.9	114.5	21,983		0.505	64,347	1.477
	4.90		192.7	115.3	22,229		0.510	66,558	1.528
	5.00		193.5	116.1	22,476		0.516	68,793	1.579
	5.10		194.3	116.9	22,724		0.522	71,053	1.631
	5.20		195.1	117.7	22,974		0.527	73,338	1.684
	5.30		195.9	118.5	23,225		0.533	75,648	1.737
	5.40		196.7	119.3	23,477		0.539	77,983	1.790
	5.50		197.5	120.1	23,731		0.545	80,344	1.844
	5.60		198.3	120.9	23,986		0.551	82,729	1.899
	5.70		199.1	121.7	24,242		0.557	85,141	1.955
	5.80		199.9	122.5	24,499		0.562	87,578	2.011
	5.90		200.7	123.3	24,758		0.568	90,041	2.067
Zone 3 (100-year)	5.98		201.4	124.0	24,965		0.573	92,030	2.113
	6.00		201.5	124.1	25,017		0.574	92,529	2.124
	6.10		202.3	124.9	25,279		0.580	95,044	2.182
	6.20		203.1	125.7	25,541		0.586	97,585	2.240
	6.30		203.9	126.5	25,805		0.592	100,152	2.299
	6.40		204.7	127.3	26,070		0.598	102,746	2.359
	6.50		205.5	128.1	26,336		0.605	105,366	2.419
	6.60		206.3	128.9	26,604		0.611	108,013	2.480
	6.70		207.1	129.7	26,873		0.617	110,687	2.541
	6.80		207.9	130.5	27,143		0.623	113,388	2.603
	6.90		208.7	131.3	27,414		0.629	116,116	2.666
	7.00		209.5	132.1	27,687		0.636	118,871	2.729
	7.10		210.3	132.9	27,961		0.642	121,653	2.793
	7.20		211.1	133.7	28,236		0.648	124,463	2.857
	7.30		211.9	134.5	28,513		0.655	127,300	2.922
	7.40		212.7	135.3	28,790		0.661	130,166	2.988
	7.50		213.5	136.1	29,069		0.667	133,059	3.055
	7.60		214.3	136.9	29,350		0.674	135,979	3.122
	7.70		215.1	137.7	29,631		0.680	138,929	3.189
	7.80		215.9	138.5	29,914		0.687	141,906	3.258
	7.90		216.7	139.3	30,199		0.693	144,911	3.327
	8.00		217.5	140.1	30,484		0.700	147,946	3.396
	8.10		218.3	140.9	30,771		0.706	151,008	3.467
	8.20		219.1	141.7	31,059		0.713	154,100	3.538
	8.30		219.9	142.5	31,348		0.720	157,220	3.609
	8.40		220.7	143.3	31,639		0.726	160,369	3.682
	8.50		221.5	144.1	31,931		0.733	163,548	3.755
	8.60		222.3	144.9	32,224		0.740	166,756	3.828
	8.70		223.1	145.7	32,518		0.747	169,993	3.902
	8.80		223.9	146.5	32,814		0.753	173,259	3.977
	8.90		224.7	147.3	33,111		0.760	176,556	4.053
	9.00		225.5	148.1	33,409		0.767	179,882	4.130
	9.10		226.3	148.9	33,709		0.774	183,238	4.207
	9.20		227.1	149.7	34,010		0.781	186,624	4.284
	9.30		227.9	150.5	34,312		0.788	190,040	4.363
	9.40		228.7	151.3	34,615		0.795	193,486	4.442
	9.50		229.5	152.1	34,920		0.802	196,963	4.522
	9.60		230.3	152.9	35,226		0.809	200,470	4.602
	9.70		231.1	153.7	35,533		0.816	204,008	4.683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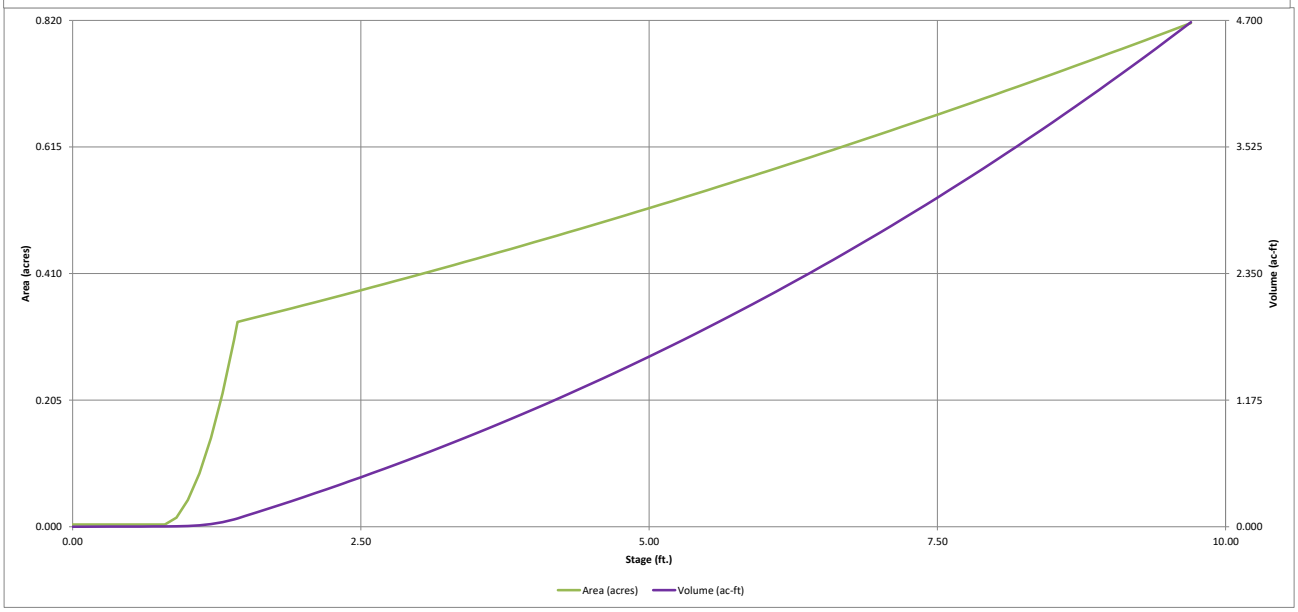
Length (ft)
Width (ft)
Area (sq.ft.)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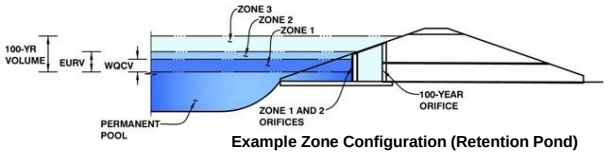
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 16**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.35	0.399	Orifice Plate
Zone 2 (EURV)	3.90	0.644	Circular Orifice
Zone 3 (100-year)	5.98	1.067	Weir&Pipe (Restrict)
Total (all zones)		2.110	

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

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

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	9.722E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.35	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.40	sq. inches (diameter = 1-5/16 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	0.80	1.60					
Orifice Area (sq. inches)	1.40	1.40	1.40					

	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)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.35	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.79	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.90	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.50	N/A	feet
Vertical Orifice Diameter =	12.00	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 =	4.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.00	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	1.85	N/A	
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	20.88	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	10.44	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 =	11.26	N/A	ft^2
Outlet Pipe Diameter =	54.00	N/A	inches	Outlet Orifice Centroid =	1.68	N/A	feet
Restrictor Plate Height Above Pipe Invert =	36.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.64	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	8.64	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.74	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.86	acre-ft

Calculated Parameters for Spillway

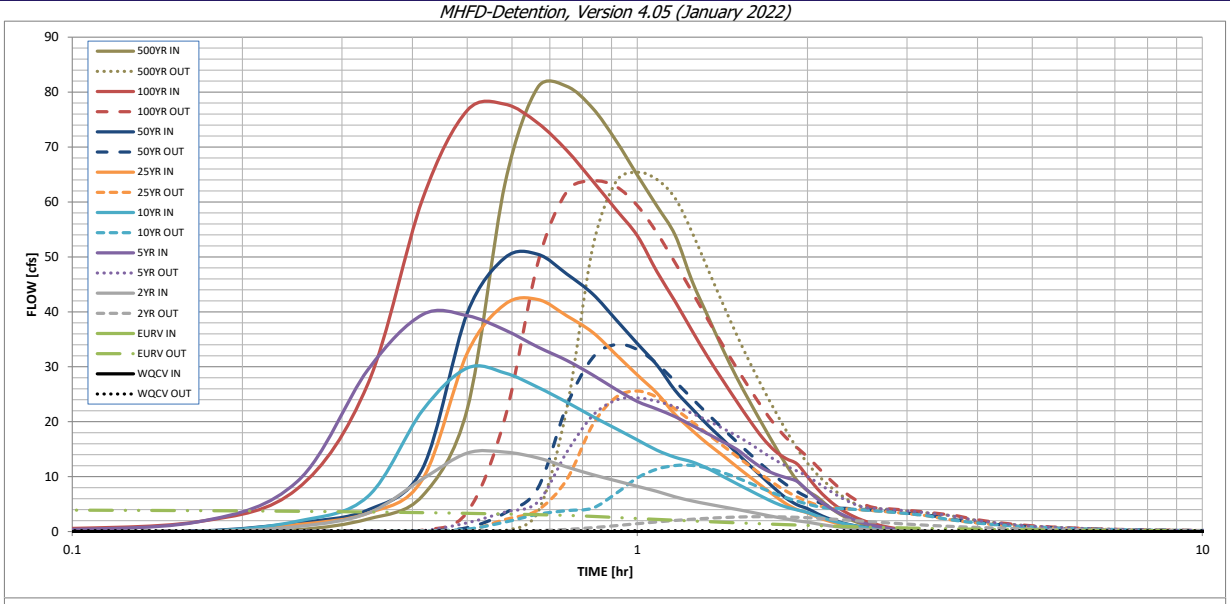
Routed Hydrograph Results

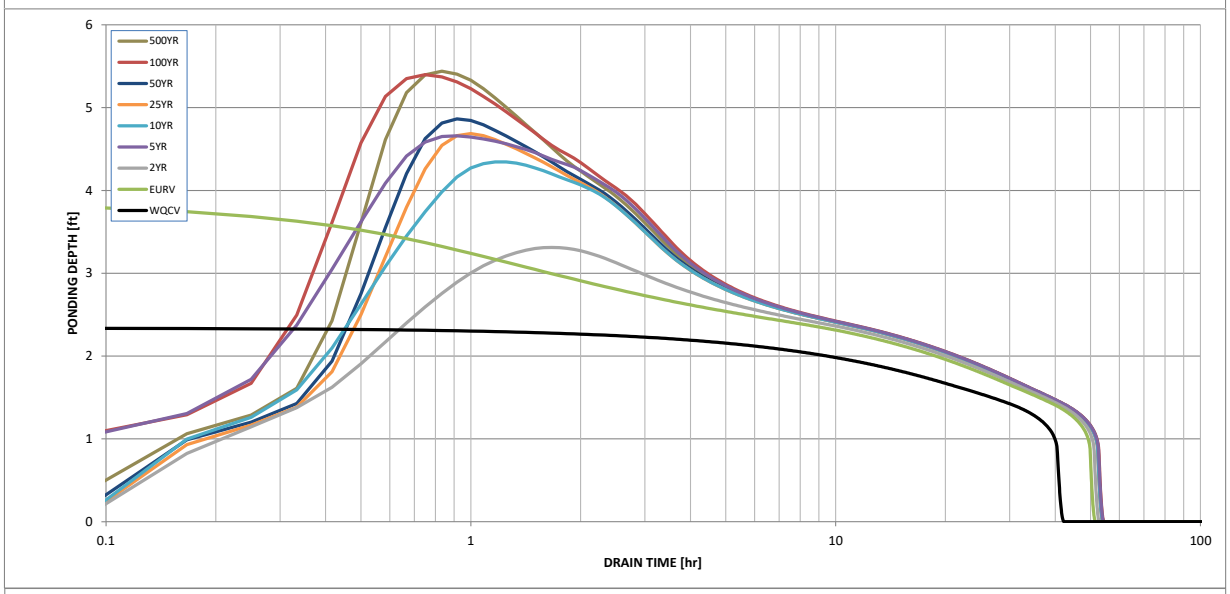
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

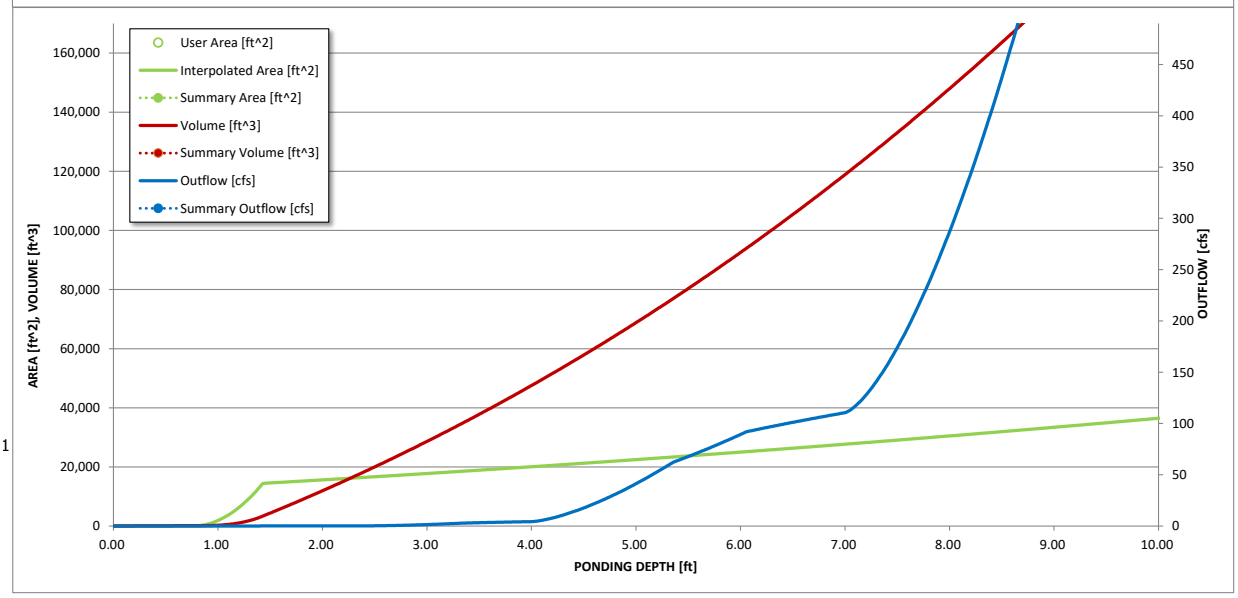
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.399	1.043	1.034	1.610	2.133	2.899	3.492	4.270	5.793
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.034	3.422	2.133	2.899	3.492	6.198	5.793
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.3	9.3	14.0	24.7	31.0	39.7	55.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		24.3				71.2	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.84	0.48	0.85	1.07	2.46	1.91
Peak Inflow Q (cfs) =	N/A	N/A	14.5	39.5	29.8	42.2	50.5	77.8	81.0
Peak Outflow Q (cfs) =	0.2	4.1	2.7	24.3	12.0	25.6	34.1	63.8	65.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.9	1.0	1.1	0.9	1.2
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.9	0.3	1.0	1.4	2.8	2.8
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	46	47	39	43	40	38	29	31
Time to Drain 99% of Inflow Volume (hours) =	**40**	49	50	48	49	48	47	44	44
Maximum Ponding Depth (ft) =	2.35	3.90	3.31	4.66	4.34	4.69	4.86	5.40	5.44
Area at Maximum Ponding Depth (acres) =	0.38	0.46	0.42	0.50	0.48	0.50	0.51	0.54	0.54
Maximum Volume Stored (acre-ft) =	0.403	1.045	0.786	1.402	1.251	1.417	1.508	1.785	1.806

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







1

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	USER	CUHP	CUHP	CUHP	USER	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	0.13	0.00	0.00	0.00	0.32	0.00
	0:10:00	0.00	0.00	0.00	1.77	0.00	0.00	0.11	1.79	0.34
	0:15:00	0.00	0.00	0.92	9.10	1.88	1.27	1.60	7.77	2.28
	0:20:00	0.00	0.00	3.34	29.42	6.38	3.35	3.92	26.81	6.51
	0:25:00	0.00	0.00	9.57	39.49	22.05	9.51	11.47	60.50	22.27
	0:30:00	0.00	0.00	14.29	39.30	29.77	32.48	39.77	76.66	63.40
	0:35:00	0.00	0.00	14.47	36.68	28.86	41.39	49.87	77.79	80.87
	0:40:00	0.00	0.00	13.41	33.60	26.27	42.25	50.47	74.36	81.05
	0:45:00	0.00	0.00	11.76	31.16	23.55	39.28	46.89	69.39	77.08
	0:50:00	0.00	0.00	10.37	28.52	20.96	36.28	43.27	63.84	71.17
	0:55:00	0.00	0.00	9.25	25.89	18.74	32.24	38.58	58.62	64.89
	1:00:00	0.00	0.00	8.24	23.69	16.69	28.51	34.22	53.85	59.25
	1:05:00	0.00	0.00	7.31	22.30	14.81	25.19	30.31	47.30	53.94
	1:10:00	0.00	0.00	6.32	20.91	13.52	21.30	25.69	41.88	45.60
	1:15:00	0.00	0.00	5.58	19.32	12.68	18.43	22.36	36.55	39.18
	1:20:00	0.00	0.00	5.01	17.80	11.48	15.95	19.36	31.73	33.21
	1:25:00	0.00	0.00	4.51	16.35	10.05	13.86	16.79	27.53	28.00
	1:30:00	0.00	0.00	4.04	14.97	8.71	11.81	14.28	23.67	23.53
	1:35:00	0.00	0.00	3.57	13.11	7.47	9.92	11.98	20.13	19.43
	1:40:00	0.00	0.00	3.12	11.52	6.31	8.17	9.85	17.04	15.66
	1:45:00	0.00	0.00	2.69	10.50	5.26	6.52	7.85	14.74	12.20
	1:50:00	0.00	0.00	2.33	9.82	4.48	5.06	6.09	13.29	9.32
	1:55:00	0.00	0.00	1.97	9.15	3.95	4.02	4.89	12.33	7.44
	2:00:00	0.00	0.00	1.73	7.52	3.49	3.41	4.18	10.02	6.27
	2:05:00	0.00	0.00	1.40	5.94	2.83	2.64	3.26	7.78	4.79
	2:10:00	0.00	0.00	1.13	4.69	2.25	2.01	2.49	6.03	3.57
	2:15:00	0.00	0.00	0.90	3.67	1.78	1.55	1.91	4.63	2.64
	2:20:00	0.00	0.00	0.71	2.86	1.39	1.18	1.46	3.57	1.92
	2:25:00	0.00	0.00	0.56	2.19	1.07	0.90	1.11	2.74	1.41
	2:30:00	0.00	0.00	0.44	1.65	0.82	0.69	0.84	2.09	1.05
	2:35:00	0.00	0.00	0.34	1.24	0.61	0.52	0.63	1.60	0.79
	2:40:00	0.00	0.00	0.27	0.92	0.46	0.39	0.48	1.23	0.61
	2:45:00	0.00	0.00	0.21	0.67	0.35	0.30	0.37	0.91	0.47
	2:50:00	0.00	0.00	0.16	0.46	0.27	0.23	0.28	0.65	0.36
	2:55:00	0.00	0.00	0.11	0.30	0.19	0.17	0.20	0.42	0.26
	3:00:00	0.00	0.00	0.08	0.17	0.13	0.12	0.14	0.25	0.18
	3:05:00	0.00	0.00	0.05	0.08	0.08	0.07	0.09	0.12	0.11
	3:10:00	0.00	0.00	0.02	0.03	0.04	0.04	0.05	0.04	0.06
	3:15:00	0.00	0.00	0.01	0.00	0.02	0.02	0.02	0.00	0.02
	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 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

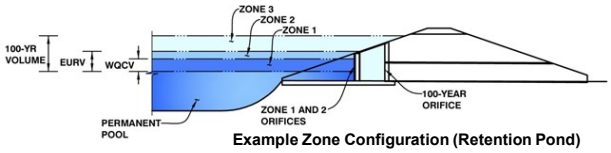
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Drainage Plan**

Basin ID: **Pond 17**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.20	0.203	Orifice Plate
Zone 2 (EURV)	3.19	0.193	Circular Orifice
Zone 3 (100-year)	5.98	0.739	Weir&Pipe (Restrict)
Total (all zones)		1.134	

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 =	5.972E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.20	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.80	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.86	sq. inches (diameter = 1-1/16 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	0.73	1.47					
Orifice Area (sq. inches)	0.86	0.86	0.86					

	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)

	Zone 2 Circular	Not Selected			Zone 2 Circular	Not Selected
Invert of Vertical Orifice =	2.20	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.02	N/A
Depth at top of Zone using Vertical Orifice =	3.19	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	N/A
Vertical Orifice Diameter =	1.98	N/A	inches			

Calculated Parameters for Vertical Orif

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 =	4.20	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.70	N/A
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	6.18	N/A
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	4.36	N/A
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.22	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	8.61	N/A
Debris Clogging % =	50%	N/A	%			

Calculated Parameters for Overflow W

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 =	3.95	N/A
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.04	N/A
Restrictor Plate Height Above Pipe Invert =	22.50		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.09	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.90	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	18.00	feet	Stage at Top of Freeboard =	7.81	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.41	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.81	acre-ft

Calculated Parameters for Spillway

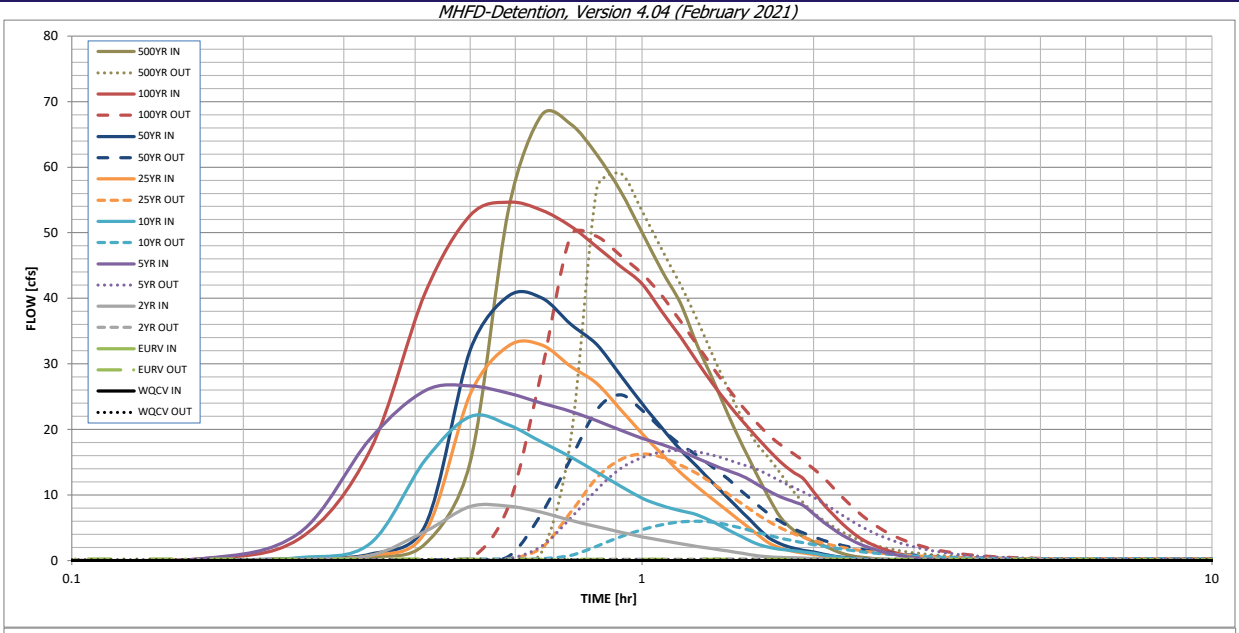
Routed Hydrograph Results

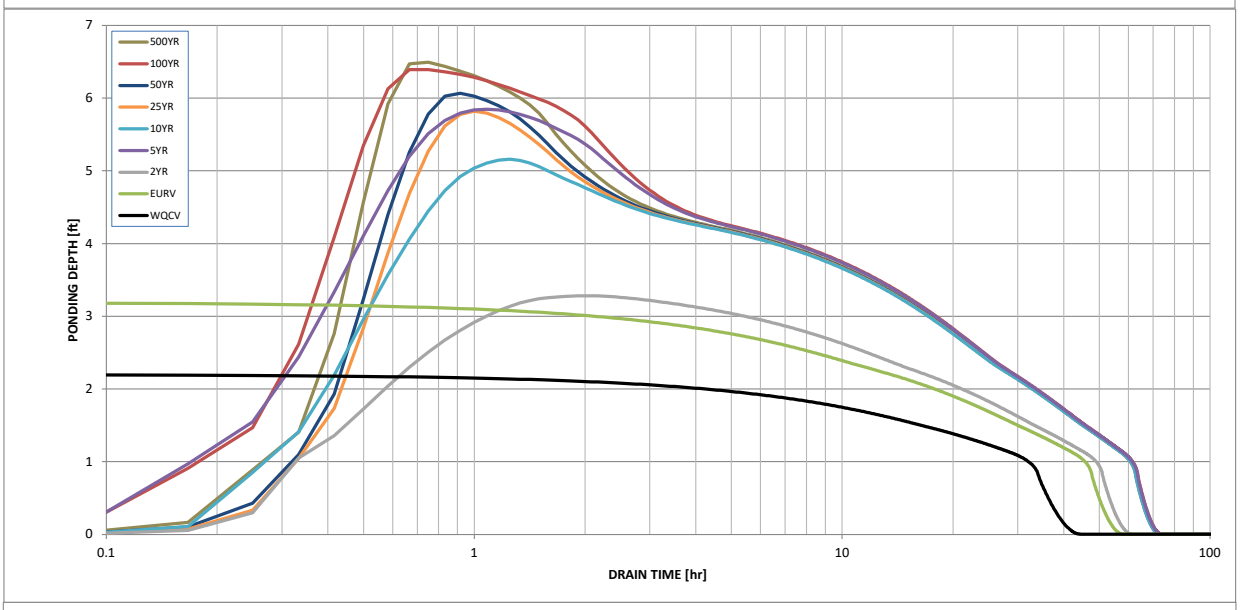
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through A

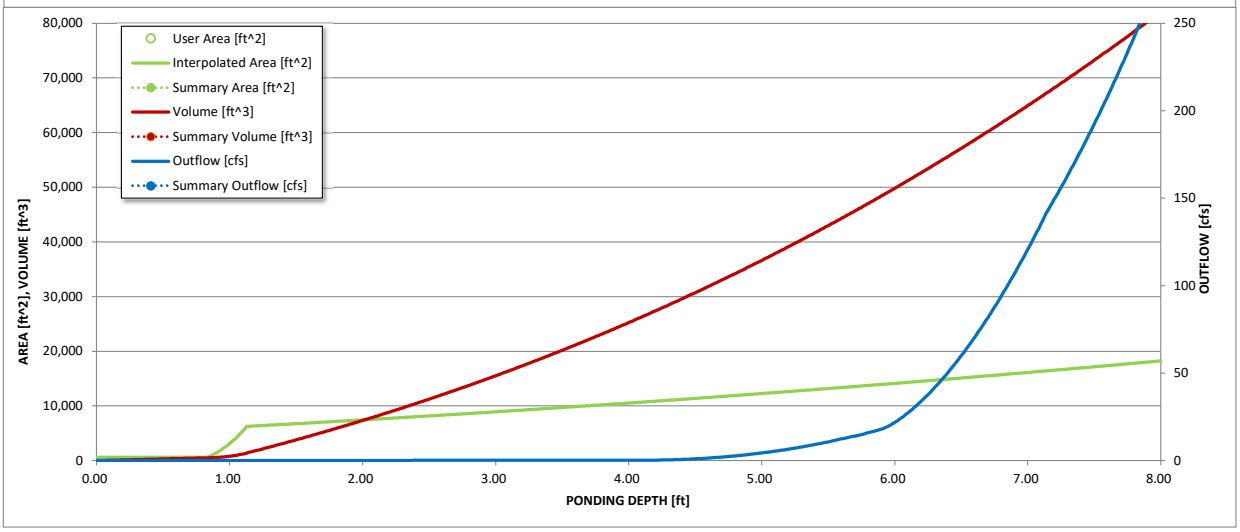
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.203	0.396	0.447	0.851	1.240	1.888	2.346	2.988
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.447	2.651	1.240	1.888	2.346	4.897
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	4.1	11.0	16.6	28.4	35.5	44.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		17.0				50.0
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.17	0.72	0.71	1.21	1.51	2.13
Peak Inflow Q (cfs) =	N/A	N/A	8.3	26.6	22.0	32.9	40.4	54.7
Peak Outflow Q (cfs) =	0.1	0.2	0.2	16.8	6.0	16.3	25.3	49.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.4	0.6	0.7	1.0
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	1.0	0.3	0.9	1.2	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	48	51	47	56	52	49	37
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	55	59	63	61	60	54
Maximum Ponding Depth (ft) =	2.20	3.20	3.28	5.85	5.16	5.82	6.07	6.39
Area at Maximum Ponding Depth (acres) =	0.18	0.21	0.21	0.32	0.29	0.32	0.33	0.34
Maximum Volume Stored (acre-ft) =	0.203	0.398	0.415	1.092	0.883	1.083	1.163	1.273

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.

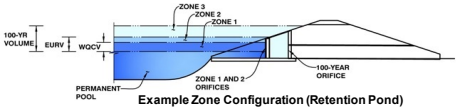
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.05	0.00
	0:10:00	0.00	0.00	0.00	0.26	0.00	0.00	0.02	0.27	0.08
	0:15:00	0.00	0.00	0.22	4.18	0.45	0.30	0.37	3.29	0.52
	0:20:00	0.00	0.00	0.79	18.56	2.61	0.77	0.98	16.80	2.53
	0:25:00	0.00	0.00	4.46	25.92	15.35	4.29	5.35	40.82	15.05
	0:30:00	0.00	0.00	8.26	26.63	21.95	25.39	32.12	52.64	53.58
	0:35:00	0.00	0.00	8.30	25.54	20.68	32.77	40.35	54.68	67.92
	0:40:00	0.00	0.00	7.36	24.02	18.10	32.91	40.08	53.45	66.58
	0:45:00	0.00	0.00	6.15	22.77	15.80	29.61	36.06	50.98	61.89
	0:50:00	0.00	0.00	5.18	21.33	13.47	27.01	32.92	47.85	56.39
	0:55:00	0.00	0.00	4.37	19.93	11.38	23.07	28.30	44.90	50.07
	1:00:00	0.00	0.00	3.63	18.66	9.55	19.40	23.96	42.22	44.24
	1:05:00	0.00	0.00	3.09	17.72	8.40	16.26	20.24	37.98	39.36
	1:10:00	0.00	0.00	2.60	16.73	7.64	13.48	16.97	34.23	32.88
	1:15:00	0.00	0.00	2.18	15.62	6.97	11.29	14.34	30.38	27.54
	1:20:00	0.00	0.00	1.81	14.58	5.89	9.31	11.82	26.90	22.25
	1:25:00	0.00	0.00	1.45	13.70	4.70	7.53	9.55	23.90	17.62
	1:30:00	0.00	0.00	1.11	12.91	3.60	5.82	7.39	21.31	13.49
	1:35:00	0.00	0.00	0.80	11.76	2.62	4.19	5.34	19.01	9.72
	1:40:00	0.00	0.00	0.58	10.63	2.04	2.73	3.53	16.90	6.62
	1:45:00	0.00	0.00	0.49	9.74	1.74	1.93	2.57	15.06	4.83
	1:50:00	0.00	0.00	0.44	9.07	1.53	1.45	1.97	13.62	3.68
	1:55:00	0.00	0.00	0.38	8.43	1.35	1.16	1.59	12.53	2.88
	2:00:00	0.00	0.00	0.33	7.13	1.12	0.95	1.33	10.52	2.30
	2:05:00	0.00	0.00	0.25	5.87	0.86	0.71	0.99	8.61	1.62
	2:10:00	0.00	0.00	0.19	4.80	0.64	0.51	0.71	6.98	1.08
	2:15:00	0.00	0.00	0.14	3.88	0.47	0.36	0.51	5.58	0.73
	2:20:00	0.00	0.00	0.11	3.11	0.34	0.27	0.37	4.39	0.53
	2:25:00	0.00	0.00	0.08	2.50	0.24	0.20	0.27	3.43	0.39
	2:30:00	0.00	0.00	0.06	2.01	0.17	0.14	0.20	2.70	0.29
	2:35:00	0.00	0.00	0.05	1.61	0.13	0.10	0.14	2.14	0.21
	2:40:00	0.00	0.00	0.03	1.29	0.09	0.08	0.11	1.70	0.16
	2:45:00	0.00	0.00	0.02	1.02	0.06	0.06	0.08	1.34	0.11
	2:50:00	0.00	0.00	0.01	0.79	0.04	0.04	0.05	1.03	0.08
	2:55:00	0.00	0.00	0.01	0.61	0.02	0.02	0.03	0.79	0.05
	3:00:00	0.00	0.00	0.00	0.46	0.01	0.01	0.02	0.59	0.02
	3:05:00	0.00	0.00	0.00	0.34	0.00	0.00	0.01	0.44	0.01
	3:10:00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.32	0.00
	3:15:00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.23	0.00
	3:20:00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.17	0.00
	3:25:00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.12	0.00
	3:30:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.09	0.00
	3:35:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.06	0.00
	3:40:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	3:45:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Flying Horse North Drainage Plan

Basin ID: Pond 17



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	23.50	acres
Watershed Length =	1,050	ft
Watershed Length to Centroid =	540	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	17.16%	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.

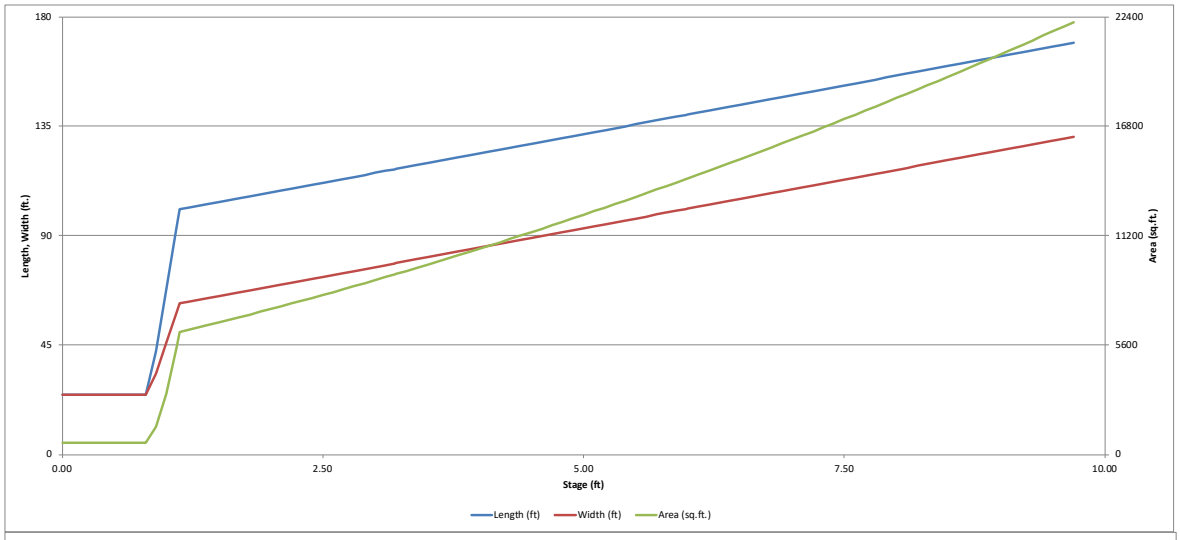
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.203	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.396	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.447	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.851	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.240	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.888	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.346	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.988	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.182	acre-feet		inches
Approximate 2-yr Detention Volume =	0.267	acre-feet		
Approximate 5-yr Detention Volume =	0.401	acre-feet		
Approximate 10-yr Detention Volume =	0.679	acre-feet		
Approximate 25-yr Detention Volume =	0.863	acre-feet		
Approximate 50-yr Detention Volume =	0.911	acre-feet		
Approximate 100-yr Detention Volume =	1.134	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.203	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.193	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.739	acre-feet
Total Detention Basin Volume =	1.134	acre-feet
Initial Surcharge Volume (ISV) =	200	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	606	ft^2
Surcharge Volume Length (L_{ISV}) =	24.6	ft
Surcharge Volume Width (W_{ISV}) =	24.6	ft
Depth of Basin Floor (H_{FLOOR}) =	0.30	ft
Length of Basin Floor (L_{FLOOR}) =	100.8	ft
Width of Basin Floor (W_{FLOOR}) =	62.1	ft
Area of Basin Floor (A_{FLOOR}) =	6,263	ft^2
Volume of Basin Floor (V_{FLOOR}) =	882	ft^3
Depth of Main Basin (H_{MAIN}) =	4.87	ft
Length of Main Basin (L_{MAIN}) =	139.8	ft
Width of Main Basin (W_{MAIN}) =	101.1	ft
Area of Main Basin (A_{MAIN}) =	14,129	ft^2
Volume of Main Basin (V_{MAIN}) =	48,372	ft^3
Calculated Total Basin Volume (V_{total}) =	**1.142**	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		24.6	24.6	606		0.014		
ISV	0.33		24.6	24.6	606		0.014	200	0.005
	0.40		24.6	24.6	606		0.014	242	0.006
	0.50		24.6	24.6	606		0.014	303	0.007
	0.60		24.6	24.6	606		0.014	364	0.008
	0.70		24.6	24.6	606		0.014	424	0.010
	0.80		24.6	24.6	606		0.014	485	0.011
	0.90		42.4	33.4	1,415		0.032	572	0.013
	1.00		67.8	45.9	3,110		0.071	793	0.018
	1.10		93.2	58.4	5,440		0.125	1,215	0.028
Floor	1.13		100.8	62.1	6,263		0.144	1,390	0.032
	1.20		101.4	62.7	6,354		0.146	1,832	0.042
	1.30		102.2	63.5	6,486		0.149	2,474	0.057
	1.40		103.0	64.3	6,619		0.152	3,129	0.072
	1.50		103.8	65.1	6,754		0.155	3,798	0.087
	1.60		104.6	65.9	6,889		0.158	4,480	0.103
	1.70		105.4	66.7	7,026		0.161	5,176	0.119
	1.80		106.2	67.5	7,165		0.164	5,885	0.135
	1.90		107.0	68.3	7,304		0.168	6,609	0.152
	2.00		107.8	69.1	7,445		0.171	7,346	0.169
	2.10		108.6	69.9	7,587		0.174	8,098	0.186
Zone 1 (WQCV)	2.20		109.4	70.7	7,731		0.177	8,864	0.203
	2.30		110.2	71.5	7,875		0.181	9,644	0.221
	2.40		111.0	72.3	8,021		0.184	10,439	0.240
	2.50		111.8	73.1	8,169		0.188	11,248	0.258
	2.60		112.6	73.9	8,317		0.191	12,073	0.277
	2.70		113.4	74.7	8,467		0.194	12,912	0.296
	2.80		114.2	75.5	8,618		0.198	13,766	0.316
	2.90		115.0	76.3	8,770		0.201	14,636	0.336
	3.00		115.8	77.1	8,924		0.205	15,520	0.356
	3.10		116.6	77.9	9,079		0.208	16,420	0.377
Zone 2 (EURV)	3.19		117.3	78.6	9,219		0.212	17,244	0.396
	3.20		117.4	78.7	9,235		0.212	17,336	0.398
	3.30		118.2	79.5	9,393		0.216	18,267	0.419
	3.40		119.0	80.3	9,551		0.219	19,215	0.441
	3.50		119.8	81.1	9,711		0.223	20,178	0.463
	3.60		120.6	81.9	9,873		0.227	21,157	0.486
	3.70		121.4	82.7	10,035		0.230	22,152	0.509
	3.80		122.2	83.5	10,199		0.234	23,164	0.532
	3.90		123.0	84.3	10,364		0.238	24,192	0.555
	4.00		123.8	85.1	10,531		0.242	25,237	0.579
	4.10		124.6	85.9	10,699		0.246	26,298	0.604
	4.20		125.4	86.7	10,868		0.249	27,377	0.628
	4.30		126.2	87.5	11,038		0.253	28,472	0.654
	4.40		127.0	88.3	11,209		0.257	29,584	0.679
	4.50		127.8	89.1	11,382		0.261	30,714	0.705
	4.60		128.6	89.9	11,556		0.265	31,861	0.731
	4.70		129.4	90.7	11,732		0.269	33,025	0.758
	4.80		130.2	91.5	11,908		0.273	34,207	0.785
	4.90		131.0	92.3	12,086		0.277	35,407	0.813
	5.00		131.8	93.1	12,266		0.282	36,625	0.841
	5.10		132.6	93.9	12,446		0.286	37,860	0.869
	5.20		133.4	94.7	12,628		0.290	39,114	0.898
	5.30		134.2	95.5	12,811		0.294	40,386	0.927
	5.40		135.0	96.3	12,995		0.298	41,676	0.957
	5.50		135.8	97.1	13,181		0.303	42,985	0.987
	5.60		136.6	97.9	13,368		0.307	44,312	1.017
	5.70		137.4	98.7	13,556		0.311	45,659	1.048
	5.80		138.2	99.5	13,746		0.316	47,024	1.080
	5.90		139.0	100.3	13,937		0.320	48,408	1.111
Zone 3 (100-year)	5.98		139.6	100.9	14,090		0.323	49,529	1.137
	6.00		139.8	101.1	14,129		0.324	49,811	1.144
	6.10		140.6	101.9	14,322		0.329	51,234	1.176
	6.20		141.4	102.7	14,516		0.333	52,675	1.209
	6.30		142.2	103.5	14,712		0.338	54,137	1.243
	6.40		143.0	104.3	14,910		0.342	55,618	1.277
	6.50		143.8	105.1	15,108		0.347	57,119	1.311
	6.60		144.6	105.9	15,308		0.351	58,640	1.346
	6.70		145.4	106.7	15,509		0.356	60,180	1.382
	6.80		146.2	107.5	15,711		0.361	61,741	1.417
	6.90		147.0	108.3	15,915		0.365	63,323	1.454
	7.00		147.8	109.1	16,119		0.370	64,924	1.490
	7.10		148.6	109.9	16,326		0.375	66,547	1.528
	7.20		149.4	110.7	16,533		0.380	68,190	1.565
	7.30		150.2	111.5	16,742		0.384	69,853	1.604
	7.40		151.0	112.3	16,952		0.389	71,538	1.642
	7.50		151.8	113.1	17,163		0.394	73,244	1.681
	7.60		152.6	113.9	17,375		0.399	74,970	1.721
	7.70		153.4	114.7	17,589		0.404	76,719	1.761
	7.80		154.2	115.5	17,804		0.409	78,488	1.802
	7.90		155.0	116.3	18,021		0.414	80,280	1.843
	8.00		155.8	117.1	18,238		0.419	82,093	1.885
	8.10		156.6	117.9	18,457		0.424	83,927	1.927
	8.20		157.4	118.7	18,677		0.429	85,784	1.969
	8.30		158.2	119.5	18,899		0.434	87,663	2.012
	8.40		159.0	120.3	19,122		0.439	89,564	2.056
	8.50		159.8	121.1	19,346		0.444	91,487	2.100
	8.60		160.6	121.9	19,571		0.449	93,433	2.145
	8.70		161.4	122.7	19,798		0.454	95,401	2.190
	8.80		162.2	123.5	20,026		0.460	97,393	2.236
	8.90		163.0	124.3	20,255		0.465	99,407	2.282
	9.00		163.8	125.1	20,485		0.470	101,444	2.329
	9.10		164.6	125.9	20,717		0.476	103,504	2.376
	9.20		165.4	126.7	20,950		0.481	105,587	2.424
	9.30		166.2	127.5	21,184		0.486	107,694	2.472
	9.40		167.0	128.3	21,420		0.492	109,824	2.521
	9.50		167.8	129.1	21,657		0.497	111,978	2.571
	9.60		168.6	129.9	21,895		0.503	114,155	2.621
	9.70		169.4	130.7	22,134		0.508	116,357	2.671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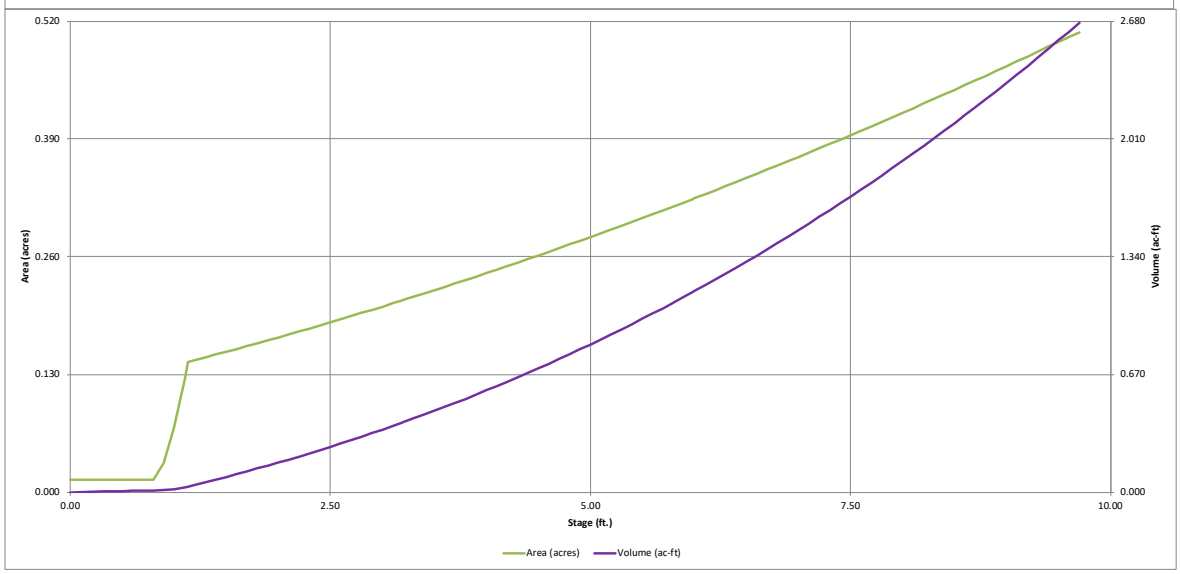
135
90
45
0
Length, Width (ft.)
22400
16800
11200
5600
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)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0.390
0.260
0.130
0.000
Area (acres)
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2.010
1.340
0.670
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

Appendix E

Worksheet for Culvert 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	3.00	ft
Discharge	58.65	ft^3/s

Results

Normal Depth	2.18	ft
Flow Area	5.51	ft^2
Wetted Perimeter	6.13	ft
Hydraulic Radius	0.90	ft
Top Width	2.67	ft
Critical Depth	2.48	ft
Percent Full	72.8	%
Critical Slope	0.00763	ft/ft
Velocity	10.65	ft/s
Velocity Head	1.76	ft
Specific Energy	3.94	ft
Froude Number	1.31	
Maximum Discharge	71.74	ft^3/s
Discharge Full	66.69	ft^3/s
Slope Full	0.00773	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	72.76	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.18	ft
Critical Depth	2.48	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00763	ft/ft

Cross Section for Culvert 1

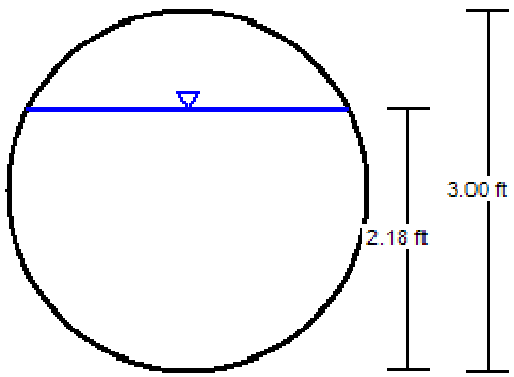
Project Description

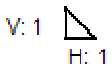
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	2.18	ft
Diameter	3.00	ft
Discharge	58.65	ft³/s

Cross Section Image





Worksheet for Culvert 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02000	ft/ft
Diameter	3.50	ft
Discharge	116.26	ft^3/s

Results

Normal Depth	2.41	ft
Flow Area	7.05	ft^2
Wetted Perimeter	6.84	ft
Hydraulic Radius	1.03	ft
Top Width	3.25	ft
Critical Depth	3.22	ft
Percent Full	68.7	%
Critical Slope	0.01159	ft/ft
Velocity	16.49	ft/s
Velocity Head	4.23	ft
Specific Energy	6.63	ft
Froude Number	1.97	
Maximum Discharge	153.05	ft^3/s
Discharge Full	142.28	ft^3/s
Slope Full	0.01335	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	68.73	%
Downstream Velocity	Infinity	ft/s

Worksheet for Culvert 2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.41	ft
Critical Depth	3.22	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.01159	ft/ft

Cross Section for Culvert 2

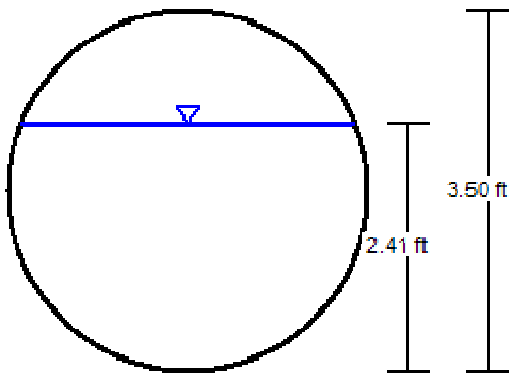
Project Description

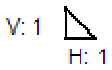
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

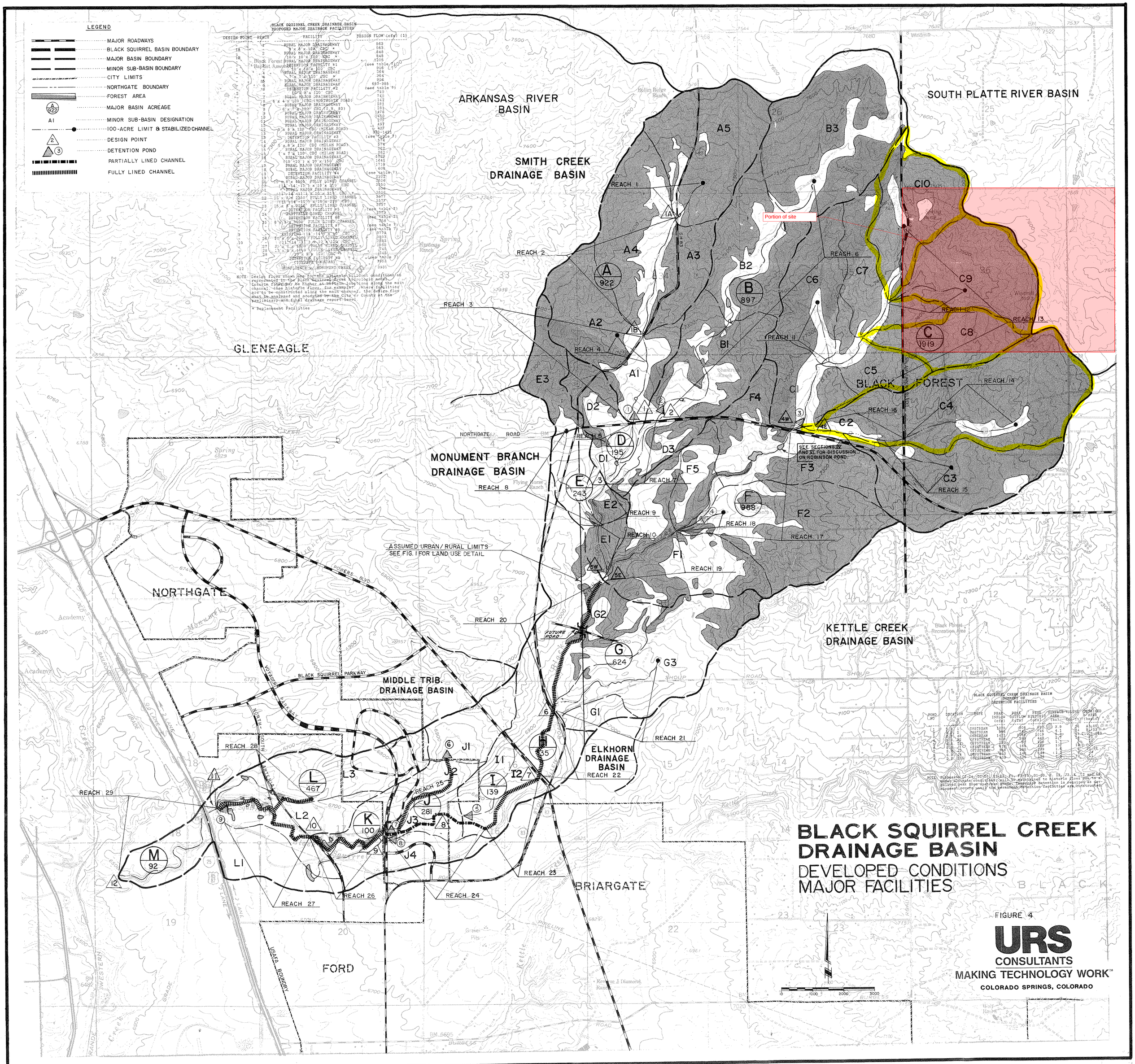
Roughness Coefficient	0.013	
Channel Slope	0.02000	ft/ft
Normal Depth	2.41	ft
Diameter	3.50	ft
Discharge	116.26	ft³/s

Cross Section Image





Appendix F


LEGEND
MAJOR ROADWAYS
BLACK SQUIRREL BASIN BOUNDARY
MAJOR BASIN BOUNDARY
MINOR SUB-BASIN BOUNDARY
CITY LIMITS
NORTHGATE BOUNDARY
FOREST AREA
MAJOR BASIN ACREAGE
A1 MINOR SUB-BASIN DESIGNATION
100-ACRE LIMIT & STABILIZED CHANNEL
DESIGN POINT
DETENTION POND
PARTIALLY LINED CHANNEL
FULLY LINED CHANNEL
ARKANSAS RIVER BASIN
SOUTH PLATTE RIVER BASIN
SMITH CREEK DRAINAGE BASIN
MONUMENT BRANCH DRAINAGE BASIN
MIDDLE TRIB. DRAINAGE BASIN
KETTLE CREEK DRAINAGE BASIN
ELKHORN DRAINAGE BASIN
BLACK FOREST
GLENEAGLE
NORTHGATE
BRIARGATE
FORD
Portion of site
SEE SECTIONS IV AND VI FOR DISCUSSION ON ROBINSON POND.
ASSUMED URBAN/RURAL LIMITS SEE FIG. 1 FOR LAND USE DETAIL
NORTHGATE ROAD
POWERS BLVD.
BLACK SQUIRREL PARKWAY
NORTH-SOUTH PARKWAY
FUTURE ROAD
USAFA BOUNDARY
BLACK SQUIRREL CREEK DRAINAGE BASIN
PROPOSED MAJOR DRAINAGE FACILITIES
BLACK SQUIRREL CREEK DRAINAGE BASIN
SUMMARY OF DETENTION FACILITIES
BLACK SQUIRREL CREEK
DRAINAGE BASIN
DEVELOPED CONDITIONS
MAJOR FACILITIES
FIGURE 4
URS
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COLORADO SPRINGS, COLORADO

INNOVATIVE DESIGN. **CLASSIC RESULTS.**

PRELIMINARY DRAINAGE REPORT
FOR
FLYING HORSE NORTH PRELIMINARY PLAN
AND
FINAL DRAINAGE REPORT
FOR
FLYING HORSE NORTH FILING NO. 1

NOVEMBER 2017
Revised June 2018

Prepared for:
PRI #2 LLC
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Prepared by:
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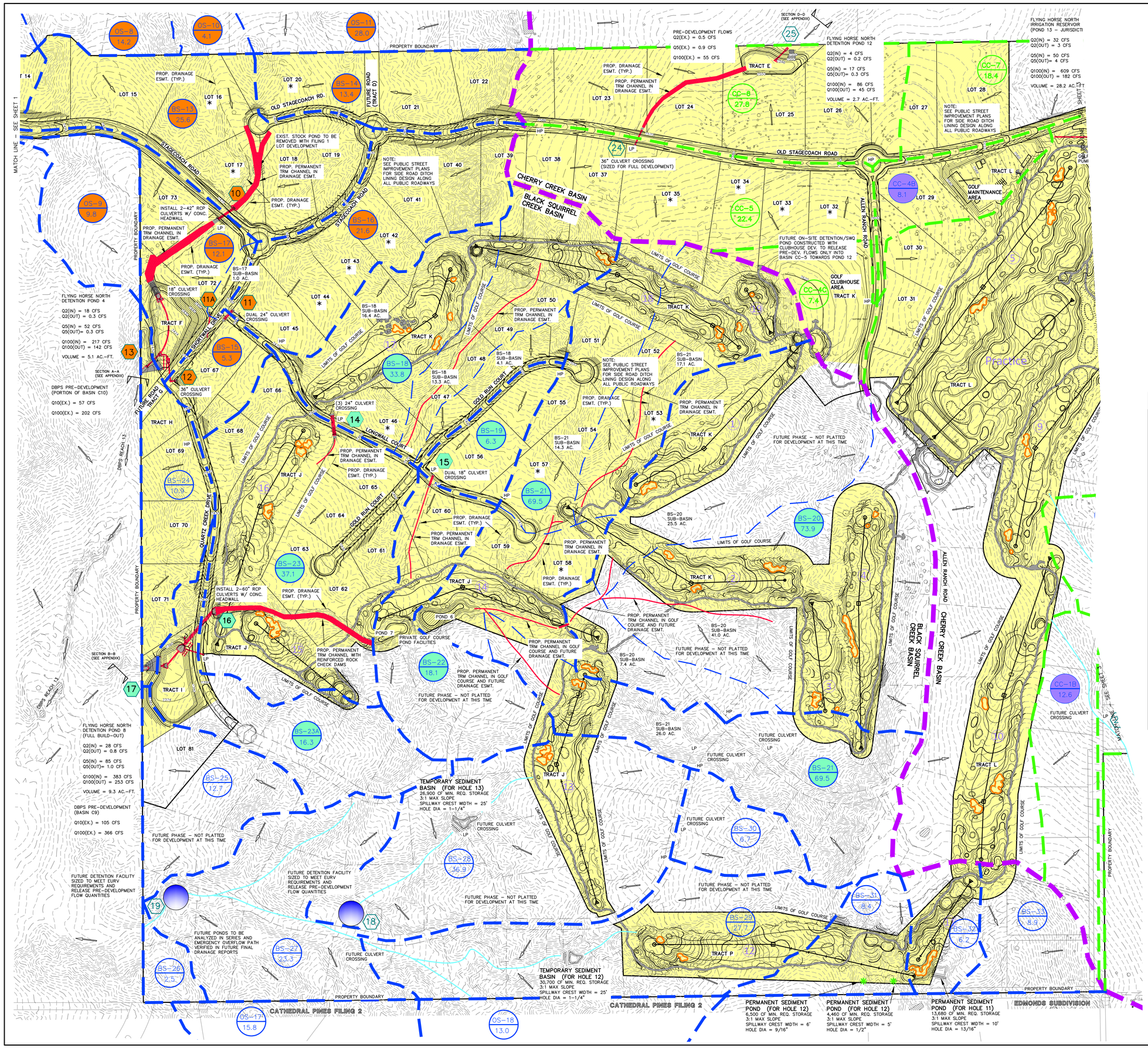
Job no. 1096.11
PCD File No. SP-17-012 and SF-18-001



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-8	14.20	65.0	0.27	2.1	6.2	24.7
OS-9	9.80	60.0	0.37	0.1	1.0	9.1
OS-10	4.10	65.0	0.17	0.7	2.1	8.2
OS-11	28.00	65.0	0.35	2.4	8.2	38.7
OS-12	68.10	62.7	0.37	2.2	11.9	75.8
OS-13	36.90	63.0	0.33	1.4	7.4	45.0
OS-14	26.40	62.0	0.31	0.7	4.6	31.0
OS-15	70.80	63.9	0.38	3.3	14.8	84.2
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
BS-13	25.60	65.0	0.23	3.7	10.2	40.7
BS-14	13.40	65.0	0.23	2.6	6.8	26.5
BS-15	5.30	65.0	0.18	1.6	3.7	12.2
BS-16	21.60	65.0	0.34	4.6	11.8	44.1
BS-17	12.10	65.0	0.21	3.1	7.7	26.7
BS-18	33.80	63.6	0.41	3.5	12.4	56.0
BS-19	6.30	65.0	0.18	2.1	4.6	15.0
BS-20	73.90	63.4	0.31	7.4	24.6	112.4
BS-21	69.50	64.3	0.35	7.8	23.9	103.0
BS-22	18.10	64.4	0.22	3.7	9.6	36.5
BS-23	37.10	63.3	0.33	4.5	13.6	58.2
BS-23A	16.30	64.4	0.29	5.5	12.0	38.3
BS-24	10.90	63.0	0.17	0.6	3.3	17.6
EX-24 (Pre-Dev.)	13.20	60.0	0.17	0.2	2.2	17.8
BS-25	12.70	63.0	0.23	0.4	2.7	17.3
BS-26	2.50	60.0	0.18	0.0	0.4	3.4
BS-27	23.30	65.0	0.22	2.1	8.0	38.8
BS-28	36.90	64.4	0.32	2.2	9.3	49.4
BS-29	27.70	64.0	0.33	1.4	6.5	35.9
BS-30	6.70	65.0	0.20	0.7	2.4	11.7
BS-31	8.40	62.5	0.23	0.3	1.9	11.8
BS-32	6.20	62.6	0.20	0.3	1.6	9.4
BS-33	8.90	64.7	0.19	0.8	3.2	15.3
CC-1A	9.80	65.0	0.23	0.8	3.3	16.0
CC-1B	12.60	64.8	0.25	1.0	4.0	19.4
CC-2A	11.00	65.0	0.22	1.0	3.8	18.3
CC-2B	20.80	65.0	0.22	1.9	7.1	34.6
CC-2C	6.40	65.0	0.18	0.7	2.5	11.5
CC-3	52.50	63.1	0.43	1.8	8.8	54.5
CC-4A	108.70	62.6	0.44	15.4	39.0	156.0
CC-4B	8.10	76.1	0.26	4.0	7.3	20.6
CC-4C (Pre-Dev.)	7.40	61.0	0.13	0.2	1.8	11.2
CC-5	22.40	65.0	0.26	1.8	7.1	34.3
CC-6	27.80	65.0	0.25	2.3	9.1	43.2
CC-7	18.40	65.0	0.29	1.4	5.4	27.0

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-10 DEV	OS-8, OS-10, OS-11, BS-13, BS-14	10.7	32.0	143
DP-11 DEV	BS-16	4.6	11.8	36
DP-12 DEV	DP-11, 1.0 Ac. Portion of BS-17 and BS-15	4.2	11.8	46
TOTAL INFLOW TO POND 4 (UD Detention hydrograph)	**DP-10, DP-12, BS-17, OS-9**	**10**	**16**	**217**
DP-13 DEV	**Release from FHN Pond 4**	**0.3**	**0.3**	**142**
DP-14 DEV	BS-18	3.5	12.4	56
DP-15 DEV	BS-19	2.1	4.6	15
DP-16 DEV	DP-14, DP-15, BS-20, BS-21, BS-22, BS-23	25.0	78.0	362
TOTAL INFLOW TO FHN POND 8 (Full Build-out) (UD Detention hydrograph)	**DP-10, DP-12, BS-17, OS-9**	**24**	**37**	**390**
DP-17 DEV (Full Build-out)	**Release from FHN Pond 8**	**0.8**	**1.0**	**253**
TOTAL INFLOW TO FHN POND 8 (Filing 1 Only) (UD Detention hydrograph)	**DP-10, DP-12, BS-17, OS-9**	**9**	**14**	**301**
DP-17 DEV (Filing 1 Only)	**Release from FHN Pond 8**	**0.4**	**0.5**	**219**
DP-18 DEV	BS-28, BS-29, BS-30, OS-18	5.0	21.6	115
DP-19 DEV	BS-27, OS-17, Release from DP-18	3.8	16.8	126
DP-20 DEV	CC-1A, OS-12	3.2	14.3	88
DP-21 DEV	CC-2A, OS-13	2.1	10.5	62
DP-22 DEV	CC-2B, Release from DP-21	3.7	16.6	92
DP-23 DEV	CC-3, OS-14	2.5	13.0	84
DP-24 DEV	CC-4C (Pre-Dev.), CC-5	1.9	8.4	45
TOTAL INFLOW TO POND 12 (UD Detention hydrograph)	**CC-4C, CC-5, CC-6**	**6**	**9**	**85**
DP-25 DEV	**Release from FHN Pond 12**	**0.2**	**0.3**	**45**

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
BASIN BOUNDARY BLACK SQUIRREL	
DESIGN POINT	3
LOTS WITH NON-STANDARD CULVERT SIZE	*
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

N

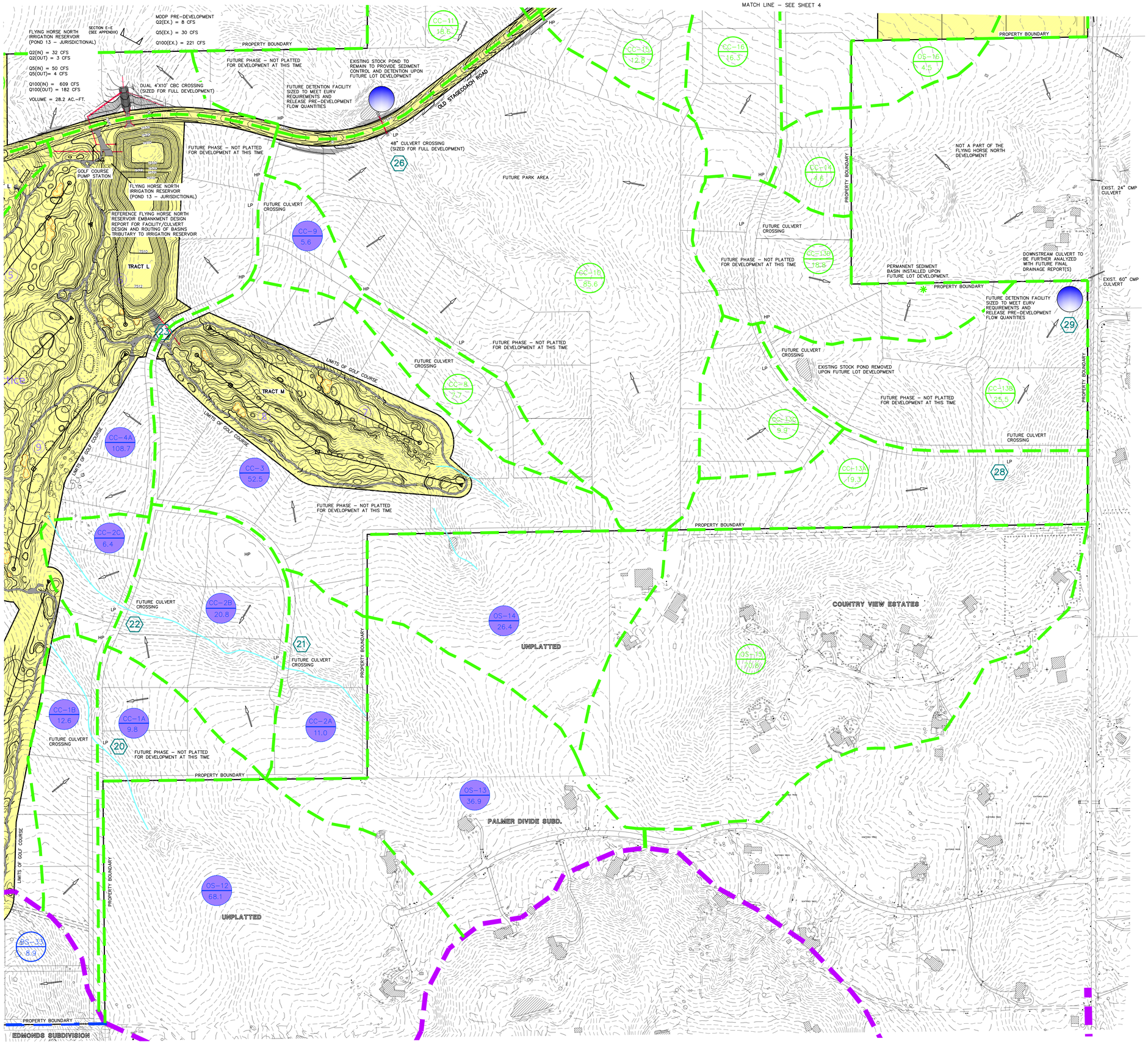
200 100 0 200 400

SCALE: 1" = 200'

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE	10-25-17
DRAWN BY	MAW	(H) 1"= 200'	SHEET	2 OF 4
CHECKED BY		(V) 1"= N/A	JOB NO.	1096.11



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-8	14.20	65.0	0.27	2.1	6.2	24.7
OS-9	9.80	60.0	0.37	0.1	1.0	9.1
OS-10	4.10	65.0	0.17	0.7	2.1	8.2
OS-11	28.00	65.0	0.35	2.4	8.2	38.7
OS-12	68.10	62.7	0.37	2.2	11.9	75.8
OS-13	36.90	63.0	0.33	1.4	7.4	45.0
OS-14	26.40	62.0	0.31	0.7	4.6	31.0
OS-15	70.80	63.9	0.38	3.3	14.8	84.2
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
CC-1A	9.80	65.0	0.23	0.8	3.3	16.0
CC-1B	12.60	64.8	0.25	1.0	4.0	19.4
CC-2A	11.00	65.0	0.22	1.0	3.8	18.3
CC-2B	20.80	65.0	0.22	1.9	7.1	34.6
CC-2C	6.40	65.0	0.18	0.7	2.5	11.5
CC-3	52.50	63.1	0.43	1.8	8.8	54.5
CC-4A	108.70	62.6	0.44	15.4	39.0	156.0
CC-4B	8.10	76.1	0.26	4.0	7.3	20.6
CC-4C (Pre-Dev.)	7.40	61.0	0.13	0.2	1.8	11.2
CC-5	22.40	65.0	0.26	1.8	7.1	34.3
CC-6	27.80	65.0	0.25	2.3	9.1	43.2
CC-7	18.40	65.0	0.29	1.4	5.4	27.0
CC-8	7.70	65.0	0.25	0.6	2.5	12.0
CC-9	5.60	65.0	0.19	0.6	2.1	9.8
CC-10	85.60	62.6	0.39	2.6	14.1	91.9
CC-11	18.60	63.1	0.21	0.9	5.0	28.1
CC-12	12.20	65.0	0.26	1.0	3.9	18.7
CC-13A	19.30	65.0	0.31	1.4	5.4	27.3
CC-13B	25.50	65.0	0.31	1.8	7.2	36.1
CC-13C	9.90	65.0	0.22	0.9	3.4	16.5
CC-13D	18.80	65.0	0.25	1.5	6.2	29.2
CC-14	4.60	65.0	0.21	0.4	1.6	7.8
CC-15	12.80	65.0	0.24	1.1	4.3	20.4
CC-16	16.30	65.0	0.30	1.2	4.6	23.6
CC-17	25.00	65.0	0.35	1.7	6.5	32.8
CC-18	6.20	66.5	0.30	0.7	2.2	9.7
CC-19	3.70	65.0	0.25	0.3	1.2	5.8
CC-20	39.30	65.0	0.25	3.2	12.9	61.0
CC-21	6.20	61.0	0.20	0.1	1.2	8.5
CC-22	13.80	65.0	0.25	1.1	4.5	21.4
CC-23	5.70	64.7	0.33	0.4	1.5	7.7
CC-24	39.60	65.0	0.25	3.3	13.0	61.5
CC-25	3.50	65.0	0.23	0.3	1.2	5.7
CC-26	16.70	65.0	0.26	1.4	5.3	25.6
CC-27	18.90	64.4	0.31	1.2	4.9	25.8
CC-28	154.80	54.4	0.63	6.5	24.7	136.3

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-20 DEV	CC-1A, OS-12	3.2	14.3	88
DP-21 DEV	CC-2A, OS-13	2.1	10.5	62
DP-22 DEV	CC-2B, Release from DP-21	3.7	16.6	92
DP-23 DEV	CC-3, OS-14	2.5	13.0	84
DP-24 DEV	CC-4C (Pre-Dev.), CC-5	1.9	8.4	45
TOTAL INFLOW TO POND 12 (UD Detention hydrograph)	**CC-4C, CC-5, CC-6**	**6**	**9**	**85**
DP-25 DEV	**Release from FHN Pond 12**	**0.2**	**0.3**	**45**
DP-26 DEV	CC-8, CC-10	3.0	15.9	102
DP-27 DEV	CC-15, CC-20	4.3	17.2	81
DP-28 DEV	CC-13A, OS-15	4.6	19.8	110
DP-29 DEV	CC-13B, CC-13C, Release from DP-28	5.8	26.6	155
DP-30 DEV	CC-18	0.7	2.2	10
DP-31 DEV	CC-19, Release from DP-30	0.9	3.2	15
DP-32 DEV	CC-17, OS-16	2.0	7.8	40
DP-33 DEV	CC-23, CC-24	3.6	14.4	69
DP-34 DEV	CC-26, CC-27, CC-28 and Release from CC-16 & DP-32	6.0	23.5	168

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
DESIGN POINT	3
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

N

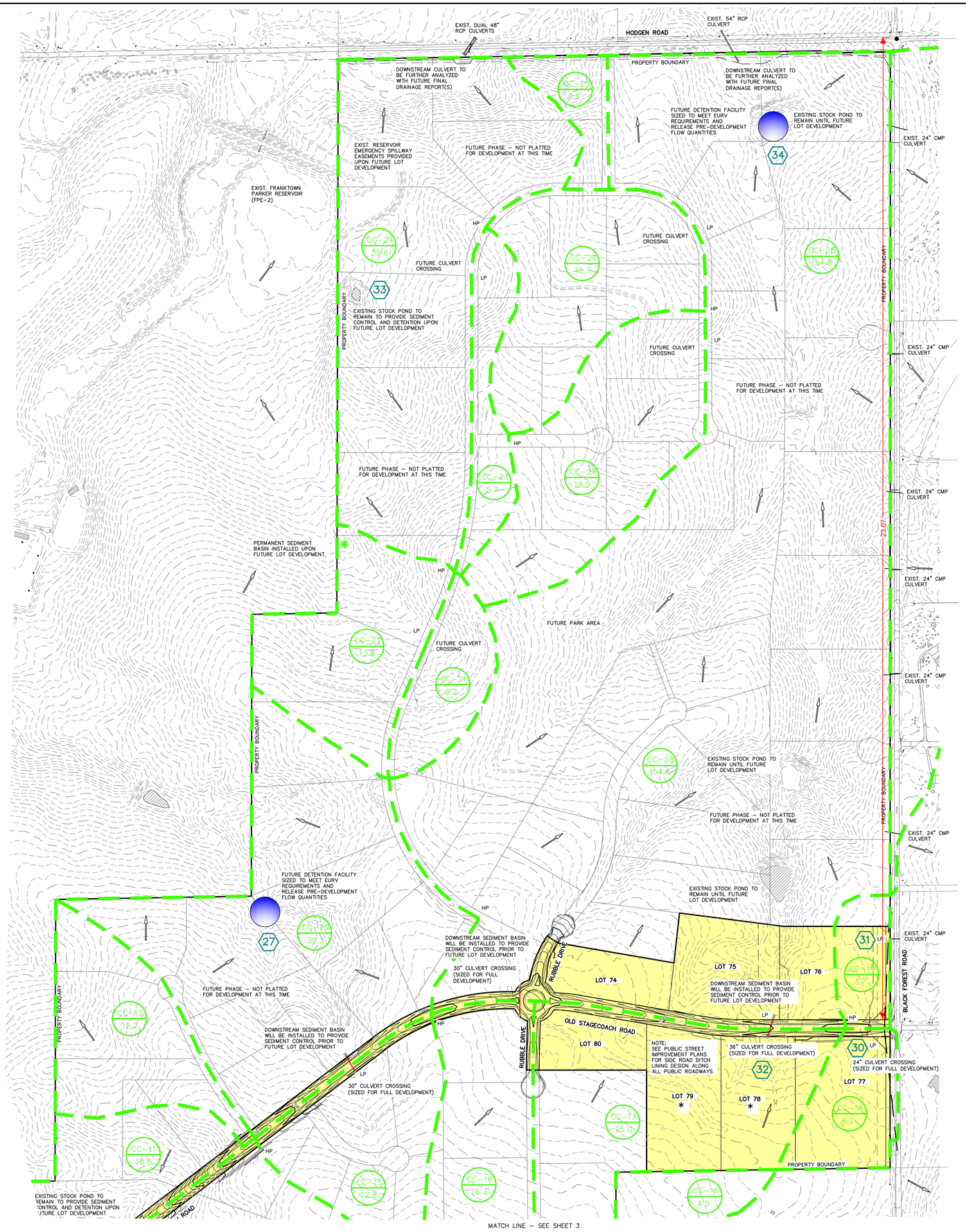
200 100 0 200 400

SCALE: 1" = 200'

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 AND
PRELIMINARY PLAN DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	10-25-17
DRAWN BY	MAW	(H) 1"= 200'		SHEET 3	OF 4
CHECKED BY		(V) 1"= N/A		JOB NO.	1096.11



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
CC-11	18.60	63.1	0.21	0.9	5.0	28.1
CC-12	12.20	65.0	0.26	1.0	3.9	18.7
CC-13A	19.30	65.0	0.31	1.4	5.4	27.3
CC-13B	25.50	65.0	0.31	1.8	7.2	36.1
CC-13C	9.90	65.0	0.22	0.9	3.4	16.5
CC-13D	18.80	65.0	0.25	1.5	6.2	29.2
CC-14	4.60	65.0	0.21	0.4	1.6	7.8
CC-15	12.80	65.0	0.24	1.1	4.3	20.4
CC-16	16.30	65.0	0.30	1.2	4.6	23.6
CC-17	25.00	65.0	0.35	1.7	6.5	32.8
CC-18	6.20	66.5	0.30	0.7	2.2	9.7
CC-19	3.70	65.0	0.25	0.3	1.2	5.8
CC-20	39.30	65.0	0.25	3.2	12.9	61.0
CC-21	6.20	61.0	0.20	0.1	1.2	8.5
CC-22	13.80	65.0	0.25	1.1	4.5	21.4
CC-23	5.70	64.7	0.33	0.4	1.5	7.7
CC-24	39.60	65.0	0.25	3.3	13.0	61.5
CC-25	3.50	65.0	0.23	0.3	1.2	5.7
CC-26	16.70	65.0	0.26	1.4	5.3	25.6
CC-27	18.90	64.4	0.31	1.2	4.9	25.8
CC-28	154.80	64.4	0.63	6.5	24.7	136.3

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-27 DEV	CC-15, CC-20	4.3	17.2	81
DP-28 DEV	CC-13A, OS-15	4.6	19.8	110
DP-29 DEV	CC-13B, CC-13C, Release from DP-28	5.8	26.6	155
DP-30 DEV	CC-18	0.7	2.2	10
DP-31 DEV	CC-19, Release from DP-30	0.9	3.2	15
DP-32 DEV	CC-17, OS-16	2.0	7.8	40
DP-33 DEV	CC-23, CC-24	3.6	14.4	69
DP-34 DEV	CC-26, CC-27, CC-28 and Release from CC-16 & DP-32	6.0	23.5	168

3.56

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
BASIN BOUNDARY BLACK SQUIRREL	
DESIGN POINT	3
LOTS WITH NON-STANDARD CULVERT SIZE	*
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

N

200 100 0 200 400

SCALE: 1" = 200'

CLASSIC CONSULTING ENGINEERS & SURVEYORS

619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 AND
PRELIMINARY PLAN DRAINAGE MAP

DESIGNED BY	MAW	SCALE		DATE	10-17-17
DRAWN BY	MAW	(H) 1"= 200'		SHEET 4	OF 4
CHECKED BY		(V) 1"= N/A		JOB NO.	1096.11

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INNOVATIVE DESIGN. **CLASSIC RESULTS.**

FLYING HORSE NORTH

IRRIGATION RESERVOIR EMBANKMENT

DESIGN REPORT

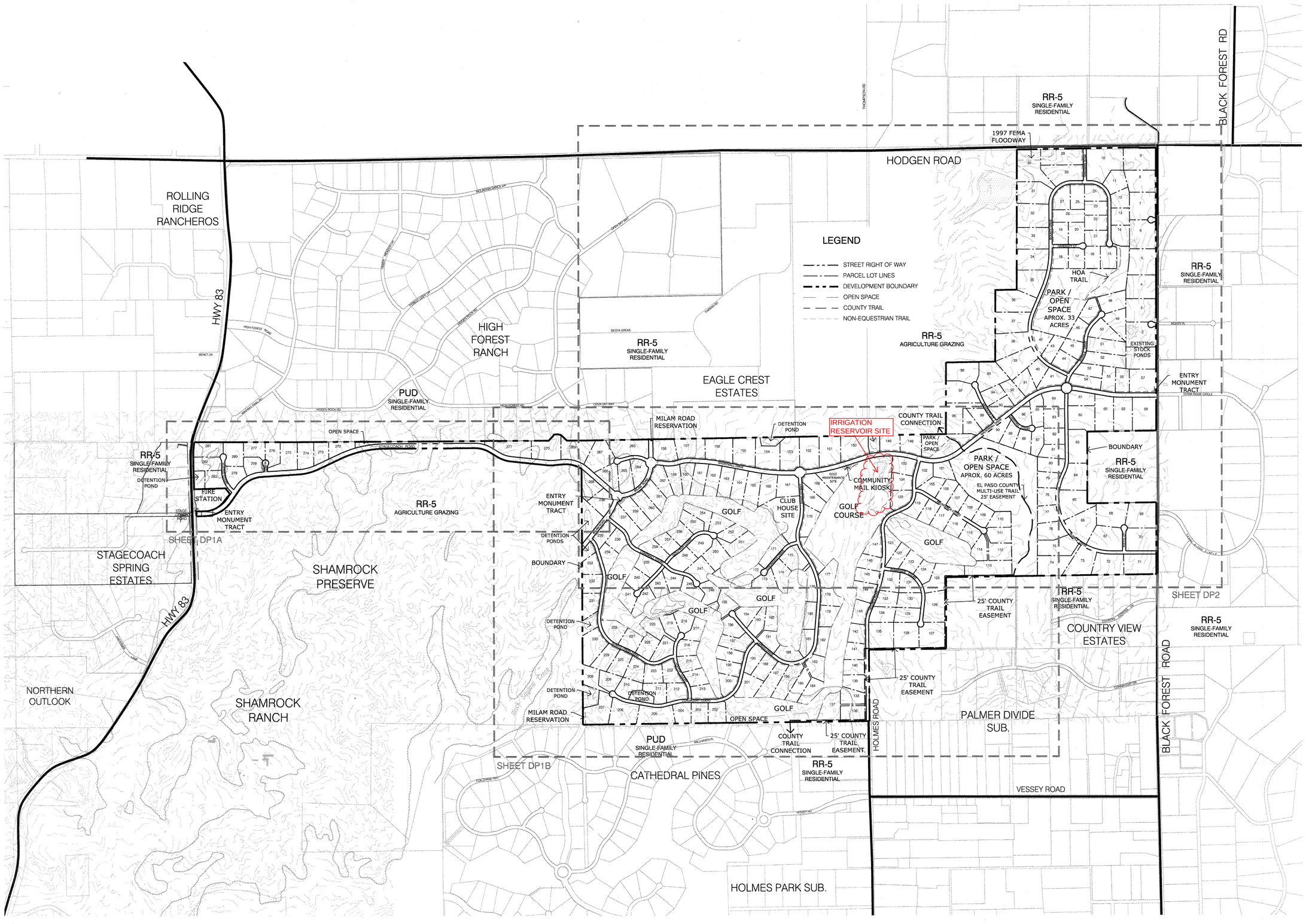
DAMID: 080459
Construction File No.: C-2085

AUGUST 2018

Prepared for:
PRI #2 LLC
6385 CORPORATE DRIVE SUITE 200
COLORADO SPRINGS CO 80919
(719) 592-9333

Prepared by:
CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. CASCADE AVE SUITE 200
COLORADO SPRINGS CO 80903
(719) 785-0790

Job no. 1096.11
PCD File No. SF-18-001



3/22/2017 217032585

NORTH

0 400 800 1600

SCALE: 1" = 800'

P:\Classic2\Shamrock Ranch\Drawings\Planning\Develop\Dp-layout\Flying_Horse_North-DP.dwg {FKLLPLAN} 2/8/2017 4:06:11 PM kmarshall

Land Planning
Landscape Architecture
Urban Design

NES

N.E.S. Inc.
619 N. Cascade Avenue, Suite 200
Colorado Springs, CO 80903

Tel. 719.471.0073
Fax 719.471.0267

www.nescolorado.com

PLANNER / LANDSCAPE ARCHITECT

IN ASSOCIATION WITH

FLYING HORSE NORTH

PLANNED UNIT DEVELOPMENT

PROJECT INFO

DATE:	04-18-2016
PROJECT MGR:	J. MAYNARD
PREPARED BY:	K. MARSHALL

SEAL

ISSUE INFO

DATE:	BY:	DESCRIPTION:
07-25-16	KMM	Per review comments
09-07-16	KMM	Per 2nd review comments
11-28-16	KMM	Milam Revisions

ISSUE / REVISION

SHEET TITLE

DEVELOPMENT PLAN OVERALL SITE

SHEET NUMBER

DP

2 OF 6

PLAN FILE #

FIGURE 1.2

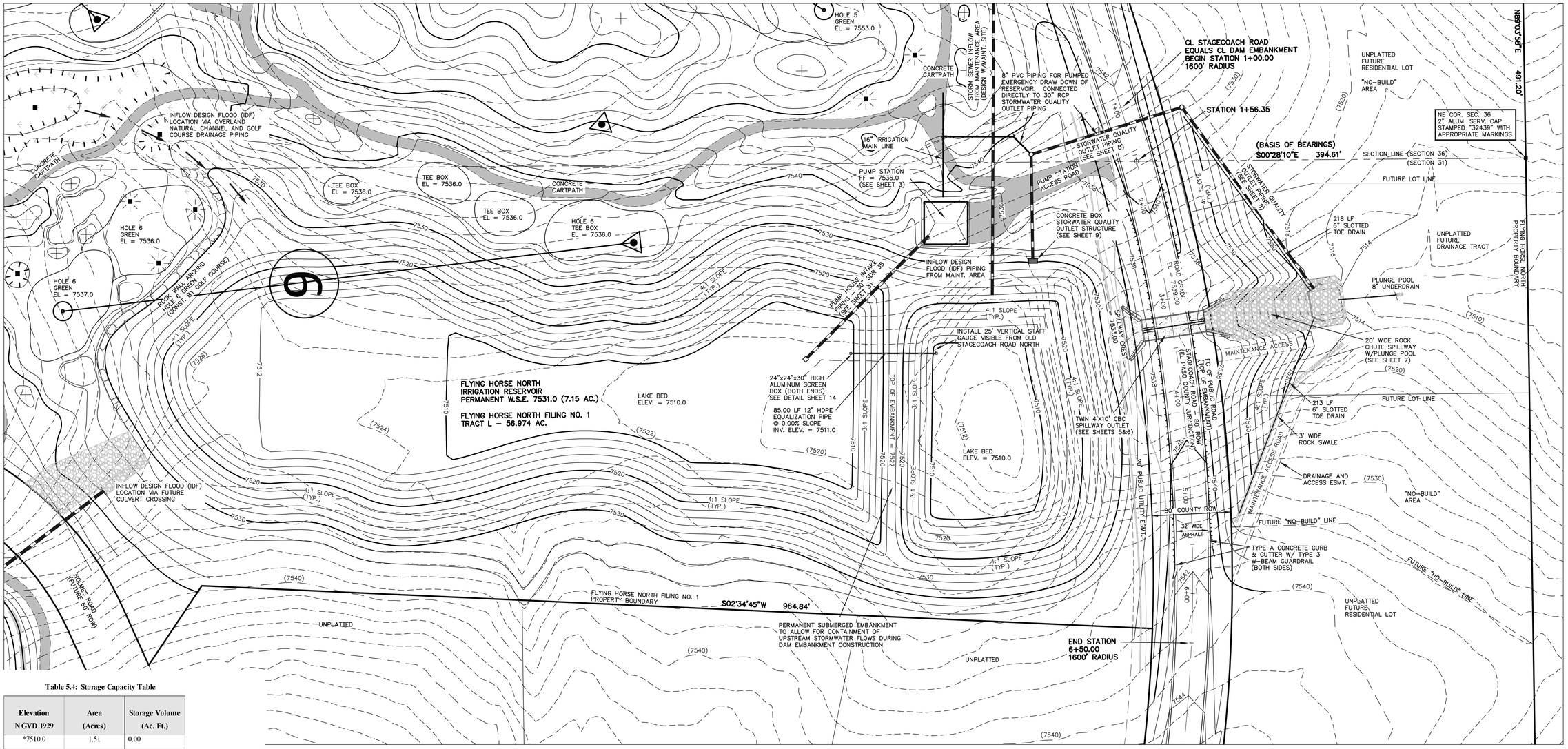


Table 5.4: Storage Capacity Table

Elevation NGVD 1929	Area (Acres)	Storage Volume (Ac. Ft.)
*7510.0	1.51	0.00
*7511.0	1.99	1.74
*7512.0	2.52	3.99
*7513.0	2.85	6.68
*7514.0	3.05	9.63
*7515.0	3.26	12.78
7516.0	3.48	16.15
7517.0	3.70	19.74
7518.0	3.93	23.56
7519.0	4.16	27.60
7520.0	4.40	31.88
7521.0	4.64	36.40
7522.0	4.88	41.16
7523.0	5.14	46.17
7524.0	5.36	51.42
7525.0	5.59	56.89
7526.0	5.84	62.61
7527.0	6.08	68.57
7528.0	6.33	74.77
7529.0	6.57	81.22
7530.0	6.81	87.91
7531.0	7.15	94.89
7532.0	7.52	102.22
7533.0	7.83	109.90
7534.0	8.37	118.00
7535.0	8.77	126.57
7536.0	9.17	135.53

*Indicates dead storage below pumping ability

Table 5.5: Reservoir Discharge Table

Elevation	Discharge (cfs) (SWQ Outlet Box)	Discharge (cfs) (Twin CBC Spillway)	Discharge (cfs) (Total)
7531.0	0.0	0.0	0.0
7532.0	13.89	0.0	13.89
7533.0	27.77	0.0	27.77
7534.0	51.31	49.05	100.36
7535.0	69.52	138.56	208.08
7536.0	74.61	254.72	329.33

Permanent WSE = 7531.0

Top of SWQ Outlet box = 7533.0

Spillway elevation = 7533.0

NOTES:

1. TOPOGRAPHIC BASE MAPPING PRODUCED FROM AERIAL PHOTOGRAPHY PROVIDED BY NORTH AMERICAN MAPPING IN 2009. HORIZONTAL CONTROL IS BASED ON LOCAL CALIBRATION TIED TO SECTION CORNER AND VERTICAL CONTROL IS BASED ON NGVD 1929 DATUM.
2. PERMANENT WSE = 7531.0
3. RESERVOIR LINER INSTALLED UP TO ELEVATION 7534.0

STAFF GAUGE DETAILS:

1. 12"X25'X1/2" PVC
2. LASER CUT ACRYLIC NUMBERS AND HATCH MARKS LIQUID WELDED TO PVC ON 1 FT. INCREMENTS
3. MOUNTED ON ALUMINUM FRAME WITH CROSS BRACKETS ANCHORED INTO SLOPE
4. BASE FASTENED TO 12" PIPE
5. ELEVATION DISPLAY RANGE: 7512–7535

50 25 0 50 100

SCALE: 1" = 50'

FIGURE 1.3

STATE ENGINEER'S CONSTRUCTION FILE NUMBER: C–2085

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS **811**
UTILITY NOTIFICATION CENTER OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE
1	REVISED PER STATE COMMENTS	5–14–18
2	REVISED PER COUNTY COMMENTS	7–31–18

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

MARC A. WHORTON, COLORADO P.E. #37155 DATE

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200 (719)785–0790
Colorado Springs, Colorado 80903 (719)785–0799(Fax)

FLYING HORSE NORTH
IRRIGATION RESERVOIR EMBANKMENT
SITE LAYOUT WITH GRADING
DAM ID – 080459

DESIGNED BY	MAW	SCALE	DATE 1–4–18
DRAWN BY	MAW	(H) 1"= 50'	SHEET 4 OF 14
CHECKED BY		(V) 1"= N/A	JOB NO. 1096.11

N:\1096\11\DRAWINGS\CONSTRUCTION\Jurisdictional Plans\4-D_POND - Site Grading.dwg, 8/21/2018 3:14:51 PM, 1:1

The travel time for overland flow is the estimate in time required for flow to travel from the uppermost part of a drainage basin to a defined channel or inlet of a local storm sewer system. Overland flow can be significant in small basins because a significant portion of time of concentration is due to overland flow. The velocity of overland flow can vary greatly with the surface cover and tillage characteristics. If the slope and land use of the overland flow reach are known, the travel time can be read from figure 5-2 or calculated using the following equation:

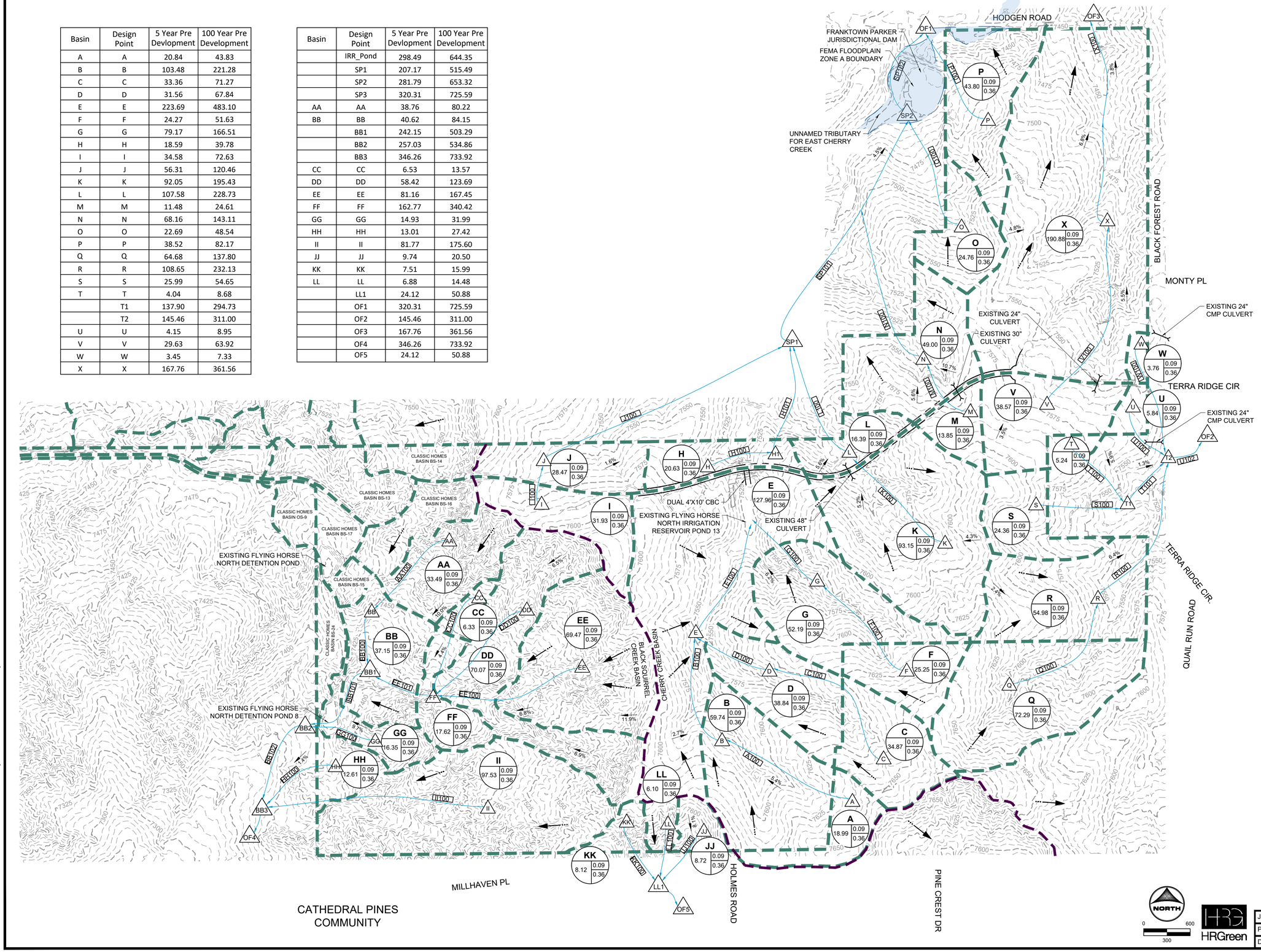
TABLE 5-1 RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

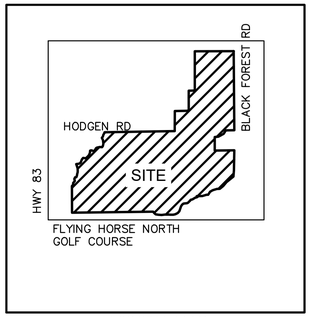
LAND USE OR SURFACE CHARACTERISTICS	**PERCENT IMPERVIOUS**	**"C" FREQUENCY**			
		10		**100**	
		A&B*	**C&D***	**A&B***	**C&D***
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
⅛ Acre or less	65	0.60	0.70	0.70	0.80
¼ Acre	40	0.50	0.60	0.60	0.70
⅓ Acre	30	0.40	0.50	0.55	0.60
½ Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis-Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45
*Hydrologic Soil Group					

Appendix G

Basin	Design Point	5 Year Pre Devlopment	100 Year Pre Development
A	A	20.84	43.83
B	B	103.48	221.28
C	C	33.36	71.27
D	D	31.56	67.84
E	E	223.69	483.10
F	F	24.27	51.63
G	G	79.17	166.51
H	H	18.59	39.78
I	I	34.58	72.63
J	J	56.31	120.46
K	K	92.05	195.43
L	L	107.58	228.73
M	M	11.48	24.61
N	N	68.16	143.11
O	O	22.69	48.54
P	P	38.52	82.17
Q	Q	64.68	137.80
R	R	108.65	232.13
S	S	25.99	54.65
T	T	4.04	8.68
	T1	137.90	294.73
	T2	145.46	311.00
U	U	4.15	8.95
V	V	29.63	63.92
W	W	3.45	7.33
X	X	167.76	361.56

Basin	Design Point	5 Year Pre Devlopment	100 Year Pre Development
	IRR_Pond	298.49	644.35
	SP1	207.17	515.49
	SP2	281.79	653.32
	SP3	320.31	725.59
AA	AA	38.76	80.22
BB	BB	40.62	84.15
	BB1	242.15	503.29
	BB2	257.03	534.86
	BB3	346.26	733.92
CC	CC	6.53	13.57
DD	DD	58.42	123.69
EE	EE	81.16	167.45
FF	FF	162.77	340.42
GG	GG	14.93	31.99
HH	HH	13.01	27.42
II	II	81.77	175.60
JJ	JJ	9.74	20.50
KK	KK	7.51	15.99
LL	LL	6.88	14.48
	LL1	24.12	50.88
	OF1	320.31	725.59
	OF2	145.46	311.00
	OF3	167.76	361.56
	OF4	346.26	733.92
	OF5	24.12	50.88





VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- EXISTING CULVERT
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION — A
- POTENTIAL WATER QUALITY LOCATION — WQ
- SWMM CONVEYANCE ELEMENT — SWMM
- PROPOSED PEAK FLOW RATE (CFS) — 850
- DESIGN POINT — X
- PROPOSED BASIN LABEL — XX BASIN DESIGNATION; AREA (AC.) XX; XX C5; XX C100

NOTES:

Job No.:	211030.01
Prepared By:	CLB
Date:	02/21/2022

EXISTING EX1

FIG.EX1

FLYING HORSE NORTH SKETCH PLAN

A PORTION OF SECTIONS 34, 35 AND 36 TOWNSHIP 11 SOUTH, RANGE 66 WEST, AND A PORTION OF SECTIONS 30 AND 31, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO

NOTES

GENERAL NOTES

1. A TOTAL OF 846 DWELLING UNITS ARE PROPOSED WITHIN THE FLYING HORSE NORTH SKETCH PLAN ON APPROXIMATELY 912.6 ACRES. THE SUBMITTAL ALSO, INCLUDES A LUXURY RESORT HOTEL, CASITAS AND FLATS THAT TOTAL 275 KEYS (ROOMS)/UNITS.
2. CLUSTERING OF UNITS WITHIN RESIDENTIAL DISTRICTS IS PERMITTED, BUT NOT REQUIRED, SO LONG AS THE OVERALL DENSITY LIMIT IS NOT EXCEEDED. THE USE OF CLUSTERING IS ENCOURAGED TO PROMOTE COMMON OPEN SPACE, PROTECT NATURAL FEATURES, AND PROVIDE CREATIVE AND FLEXIBLE DESIGN ALTERNATIVES.
3. A DENSITY TRANSFER MAY BE PERMITTED ON FLYING HORSE NORTH FOR ALL RESIDENTIAL DISTRICTS. THIS TRANSFER WOULD BE PROPOSED AT THE TIME OF REZONING AND/OR PRELIMINARY PLAN (WHERE APPROPRIATE) AND WOULD NEED TO BE REVIEWED BY STAFF TO ENSURE THAT THE OVERALL DEVELOPMENT CONCEPT IS ADHERED TO. A DENSITY TRANSFER NOT TO EXCEED TWENTY PERCENT (20%) OF THE MAXIMUM UNITS FOR EACH PARCEL IS PERMITTED. THE TRANSFERRED DENSITY SHALL MEET ALL MINIMUM REQUIREMENTS OF THE RECEIVING AREA SUCH AS LOT SIZE, SETBACKS, ETC. IN NO CASE SHALL THE OVERALL DENSITY CAP EXCEED THE TOTAL UNITS APPROVED FOR THE PROJECT.
4. SPECIFIC DEVELOPMENT STANDARDS SUCH AS SETBACKS, LOT COVERAGE, BUILDING HEIGHTS AND LAND USES SHALL BE ADDRESSED WITH A SUBSEQUENT ZONING OF THE PROPERTY AT A LATER DATE. THESE STANDARDS WILL EITHER FOLLOW SPECIFIC PROPOSED PUD DEVELOPMENT PLANS OR PER COUNTY ZONING STANDARDS IF FOLLOWING "CONVENTIONAL ZONING" OF THE COUNTY.
5. ALL COMMON LANDSCAPE, OPEN SPACE, PARKS, TRACTS AND DRAINAGE FACILITIES WITHIN THIS DEVELOPMENT SHALL BE OWNED AND MAINTAINED BY THE HOA (TO BE NAMED) OR FLYING HORSE NORTH METROPOLITAN DISTRICT WITH THE EXCEPTION OF THE COUNTY TRAIL AS DEPICTED ON THE SKETCH PLAN.
6. ALL DETENTION PONDS AND CROSS LOT DRAINAGE DITCHES WILL BE LOCATED WITHIN DRAINAGE EASEMENTS PROVIDING ACCESS FOR MAINTENANCE TO THE FLYING HORSE NORTH METROPOLITAN DISTRICT OR HOA (TO BE NAMED).
7. THERE SHALL BE NO DIRECT RESIDENTIAL LOT ACCESS TO BLACK FOREST ROAD EXCEPT FOR THE EXISTING STAGECOACH ROAD ACCESS AND POTENTIAL COMMERCIAL ACCESS.
8. PARK IMPROVEMENTS PROVIDED BY THE DEVELOPER MAY BE APPLIED TO PARK LAND DEDICATION AND/OR FEES WITH REVIEW AND APPROVAL BY EL PASO COUNTY PARKS. ANY PARK IMPROVEMENTS WILL BE COORDINATED AT A LATER DATE WITH EL PASO COUNTY PARKS VIA PARK LAND AGREEMENTS.
9. ALL ELECTRIC SERVICE SHALL BE PROVIDED BY MOUNTAIN VIEW ELECTRIC ASSOCIATION AND GAS TO BE PROVIDED BY BLACK HILLS ENERGY. NATURAL GAS EASEMENTS WILL BE PROVIDED AS REQUIRED.
10. SITE LIGHTING, IF REQUIRED, WILL MEET THE REQUIREMENTS SET FORTH IN SECTION 6.2.3 OF EL PASO COUNTY LAND DEVELOPMENT CODE.
11. THE DEVELOPER SHALL COMPLY WITH FEDERAL AND STATE LAWS, REGULATIONS, ORDINANCES, REVIEW AND PERMIT REQUIREMENTS, AN OTHER AGENCY REQUIREMENTS, IF ANY, OF APPLICABLE AGENCIES INCLUDING, BUT NOT LIMITED TO, THE COLORADO PARKS AND WILDLIFE, COLORADO DEPARTMENT OF TRANSPORTATION, U.S. ARMY CORPS OF ENGINEERS, AND THE U.S. FISH AND WILDLIFE SERVICE REGARDING THE ENDANGERED SPECIES ACT, PARTICULARLY AS IT RELATES TO ANY LISTED SPECIES.
12. THE FOLLOWING DISTRICTS WILL SERVE THE PROPERTY

    LEWIS-PALMER DISTRICT 38 AND ACADEMY DISTRICT 20

    FIRE EMERGENCY - BLACK FOREST FIRE PROTECTION DISTRICT

    EMERGENCY SERVICES - BLACK FOREST FIRE PROTECTION DISTRICT

    TELECOM/FIBER - FORCE BROADBAND & COMCAST

    PIKES PEAK LIBRARY DISTRICT

    ELECTRICAL SERVICES - MVEA
13. THE MAILBOX KIOSK WILL BE DETERMINED WITH EACH FINAL PLAT AND IN COORDINATION WITH THE U.S. POSTAL SERVICE.
14. THE FIRE STATION LOCATED IN FILING 1 CAN BE RELOCATED ANYWHERE IN THE SKETCH PLAN AREA IF NEEDED. IF FIRE DEPARTMENT DETERMINES RELOCATION IS NOT NEEDED, THE LAND NEED NOT BE DEDICATED TO THEM.
15. APPLICABLE PARK, SCHOOL, TRANSPORTATION, DRAINAGE, BRIDGE, AND TRAFFIC FEES SHALL BE PAID TO THE EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT AT THE TIME OF RECORDING ANY FINAL PLAT.
16. ACCESS LOCATIONS AND ROADWAY CLASSIFICATIONS ARE CONCEPTUAL ONLY AND WILL BE DETERMINED AT THE TIME PRELIMINARY PLAN REVIEW. FINAL LOCATIONS AND CLASSIFICATIONS OF ROADWAYS WILL BE SUBJECT MORE DETAILED LAND DESIGN AND SUBDIVISION REVIEW.

FLOODPLAIN NOTES:

1. PORTIONS OF THIS PROPERTY ARE LOCATED WITHIN A DESIGNATED FEMA FLOODPLAIN AS DETERMINED BY THE FEMA NATIONAL FLOOD INSURANCE PROGRAM FLOOD INSURANCE MAP NUMBERS '08041C0305G' AND '08041C0315G' WITH AN EFFECTIVE DATE OF DECEMBER 7, 2018.
2. THE EXISTING FLOODPLAIN BOUNDARIES ARE INTENDED TO REMAIN AND DEVELOPMENT WILL OCCUR OUTSIDE THE FLOODPLAIN LIMITS.
3. NO STRUCTURES OR SOLID FENCES ARE PERMITTED WITHIN THE DESIGNATED FLOODPLAIN AREA.

PUBLIC STREETS

1. PER THE INTERGOVERNMENTAL AGREEMENT, THE CITY OF COLORADO SPRINGS WILL REQUIRE THE STREETS TO BE DESIGNED AND CONSTRUCTED TO THE CITY STANDARDS.
2. SIDEWALKS OR WALKWAYS WILL BE PROVIDED ALONG ALL STREETS AND INTERIOR TO DEVELOPMENT PARCELS, PARKS AND TRAIL SYSTEMS.
3. PUBLIC STREETS WITHIN THIS DEVELOPMENT SHALL PROVIDE FOR LEVELS OF VEHICULAR CIRCULATION REQUIRED BY THE TRAFFIC STUDY AND SHALL BE PAVED.
4. UNTIL APPROVED BY THE COUNTY ENGINEER ALL ACCESS POINTS SHOWN ON THIS PLAN ARE CONCEPTUAL AND NON-BINDING UPON THE COUNTY APPROVAL OF THIS SKETCH PLAN AMENDMENT SHALL NOT BE INTERPRETED TO INCLUDE APPROVAL OF ANY ACCESS TO ANY PUBLIC ROADS. THE COUNTY ENGINEER SHALL APPROVE ALL ACCESSES IN ACCORDANCE WITH THE REQUIREMENTS AND PROCEDURES OF THE ENGINEERING CRITERIA MANUAL AT THE TIME OF PUD DEVELOPMENT PLAN AND/OR SUBDIVISION SUBMITTAL AND REVIEW.

PRIVATE STREETS

1. ANY FUTURE PRIVATE STREETS, IF PROPOSED, WILL BE PRIVATELY OWNED AND MAINTAINED BY THE FLYING HORSE NORTH METROPOLITAN DISTRICT NO. 1 OR HOA (HOMEOWNERS ASSOCIATION-TO BE NAMED).

PHASING PLAN:

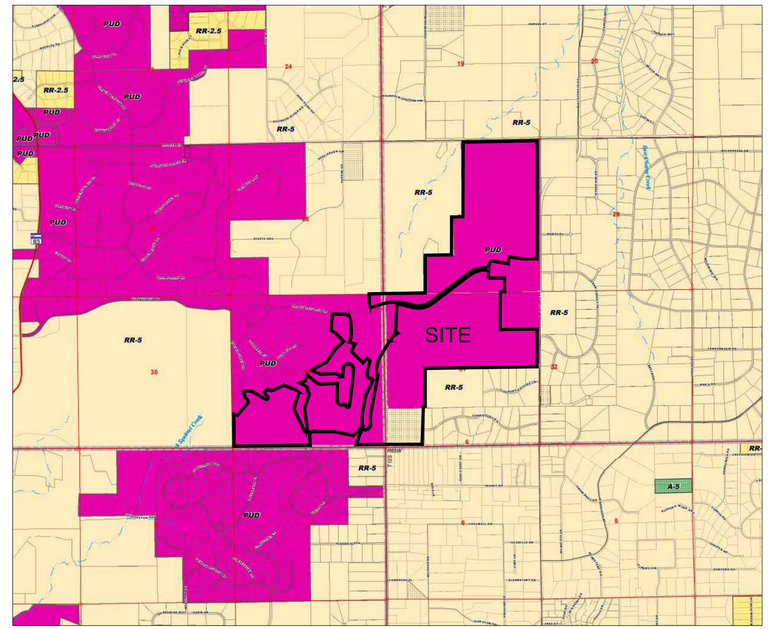
1. THE FLYING HORSE NORTH PROJECT WILL BE DEVELOPED IN MULTIPLE PHASES AND PLATTED IN MULTIPLE FILINGS, WHICH HAVE YET TO BE DETERMINED. THE SEQUENCE OF CONSTRUCTION AND DEVELOPMENT IS NOT DEPENDENT UPON UTILITIES OR INFRASTRUCTURE.

GEOLOGIC HAZARDS DISCLOSURE STATEMENT:

1. AREAS OF PROPOSED SUBDIVISION HAVE BEEN FOUND TO BE IMPACTED BY GEOLOGICAL CONDITIONS, INCLUDING SEASONAL AND POTENTIALLY SEASONAL SHALLOW GROUND WATER, ARTIFICIAL FILL, LOOSE AND EXPANSIVE SOILS AND SLOPE STABILITY. THESE CONDITIONS CAN BE MITIGATED BY AVOIDANCE, RE-GRADING, PROPER ENGINEERING DESIGN, AND CONSTRUCTION TECHNIQUES. A MAP OF THE HAZARD AREAS AND PROPOSED MITIGATION MEASURES CAN BE FOUND IN THE GEOLOGICAL HAZARD STUDY AND WASTEWATER STUDY PREPARED BY ENTECH ENGINEERING INC., DATED JANUARY 15, 2019. FURTHER STUDIES OF THESE CONDITIONS SHALL BE PROVIDED WITH EITHER PRELIMINARY OR FINAL PLANS.

ZONING MAP

SCALE = N.T.S



SHEET INDEX

OWNER/DEVELOPER:
FLYING HORSE DEVELOPMENT LLC
2138 FLYING HORSE CLUB DRIVE
COLORADO SPRINGS, CO 80921

PLANNER/LANDSCAPE ARCHITECT:
HRGREEN DEVELOPMENT, LLC
1975 RESEARCH PARKWAY SUITE 230
COLORADO SPRINGS, CO 80920
720.602.4941

CIVIL ENGINEER:
HRGREEN DEVELOPMENT, LLC
1975 RESEARCH PARKWAY SUITE 230
COLORADO SPRINGS, CO 80920
720.602.4965

ECOLOGIST:
BRISTLECONE ECOLOGY
2023 W. SCOTT PLACE
DENVER, CO 80211
971.237.3906

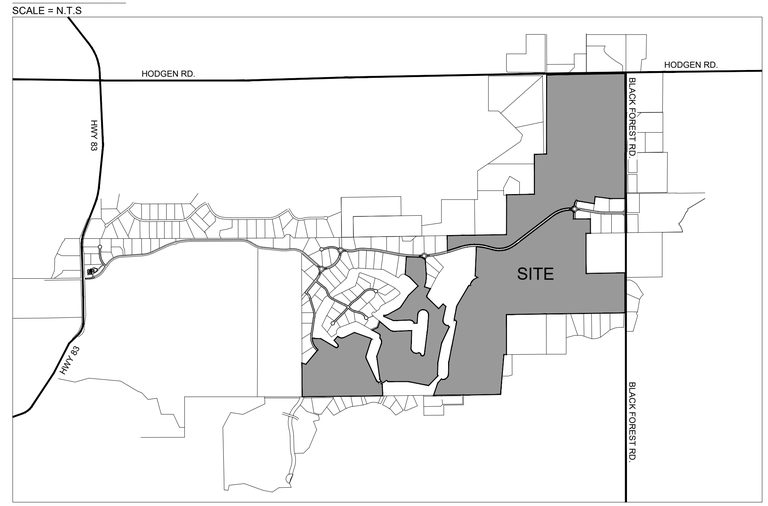
TRANSPORTATION CONSULTANTS:
SM ROCHA, LLC
DENVER, CO 80211
303.458.9798

SITE DATA

EXISTING LAND USE:	VACANT
EXISTING ZONING:	PUD & RR-5
SITE ACREAGE:	912.6 AC
MAXIMUM NUMBER OF RESIDENTIAL UNITS:	846
MAXIMUM GROSS DENSITY FOR RESIDENTIAL UNITS:	0.93 DU/AC
TOTAL AREAS (SEE LAND USE CHART ON SHEET 2)	
RESIDENTIAL:	853.8 AC
ESTATE LOTS (5 ACRES)	118.3 AC
ESTATE LOTS (2.5 ACRES)	152.7 AC
LOW DENSITY	332.9 AC
MEDIUM DENSITY	46.0 AC
ESTIMATED OPEN SPACE	203.9 AC
HOTEL/CASITAS/FLATS	32.2 AC
GOLF CLUB, RESTAURANT/BAR, GOLF AMENITIES (HOTEL)	11.0 AC
ESTATE CLUBHOUSE (HOTEL)	2.4 AC
COMMERCIAL	9.1 AC
FITNESS CENTER	4.1 AC

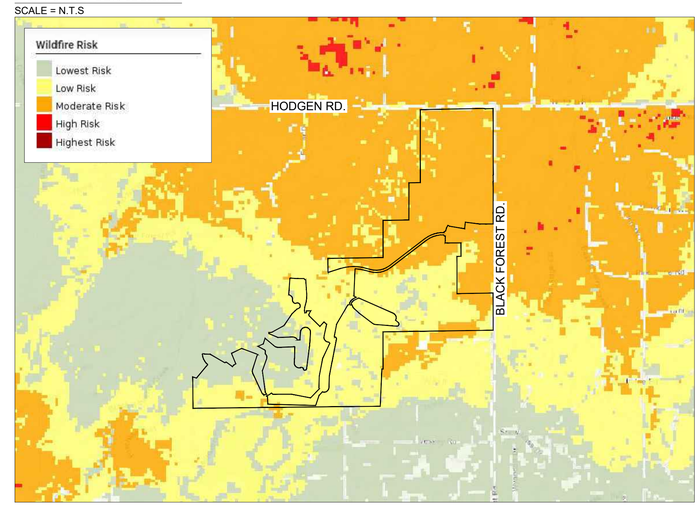
VICINITY MAP

SCALE = N.T.S



WILDFIRE RISK MAP

SCALE = N.T.S



COUNTY FILE NUMBER: SKP223

DRAWN BY: JAG	JOB DATE: 3/1/2022		BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1" IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.
APPROVED: PLS	JOB NUMBER: 211030		
CAD DATE: 9/15/2022			
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Sketch-Plan\COVER-SHEET			

NO.	DATE	BY	REVISION DESCRIPTION

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FLYING HORSE NORTH
DEVELOPMENT, LLC.
EL PASO COUNTY, COLORADO

FLYING HORSE NORTH SKETCH PLAN
COVER SHEET

SHEET SP.1

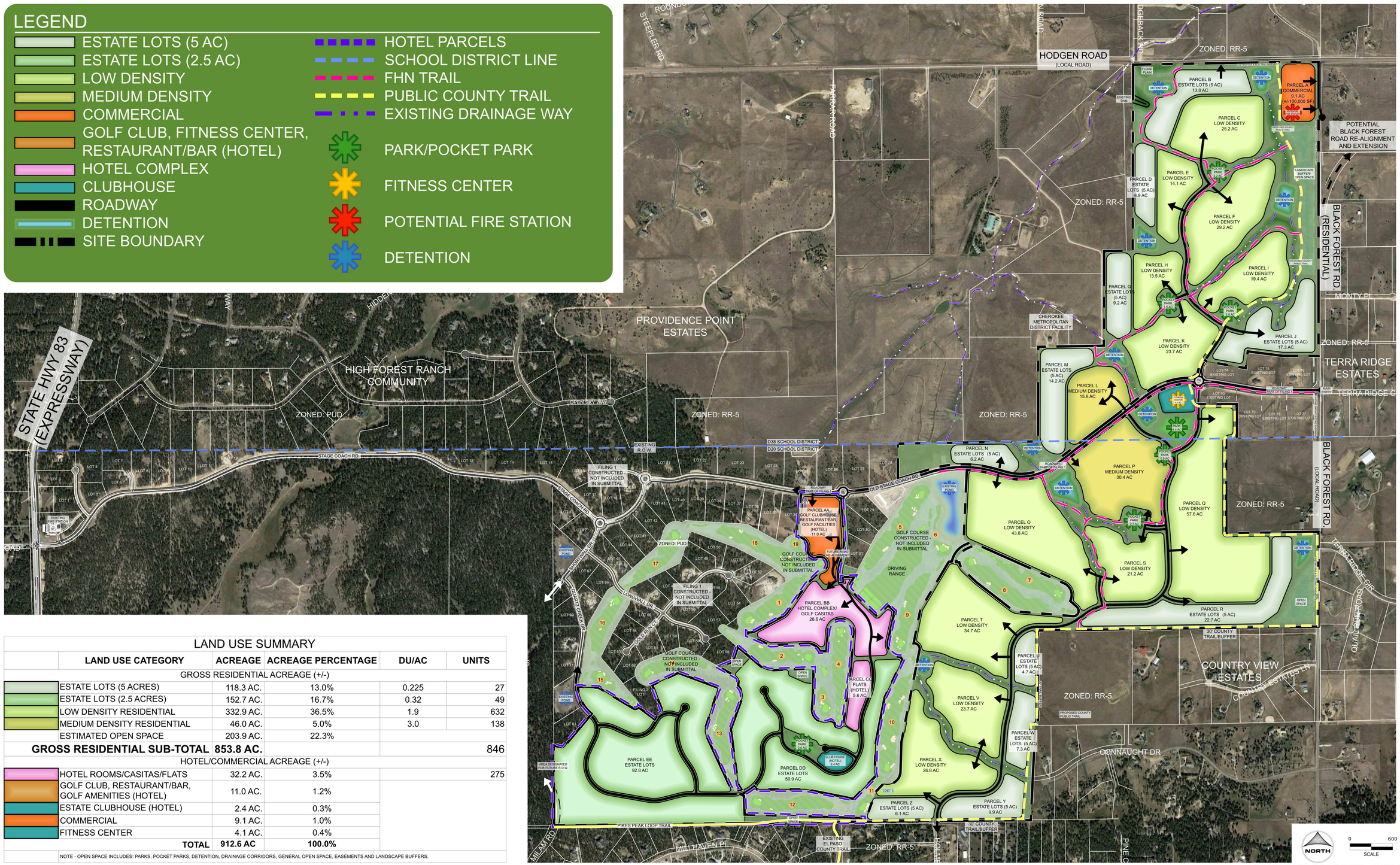
1

HR GREEN Xref: xgl-1-ARCH DH01

FLYING HORSE NORTH SKETCH PLAN

LEGEND

- ESTATE LOTS (5 AC)
- ESTATE LOTS (2.5 AC)
- LOW DENSITY
- MEDIUM DENSITY
- COMMERCIAL
- GOLF CLUB, FITNESS CENTER, RESTAURANT/BAR (HOTEL)
- HOTEL COMPLEX
- CLUBHOUSE
- ROADWAY
- DETENTION
- SITE BOUNDARY
- HOTEL PARCELS
- SCHOOL DISTRICT LINE
- FHN TRAIL
- PUBLIC COUNTY TRAIL
- EXISTING DRAINAGE WAY
- PARK/POCKET PARK
- FITNESS CENTER
- POTENTIAL FIRE STATION
- DETENTION



COUNTY FILE NUMBER: SKP223

LAND USE SUMMARY

LAND USE CATEGORY	ACREAGE	ACREAGE PERCENTAGE	DU/AC	UNITS
GROSS RESIDENTIAL ACREAGE (+/-)				
ESTATE LOTS (5 ACRES)	118.3 AC.	13.0%	0.225	27
ESTATE LOTS (2.5 ACRES)	152.7 AC.	16.7%	0.32	49
LOW DENSITY RESIDENTIAL	332.9 AC.	36.5%	1.9	632
MEDIUM DENSITY RESIDENTIAL	46.0 AC.	5.0%	3.0	138
ESTIMATED OPEN SPACE	203.9 AC.	22.3%		
GROSS RESIDENTIAL SUB-TOTAL	**853.8 AC.**			846
HOTEL/COMMERCIAL ACREAGE (+/-)				
HOTEL ROOMS/CASITAS/FLATS	32.2 AC.	3.5%		275
GOLF CLUB, RESTAURANT/BAR, GOLF AMENITIES (HOTEL)	11.0 AC.	1.2%		
ESTATE CLUBHOUSE (HOTEL)	2.4 AC.	0.3%		
COMMERCIAL	9.1 AC.	1.0%		
FITNESS CENTER	4.1 AC.	0.4%		
TOTAL	**912.6 AC**	**100.0%**		

NOTE - OPEN SPACE INCLUDES: PARKS, POCKET PARKS, DETENTION, DRAINAGE CORRIDORS, GENERAL OPEN SPACE, EASEMENTS AND LANDSCAPE BUFFERS.

HR GREEN Xrefs: EX-Topo; EX-Atlas; xgt-1-ARCH DH01; EX-Parcels

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CAD DATE: 07/01/2022			
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NO.	DATE	BY	REVISION DESCRIPTION

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FLYING HORSE NORTH
DEVELOPMENT, LLC.
EL PASO COUNTY, COLORADO

FLYING HORSE NORTH SKETCH PLAN
SKETCH PLAN DRAWING

SHEET
SP.2

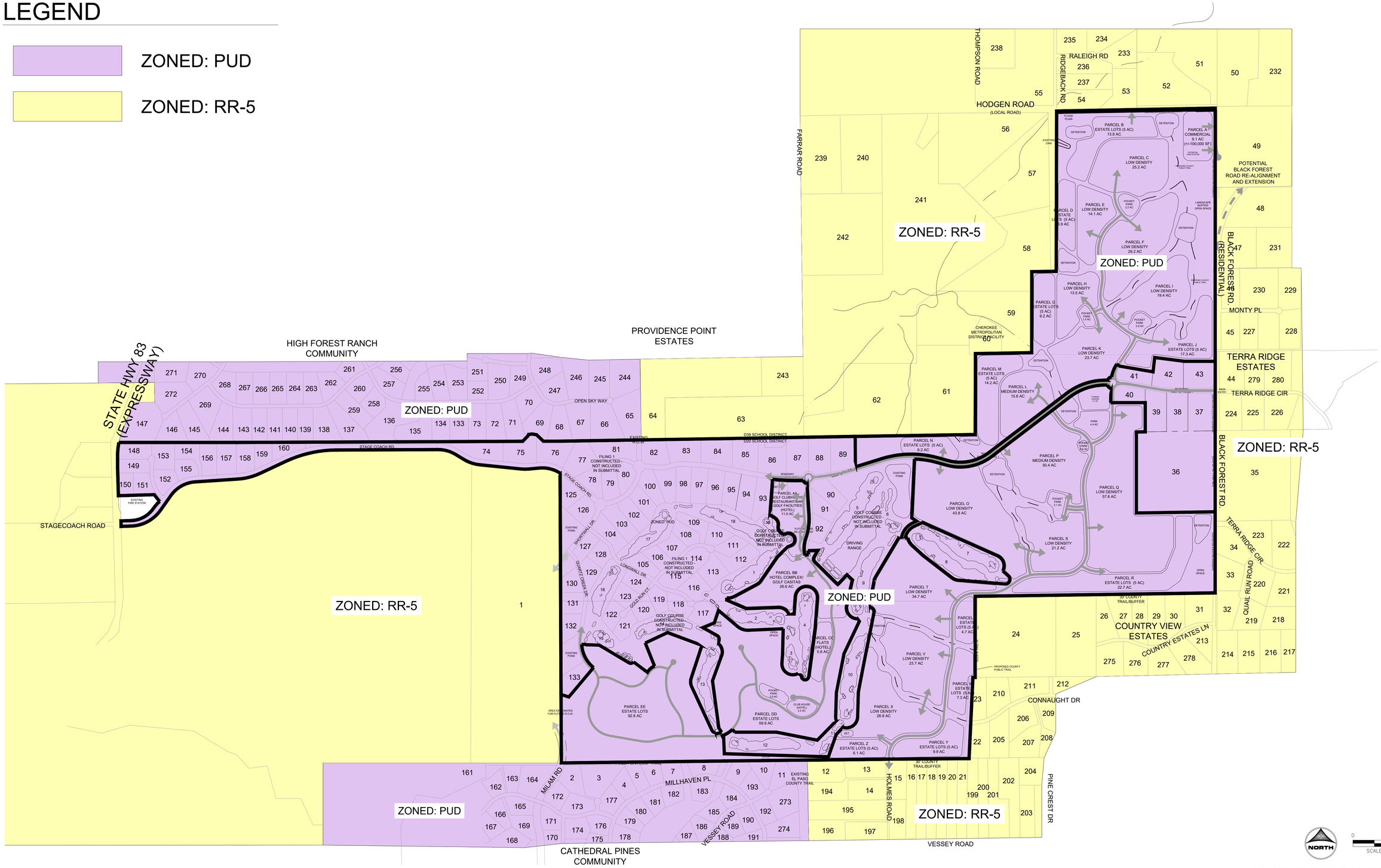
2

FLYING HORSE NORTH SKETCH PLAN

LEGEND

ZONED: PUD

ZONED: RR-5



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NO.	DATE	BY	REVISION DESCRIPTION

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FLYING HORSE NORTH
DEVELOPMENT, LLC.
EL PASO COUNTY, COLORADO

FLYING HORSE NORTH SKETCH PLAN

ADJACENT PROPERTY DATA MAP

SHEET SP.3

3

HR GREEN Xrefs: xgt-1-ARCH DH01; BUBBLE-PLAN; EX-Parcels

FLYING HORSE NORTH SKETCH PLAN

1. SHAMROCK SS LLC
ZONING - RR-5
15555 HWY 83
COLORADO SPRINGS, CO

2. BRI J FAMILY TRUST
ZONED - PUD
4820 FOXCHASE WAY
COLORADO SPRINGS, CO

3. PIASECKI NANCY L REVOC TRUST
ZONED - PUD
4940 FOXCHASE WAY
COLORADO SPRINGS, CO

4. BRINGARD FAMILY LICING TRUST
ZONED - PUD
14465 MILLHAVEN PLACE
COLORADO SPRINGS, CO

5. ALLAN NEAL A
ZONED - PUD
14425 MILLHAVEN PLACE
COLORADO SPRINGS, CO

6. ALEX & AUTUMM SIMPSON
ZONED - PUD
14385 MILLHAVEN PLACE
COLORADO SPRINGS, CO

7. MAITHILI VENKATACHALLAM
ZONED - PUD
14345 MILLHAVEN PLACE
COLORADO SPRINGS, CO

8. DULANEY KIMBERLY L
ZONED - PUD
14325 MILLHAVEN PLACE
COLORADO SPRINGS, CO

9. SMITH PAUL R
ZONED - PUD
14265 MILLHAVEN PLACE
COLORADO SPRINGS, CO

10. ANDERSON MATTHEW P
ZONED - PUD
5025 VESSEY ROAD
COLORADO SPRINGS, CO

11. ESPENLAUB ECTON
ZONED - PUD
4985 VESSEY ROAD
COLORADO SPRINGS, CO

12. DILLINGHAM MICHAEL V
ZONED - RR-5
14498 HOLMES ROAD
COLORADO SPRINGS, CO

13. THOMAS JOHN K
ZONED - RR-5
14490 HOLMES ROAD
COLORADO SPRINGS, CO

14. ERNST CHARLES H
ZONED - RR-5
14410 HOMES ROAD
COLORADO SPRINGS, CO

15. WAUGH JOSHUA T
ZONED - RR-5
14445 HOLMES ROAD
COLORADO SPRINGS, CO

16. HOFFPAUIR DAN W JR
ZONED - RR-5
14495 HOMES ROAD
COLORADO SPRINGS, CO

17. SELF BOB J
ZONED - RR-5
5910 VESSEY ROAD
COLORADO SPRINGS, CO

18. JONES INGRID L
ZONED - RR-5
5940 VESSEY ROAD
COLORADO SPRINGS, CO

19. RUPP JERRREY D
ZONED - RR-5
5970 VESSEY ROAD
COLORADO SPRINGS, CO

20. LITTLETON STANLEY
ZONED - RR-5
6010 VESSEY ROAD
COLORADO SPRINGS, CO

21. SWANSON BRECK C
ZONED - RR-5
6030 VESSEY ROAD
COLORADO SPRINGS, CO

22. HOOKS GROUP LP
ZONED - RR-5
6005 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

23. MCILRATH WILLIAM F TRUSTEE
ZONED - RR-5
6010 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

24. WAY MARGARET E
ZONED - RR-5
14820 BLACK FOREST ROAD
COLORADO SPRINGS, CO

25. ABELL LIVING TRUST
ZONED - RR-5
6620 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

26. HERRON PATRICK J
ZONED - RR-5
6650 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

27. ABELL LIVING TRUST
ZONED - RR-5
6620 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

28. COPPOCK AARON O
ZONED - RR-5
6680 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

29. MACEDO JUAN H LOMEIL
ZONED - RR-5
6710 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

30. SOMBRIC WAYNE S
ZONED - RR-5
6740 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

31. HOPSON SEAN
ZONED - RR-5
6770 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

32. MCKINLEY DAVID R
ZONED - RR-5
14920 QUAIL RUN ROAD
COLORADO SPRINGS, CO

33. WINNINGHAM AARON JASON
ZONED - RR-5
14940 QUAIL RUN ROAD
COLORADO SPRINGS, CO

34. LYNDE ROBERT A
ZONED - RR-5
15015 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

35. SPLIT PINE RANCH LIVING TRUST
ZONED - RR-5
15385 BLACK FOREST ROAD
COLORADO SPRINGS, CO

36. APODACA LESLIE E
ZONED - RR-5
15380 BLACK FOREST ROAD
COLORADO SPRINGS, CO

37. DERKSEN PROPERTIES LLC
ZONED - PUD
6755 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

38. NGUYEN LINH T
ZONED - PUD
6715 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

39. MONACO57 LIVING TRUST
ZONED - PUD
6675 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

40. ST HENRYS LLC
ZONED - PUD
6595 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

41. SMITH AARON
ZONED - PUD
6590 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

42. HARRIS GEORGE D
ZONED - PUD
6670 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

43. MCCGRATH DONALD T
ZONED - PUD
6750 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

44. MIKUSKA ERIC
ZONED - RR-5
15645 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

45. GARD DIANA M
ZONED - RR-5
6835 MONTY PLACE
COLORADO SPRINGS, CO

46. FRANKOVIS JESSE J
ZONED - RR-5
6840 MONTY PLACE
COLORADO SPRINGS, CO

47. OLIVAS SOCORRO J
ZONED - RR-5
6905 ALPACA HEIGHTS
COLORADO SPRINGS, CO

48. HILL DOUGLAS E
ZONED - RR-5
6910 ALPACA HEIGHTS
COLORADO SPRINGS, CO

49. WHITNEY CHRISTOPHER D
ZONED - RR-5
16485 BLACK FOREST ROAD
COLORADO SPRINGS, CO

50. BERENS MARK E
ZONED - RR-5
6850 HODGEN ROAD
COLORADO SPRINGS, CO

51. MOLES JUSTIN
ZONED - RR-5
16550 BLACK FOREST ROAD
COLORADO SPRINGS, CO

52. MUNSON BRANDON J
ZONED - RR-5
16710 BLACK FOREST ROAD
COLORADO SPRINGS, CO

53. MILLER ROBERT S
ZONED - RR-5
6520 HODGEN ROAD
COLORADO SPRINGS, CO

54. JOHN R SHANTZ & BELINDA S
ZONED - RR-5
16547 RIDGEBACK ROAD
COLORADO SPRINGS, CO

55. NAVARETTE JEANINE A
ZONED - RR-5
6280 HODGEN ROAD
COLORADO SPRINGS, CO

56. ANDREWS SCOTT W
ZONED - RR-5
HODGEN ROAD
COLORADO SPRINGS, CO

57. DEIM CONNIE
ZONED - RR-5
SUNDANCE RANCH LANE
COLORADO SPRINGS, CO

58. BR&C INC
ZONED - RR-5
30-11-65
COLORADO SPRINGS, CO

59. BR&C INC
ZONED - RR-5
30-11-65
COLORADO SPRINGS, CO

60. CHEROKEE METROPOLITAN DISTRICT
ZONED - RR-5
30-11-65
COLORADO SPRINGS, CO

61. SUNDANCE RANCH OF BLACK FOREST
ZONED - RR-5
HODGEN ROAD
COLORADO SPRINGS, CO

62. SUNDANCE RANCH OF BLACK FOREST
ZONED - RR-5
HODGEN ROAD
COLORADO SPRINGS, CO

63. SHELL JAMES R II
ZONED - RR-5
15550 FARRAR ROAD
COLORADO SPRINGS, CO

64. SHELL JAMES R II
ZONED - RR-5
15550 FARRAR ROAD
COLORADO SPRINGS, CO

65. BREWER GEORGE F II
ZONED - PUD
15501 OPEN SKY WAY
COLORADO SPRINGS, CO

66. MONTGOMERY MONTIE C
ZONED - PUD
15547 OPEN SKY WAY
COLORADO SPRINGS, CO

67. RANGER CANDACE S LIVING TRUST
ZONED - PUD
15593 OPEN SKY WAY
COLORADO SPRINGS, CO

68. JANNELLE EVA ALLEN REVOCABLE TRUST
ZONED - PUD
15639 OPEN SKY WAY
COLORADO SPRINGS, CO

69. STUDHOLME FAMILY TRUST
ZONED - PUD
15685 OPEN SKY WAY
COLORADO SPRINGS, CO

70. MAHER FAMILY REVOC LIVING TRUST
ZONED - PUD
4961 HIGH FOREST ROAD
COLORADO SPRINGS, CO

71. STEPHENSON TRAVIS
ZONED - PUD
4901 HIGH FOREST ROAD
COLORADO SPRINGS, CO

72. JOHNSON LIVING TRUST
ZONED - PUD
4841 HIGH FOREST ROAD
COLORADO SPRINGS, CO

73. RAMIREZ MELODY B
ZONED - PUD
4781 HIGH FOREST ROAD
COLORADO SPRINGS, CO

74. FOWLER NORMAN W
ZONED - PUD
4670 STAGECOACH ROAD
COLORADO SPRINGS, CO

75. OLSON TYRONE L
ZONED - PUD
4760 STAGECOACH ROAD
COLORADO SPRINGS, CO

76. JONES CHRISTOPHER P
ZONED - PUD
4850 STAGECOACH ROAD
COLORADO SPRINGS, CO

77. WALTERS MICHAEL A
ZONED - PUD
4910 STAGECOACH ROAD
COLORADO SPRINGS, CO

78. YOUNG MICHAEL J
ZONED - PUD
4915 STAGECOACH ROAD
COLORADO SPRINGS, CO

79. DAY GREGORY
ZONED -PUD
4955 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

80. RZONCA THADDEUS
ZONED - PUD
4995 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

81. SIDWELL DUSTIN JEFFREY
ZONED - PUD
4990 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

82. SPARKS DUSTIN R
ZONED - PUD
5070 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

83. SPILLERS STEVEN HOWARD
ZONED - PUD
5150 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

84. PECK JAMES D
ZONED - PUD
5230 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

85. WELLER ERICH G
ZONED - PUD
5310 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

86. LAM TU T
ZONED - PUD
5390 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

87. LUERS BEACH LLC
ZONED - PUD
5470 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

88. GREENWOOD TAYLOR J
ZONED - PUD
5550 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

89. LONG RUSSEL I
ZONED - PUD
5630 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

90. PECK MICHAEL S
ZONED - PUD
5555 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

91. RENNER LLC
ZONED - PUD
15331 ALLEN RANCH ROAD
COLORADO SPRINGS, CO

92. BOOGAARD RYAN
ZONED - PUD
15271 ALLEN RANCH ROAD
COLORADO SPRINGS, CO

93. ALEXANDER SCOTT E
ZONED - PUD
5395 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

94. CLAWSON MATTHEW R
ZONED - PUD
5355 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

95. PLAISTOWE NORMAN H
ZONED - PUD
5315 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

96. RAMPART ENTERPRISES INC
ZONED - PUD
5235 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

97. KELLY J PHELAN TRUST
ZONED - PUD
5155 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

98. WINGO JAMES D
ZONED - PUD
5115 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

99. KIM MICHAEL SANG-HAK
ZONED - PUD
5075 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

100. TEUSCHER KURT
ZONED - PUD
5035 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

101. DOWNS BRADLEY JAMES
ZONED - PUD
55305 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

102. KAVERMAN JOSEPH A
ZONED - PUD
5215 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

103. PIEPER RANDALL L
ZONED - PUD
5125 OLD STAGECOACH ROAD
COLORADO SPRINGS, CO

104. SHECTER TRUST
ZONED - PUD
15291 LONGWALL DRIVE
COLORADO SPRINGS, CO

105. CHRISTOPHER MICHAEL MARSHALL
ZONED - PUD
15051 LONGWALL DRIVE
COLORADO SPRINGS, CO

106. BECKER JACOB J
ZONED - PUD
5142 GOLD RUN COURT
COLORADO SPRINGS, CO

107. KEV PARTNERS LTD
ZONED - PUD
5172 GOLD RUN COURT
COLORADO SPRINGS, CO

108. HENDRICKS JAMES
ZONED - PUD
5202 GOLD RUN COURT
COLORADO SPRINGS, CO

109. C&C LIVING TRUST
ZONED - PUD
5232 GOLD RUN COURT
COLORADO SPRINGS, CO

110. ALBRIGHT MARK PHILLIP
ZONED - PUD
5262 GOLD RUN COURT
COLORADO SPRINGS, CO

111. VILIESIS TRUST
ZONED - PUD
5292 GOLD RUN COURT
COLORADO SPRINGS, CO

112. SHOPTAUGH GLENN MARK
ZONED - PUD
5261 GOLD RUN COURT
COLORADO SPRINGS, CO

113. VILLAGREE LLC
ZONED - PUD
5231 GOLD RUN COURT
COLORADO SPRINGS, CO

114. S&J TRUST
ZONED - PUD
5201 GOLD RUN COURT
COLORADO SPRINGS, CO

115. CHAVEZ XAVIER D
ZONED - PUD
5141 GOLD RUN COURT
COLORADO SPRINGS, CO

116. DALY FAMILY TRUST
ZONED - PUD
14911 LONGWALL DRIVE
COLORADO SPRINGS, CO

117. STIMPLE FAMILY LLLP
ZONED - PUD
14842 LONGWALL DRIVE
COLORADO SPRINGS, CO

118. CREPS DARREL E III
ZONED - PUD
14912 LONGWALL DRIVE
COLORADO SPRINGS, CO

119. CAIN JASON
ZONED - PUD
14982 LONGWALL DRIVE
COLORADO SPRINGS, CO

120. DICKEY MICHAEL R
ZONED - PUD
5021 GOLD RUN CT
COLORADO SPRINGS, CO

121. LIDDIARD JEREMY
ZONED - PUD
5013 GOLD RUN CT
COLORADO SPRINGS, CO

122. MILLER SCOTT G
ZONED - PUD
5012 GOLD RUN CT
COLORADO SPRINGS, CO

123. BRENNAN THOMAS LIVING TRUST
ZONED - PUD
5022 GOLD RUN CT
COLORADO SPRINGS, CO

124. WINTER CHARLES C
ZONED - PUD
5082 GOLD RUN CT
COLORADO SPRINGS, CO

125. THEOBARD CHARLES N
ZONED - PUD
4945 STAGECOACH ROAD
COLORADO SPRINGS, CO

126. HOWARTH WILLIAM
ZONED - PUD
15290 SHORTWALL DRIVE
COLORADO SPRINGS, CO

127. GERBER JOSEPH DAVID
ZONED - PUD
15262 SHORTWALL DRIVE
COLORADO SPRINGS, CO

128. COFFEY LAVANSON C III
ZONED - PUD
15192 SHORTWALL DRIVE
COLORADO SPRINGS, CO

129. ST AUBYN JARED
ZONED - PUD
15233 QUARTZ CREEK DRIVE
COLORADO SPRINGS, CO

130. MOMBER SIMON R
ZONED - PUD
15232 QUARTZ CREEK DRIVE
COLORADO SPRINGS, CO

131. SHABE ERIC M
ZONED - PUD
15182 QUARTZ CREEK DRIVE
COLORADO SPRINGS, CO

132. ZACHAR MICHAEL R
ZONED - PUD
15132 QUARTZ CREEK DRIVE
COLORADO SPRINGS, CO

133. HARVEY SETH A
ZONED - PUD
15032 QUARTZ CREEK DRIVE
COLORADO SPRINGS, CO

134. PITTS JOHN
ZONED - PUD
4661 HIGH FOREST ROAD
COLORADO SPRINGS, CO

135. LAVEZZO NICHOLAS J
ZONED - PUD
1601 HIGH FOREST ROAD
COLORADO SPRINGS, CO

136. HIGH FOREST RANCH HOMEOWNERS
ZONED - PUD
4541 HIGH FOREST ROAD
COLORADO SPRINGS, CO

137. SALGADO PAUL R
ZONED - PUD
4415 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

138. JOHNSON GREGG
ZONED - PUD
4365 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

139. ROMANS LIVING TRUST
ZONED - PUD
4315 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

140. RYAN CHRISTOPHER J
ZONED - PUD
4265 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

141. MARY CLAUDE F TRUSTEE
ZONED - PUD
4215 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

142. STREVELL MICHAEL W
ZONED - PUD
4165 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

143. GOULD TODD E
ZONED - PUD
4115 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

144. DESAUTELS BRUCE T
ZONED - PUD
4661 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

145. HOUSE JAMIE GLEN
ZONED - PUD
15575 WINDING TRAIL ROAD
COLORADO SPRINGS, CO

146. MATALIUS ANDREW J III
ZONED - PUD
15525 WINDING TRAIL ROAD
COLORADO SPRINGS, CO

147. WATSON RANDY
ZONED - PUD
15520 WINDING TRAIL ROAD
COLORADO SPRINGS, CO

148. MARSHALL KARLYE
ZONED - PUD
15480 BILLINGS COURT
COLORADO SPRINGS, CO

149. VANCE ERZA G
ZONED - PUD
15450 BILLINGS COURT
COLORADO SPRINGS, CO

150. PRI #2 LLC
ZONED - PUD
HIGHWAY 83
COLORADO SPRINGS, CO

151. MCKENZIE J THOMAS
ZONED - PUD
15420 BILLINGS COURT
COLORADO SPRINGS, CO

152. JONE LUCAS
ZONED - PUD
15419 BILLINGS COURT
COLORADO SPRINGS, CO

153. ROGER WILLIAM T
ZONED - PUD
15479 BILLINGS COURT
COLORADO SPRINGS, CO

154. DOMBROWSKI MICHAEL J
ZONED - PUD
3680 STAGECOACH ROAD
COLORADO SPRINGS, CO

155. ROBIN SCOTT BROWN LIVING TRUST
ZONED - PUD
3590 STAGECOACH ROAD
COLORADO SPRINGS, CO

156. JACKOWIAK RYAN
ZONED - PUD
3770 STAGECOACH ROAD
COLORADO SPRINGS, CO

157. BALSICK LUKE A
ZONED - PUD
3860 STAGECOACH ROAD
COLORADO SPRINGS, CO

158. HIMES ELMER S
ZONED - PUD
3950 STAGECOACH ROAD
COLORADO SPRINGS, CO

159. OTERO THEODAORE M III
ZONED - PUD
4040 STAGECOACH ROAD
COLORADO SPRINGS, CO

160. HARRIS GUY MCALLISTER
ZONED - PUD
4130 STAGECOACH ROAD
COLORADO SPRINGS, CO

COUNTY FILE NUMBER: SKP223

DRAWN BY: JAG
APPROVED: PLS
CAD DATE: 9/15/2022
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Sketch-Plan\ADJACENT-PROPERTY
JOB DATE: 3/1/2022
JOB NUMBER: 211030
BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

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FLYING HORSE NORTH DEVELOPMENT, LLC.
EL PASO COUNTY, COLORADO

FLYING HORSE NORTH SKETCH PLAN
ADJACENT PROPERTY DATA OWNERS

SHEET SP.4

4

HR GREEN Xrefs: xgt-1-ARCH DH01; BUBBLE-PLAN; EX-Parcels

FLYING HORSE NORTH SKETCH PLAN

161. RED HORSE HILL LLC
ZONED - PUD
AUNDERTON GRV
COLORADO SPRINGS, CO

162. WILKINSON SUZANNE ELIZABETH
ZONED - PUD
4540 FOXCHASE WAY
COLORADO SPRINGS, CO

163. JOHNSON SAM CHRISTOPHER
ZONED - PUD
4580 FOXCHASE WAY
COLORADO SPRINGS, CO

164. S&BT LIVING TRUST
ZONED - PUD
4660 FOXCHASE WAY
COLORADO SPRINGS, CO

165. CURRAN LARRY DAVID
ZONED - PUD
4615 FOXCHASE WAY
COLORADO SPRINGS, CO

166. LEE MARVIN
ZONED - PUD
4455 FOXCHASE WAY
COLORADO SPRINGS, CO

167. JASMIN TREMBLAY REVOCABLE TRUST
ZONED - PUD
4415 FOXCHASE WAY
COLORADO SPRINGS, CO

168. EVANS LIVING TRUST
ZONED - PUD
14190 MARBLE ARCH COURT
COLORADO SPRINGS, CO

169. TAYLOR CHRISTINA MARIE
ZONED - PUD
4535 FOXCHASE WAY
COLORADO SPRINGS, CO

170. LUTHY ROBERT EDWARD
ZONED - PUD
14250 FARNHAM ROYAL COURT
COLORADO SPRINGS, CO

171. BEHNKEN CHAD L
ZONED - PUD
4735 FOXCHASE WAY
COLORADO SPRINGS, CO

172. SWARTHOUT ANDREW T
ZONED - PUD
4740 FOXCHASE WAY
COLORADO SPRINGS, CO

173. ERLING BRIAN F
ZONED - PUD
4780 FOXCHASE WAY
COLORADO SPRINGS, CO

174. ARORA PRATHEEP
ZONED - PUD
14285 FARNHAM ROYAL COURT
COLORADO SPRINGS, CO

175. ROSENBAUM DAVID A REVOC TRUST
ZONED - PUD
14585 MILLHAVEN PLACE
COLORADO SPRINGS, CO

176. KELLY LIVING TRUST
ZONED - PUD
4975 FOXCHASE WAY
COLORADO SPRINGS, CO

177. FLEMING FAMILY LIVING TRUST
ZONED - PUD
14505 MILLHAVEN PLACE
COLORADO SPRINGS, CO

178. LONGHORNS 07 TURST
ZONED - PUD
14550 MILLHAVEN PLACE
COLORADO SPRINGS, CO

179. KROEKER KARL
ZONED - PUD
14510 MILLHAVEN PLACE
COLORADO SPRINGS, CO

180. COLOSSEE PARTNERS LLLP
ZONED - PUD
14470 MILLHAVEN PLACE
COLORADO SPRINGS, CO

181. SEDDON JOHN TA
ZONED - PUD
14390 MILLHAVEN PLACE
COLORADO SPRINGS, CO

182. MEDRICK JAMES G
ZONED - PUD
14350 MILLHAVEN PLACE
COLORADO SPRINGS, CO

183. JAIN RUPESH
ZONED - PUD
14320 MILLHAVEN PLACE
COLORADO SPRINGS, CO

184. KLAIBER LIVING TRUST
ZONED - PUD
14230 MILLHAVEN PLACE
COLORADO SPRINGS, CO

185. SEXTON KENNETH R
ZONED - PUD
5225 VESSEY ROAD
COLORADO SPRINGS, CO

186. POPE MARK S
ZONED - PUD
5265 VESSEY ROAD
COLORADO SPRINGS, CO

187. ALDER FAMILY TRUST
ZONED - PUD
5345 VESSEY ROAD
COLORADO SPRINGS, CO

188. LNB FAMILY TRUST
ZONED - PUD
5270 VESSEY ROAD
COLORADO SPRINGS, CO

189. RAYMOND CHARLES DENT JR.
ZONED - PUD
5230 VESSEY ROAD
COLORADO SPRINGS, CO

190. KOSZEWNIK JOHN JOSEPH
ZONED - PUD
5190 VESSEY ROAD
COLORADO SPRINGS, CO

191. ENEA STEVEN A
ZONED - PUD
14150 MILLHAVEN PLACE
COLORADO SPRINGS, CO

192. KARL C & DAWN M FINDLEY
ZONED - PUD
5070 VESSEY ROAD
COLORADO SPRINGS, CO

193. MURPHY ROBERT C JR
ZONED - PUD
5065 VESSEY ROAD
COLORADO SPRINGS, CO

194. HAWKINS JOSEPH C JR
ZONED - RR-5
14450 HOLMES ROAD
COLORADO SPRINGS, CO

195. KRISTY MICHAEL H
ZONED - RR-5
14350 HOLMES ROAD
COLORADO SPRINGS, CO

196. GARLICK JEFFREY
ZONED - RR-5
14320 HOLMES ROAD
COLORADO SPRINGS, CO

197. STELZEL DANIEL M
ZONED - RR-5
14290 HOLMES ROAD
COLORADO SPRINGS, CO

198. MCGOWAN PATRICK J JR
ZONED - RR-5
14355 HOLMES ROAD
COLORADO SPRINGS, CO

199. WANTY LISA M
ZONED - RR-5
6060 VESSEY ROAD
COLORADO SPRINGS, CO

200. HAYES MARK G
ZONED - RR-5
6090 VESSEY ROAD
COLORADO SPRINGS, CO

201. DOLES THOMAS ALBERT
ZONED - RR-5
6130 VESSEY ROAD
COLORADO SPRINGS, CO

202. ELLEN KLEIN LIVING TRUST
ZONED - RR-5
6180 VESSEY ROAD
COLORADO SPRINGS, CO

203. BRADBURY DAVID J
ZONED - RR-5
6220 VESSEY ROAD
COLORADO SPRINGS, CO

204. STEWART ANTHONY NEIL
ZONED - RR-5
14450 PINE CREST DRIVE
COLORADO SPRINGS, CO

205. CHAMBERS REVOCABLE TRUST
ZONED - RR-5
6065 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

206. CARTER THOMAS J
ZONED - RR-5
6125 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

207. MOREAU WILLIAM J
ZONED - RR-5
6185 CONNAUGHT DRIVE
COLORADO SPRINGS, CO3

208. MOREAU WILLIAM J
ZONED - RR-5
6245 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

209. RODAS PETER G
ZONED - RR-5
6305 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

210. DAWSON FAMILY TRUST
ZONED - RR-5
6070 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

211. PALAZZARI ANTHONY A
ZONED - RR-5
6250 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

212. TRUMP CAROLYN D
ZONED - RR-5
6370 CONNAUGHT DRIVE
COLORADO SPRINGS, CO

213. CORBETT NORMAN
ZONED - RR-5
6745 COUNTY ESTATES LANE
COLORADO SPRINGS, CO

214. BAHR JACOB
ZONED - RR-5
6818 MARSHBERN COURT
COLORADO SPRINGS, CO

215. WESTOVER HOMES LLC
ZONED - RR-5
6902 MARSHBERN COURT
COLORADO SPRINGS, CO

216. WESTOVER HOMES LLC
ZONED - RR-5
6986 MARSHBERN COURT
COLORADO SPRINGS, CO

217. WESTOVER HOMES LLC
ZONED - RR-5
7070 MARSHBERN COURT
COLORADO SPRINGS, CO

218. ELLSWORTH FRANK F
ZONED - RR-5
15105 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

219. DENNIS REBECCA L
ZONED - RR-5
14915 QUAIL RUN ROAD
COLORADO SPRINGS, CO

220. JAMES P REEG REVOCABLE TRUST
ZONED - RR-5
14935 QUAIL RUN ROAD
COLORADO SPRINGS, CO

221. FELLAR DENNIS W
ZONED - RR-5
15095 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

222. HUTCHINS-VAN TASSEL LESLIE
ZONED - RR-5
15090 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

223. FERL DIANE F
ZONED - RR-5
15010 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

224. CHAFFEE GREGORY B
ZONED - RR-5
15650 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

225. PETERSON JEFFREY L
ZONED - RR-5
15610 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

226. MCLELLAN CHRISTOPHER S
ZONED - RR-5
15570 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

227. BARR RHONDA LYN
ZONED - RR-5
6915 MONTY PLACE
COLORADO SPRINGS, CO

228. KHALIQI DAVID H
ZONED - RR-5
6985 MONTY PLACE
COLORADO SPRINGS, CO

229. ANDREWS TODD
ZONED - RR-5
6990 MONTY PLACE
COLORADO SPRINGS, CO

230. LEVY JOEL D
ZONED - RR-5
6950 MONTY PLACE
COLORADO SPRINGS, CO

231. SANCHEZ LAISSA
ZONED - RR-5
6925 ALPACA HEIGHTS
COLORADO SPRINGS, CO

232. ENGET AARON
ZONED - RR-5
6950 HODGEN ROAD
COLORADO SPRINGS, CO

233. SAVAGE JORDAN L
ZONED - RR-5
6498 RALEIGH ROAD
COLORADO SPRINGS, CO

234. CONNOLLY ANDREW
ZONED - RR-5
6442 RALEIGH ROAD
COLORADO SPRINGS, CO

235. VOLK SETH K
ZONED - RR-5
6386 RALEIGH ROAD
COLORADO SPRINGS, CO

236. GIBB RONALD JESSE
ZONED - RR-5
6387 RALEIGH ROAD
COLORADO SPRINGS, CO

237. SAVAGE JORDAN L
ZONED - RR-5
16587 RIDGEBACK ROAD
COLORADO SPRINGS, CO

238. BISHOP BARBARA K
ZONED - RR-5
16755 THOMPSON ROAD
COLORADO SPRINGS, CO

239. DUNSTON MATTHEW W
ZONED - RR-5
5525 HODGEN ROAD
COLORADO SPRINGS, CO

240. LAVALLEY BRANDON DALE
ZONED - RR-5
5735 HODGEN ROAD
COLORADO SPRINGS, CO

241. STEARNS KRYSTAL
ZONED - RR-5
HODGEN ROAD
COLORADO SPRINGS, CO

242. STEARNS KRYSTAL
ZONED - RR-5
FARRAR DRIVE
COLORADO SPRINGS, CO

243. HARVEY TINA MARIE
ZONED - RR-5
15975 FARRAR DRIVE
COLORADO SPRINGS, CO

244. HARVEY CAROLYN C
ZONED - RR-5
15502 OPEN SKY WAY
COLORADO SPRINGS, CO

245. ROEHRICH DN FAMILY TRUST
ZONED - RR-5
15548 OPEN SKY WAY
COLORADO SPRINGS, CO

246. JAMES F BREGLIO LIVING TRUST
ZONED - RR-5
15594 OPEN SKY WAY
COLORADO SPRINGS, CO

247. CARPER CHRISTOPHER
ZONED - RR-5
15686 OPEN SKY WAY
COLORADO SPRINGS, CO

248. COYLE JOHN MORGAN LIVING TRUST
ZONED - RR-5
15778 OPEN SKY WAY
COLORADO SPRINGS, CO

249. JONES CHARLES D
ZONED - RR-5
4781 SECLUDED CREEK COURT
COLORADO SPRINGS, CO

250. SELVA MICHAEL D
ZONED - RR-5
4691 SECLUDED CREEK COURT
COLORADO SPRINGS, CO

251. PRIBBLE FAMILY LIVING TRUST
ZONED - RR-5
4601 SECLUDED CREEK COURT
COLORADO SPRINGS, CO

252. CHAMBERS MARK L
ZONED - RR-5
4782 HIGH FOREST ROAD
COLORADO SPRINGS, CO

253. MURROW RICHARD C TRUST
ZONED - RR-5
4722 HIGH FOREST ROAD
COLORADO SPRINGS, CO

254. MOORE DAVID S
ZONED - RR-5
4662 HIGH FOREST ROAD
COLORADO SPRINGS, CO

255. CIABARRA JAIMIE K
ZONED - RR-5
4602 HIGH FOREST ROAD
COLORADO SPRINGS, CO

256. VAN AUKEN LIVING TRUST
ZONED - RR-5
4715 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

257. BRAY THEODORE C
ZONED - RR-5
4482 HIGH FOREST ROAD
COLORADO SPRINGS, CO

258. CICCONE LYNDA M
ZONED - RR-5
4481 HIGH FOREST ROAD
COLORADO SPRINGS, CO

259. CICCONE LYNDA M
ZONED - RR-5
4481 HIGH FOREST ROAD
COLORADO SPRINGS, CO

260. STONESTREET JOHN B
ZONED - RR-5
4515 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

261. OLIVIAS RAYMOND B
ZONED - RR-5
4301 HIGH FOREST ROAD
COLORADO SPRINGS, CO

262. SUTHERLAND STEPHEN ARTHUR
ZONED - RR-5
4460 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

263. WEBER CHARLES L
ZONED - RR-5
4360 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

264. NELSON NORMAN D
ZONED - RR-5
4260 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

265. JOHNSON TRACIE LIVING TRUST
ZONED - RR-5
4210 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

266. BREWER STEVEN W
ZONED - RR-5
4160 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

267. WOGEN BRYAN
ZONED - RR-5
4110 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

268. FRANZ CHRISTOPHER A
ZONED - RR-5
4010 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

269. PAESCHKE TRACY
ZONED - RR-5
4015 HIDDEN ROCK ROAD
COLORADO SPRINGS, CO

270. OLSEN TODD A
ZONED - RR-5
3985 CANOPY COURT
COLORADO SPRINGS, CO

271. DAHILL DEVIN
ZONED - RR-5
3955 CANOPY COURT
COLORADO SPRINGS, CO

272. CASE FAMILY REVOC LIVING TRUST
ZONED - RR-5
15570 WINDING TRAIL ROAD
COLORADO SPRINGS, CO

273. PARKER JEFFREY
ZONED - RR-5
5030 VESSEY ROAD
COLORADO SPRINGS, CO

274. TERESA L FERGUSON LIVING TRUST
ZONED - RR-5
14145 MILLHAVEN PLACE
COLORADO SPRINGS, CO

275. HOLLINGSWORTH KIMBERLEY
ZONED - RR-5
6625 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

276. BURST DAVID K
ZONED - RR-5
6655 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

277. PIRTLE CYNTHIA K
ZONED - RR-5
6685 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

278. TWOMBLY MARCI
ZONED - RR-5
6715 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO

279. SUMPTER JUSTIN MICHAEL
ZONED - RR-5
15605 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

280. DAVIS MARK K
ZONED - RR-5
15565 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO

SCOTT W ANDREWS
PO BOX 158
USAF ACADEMY, CO 80840

CHRISTOPHER A BOWMAN
6425 CONNAUGHT DRIVE
COLORADO SPRINGS, CO 80908

GREGORY B CHAFFEE
15650 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO 80908

AARON O COPPOCK
6680 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO 80908

DERKSEN PROPERTIES LLC
5491 PADDINGTON CREEK
COLORADO SPRINGS, CO 80924

JOHN R AND BELINDA SHANTZ
2651 19TH AVE
KINGSBURG, CA 93631

DANIEL W LULCHUK
6790 CONNAUGHT DRIVE
COLORADO SPRINGS, CO 80908

ROBERT MELANSON
14725 BLACK FOREST ROAD
COLORADO SPRINGS, CO 80908

ERIC MIKUSKA
15645 TERRA RIDGE CIRCLE
COLORADO SPRINGS, CO 80908

ANTHONY A PALAZZARI
6250 CONNAUGHT DRIVE
COLORADO SPRINGS, CO 80908

PETER G RODAS
6305 CONNAUGHT DRIVE
COLORADO SPRINGS, CO 80908

ERIC J ROWE
6670 CONNAUGHT DRIVE
COLORADO SPRINGS, CO 80908

RYE LLC
16755 HAPPY LANDING
MONUMENT, CO 80132

MARK A SLUTZ
6730 CONNAUGHT DRIVE
COLORADO SPRINGS, CO 80908

JEFFREY B SMITH
13925 HIGHWAY 83
COLORADO SPRINGS, CO 80921

BART W TIMM
14695 BLACK FOREST ROAD
COLORADO SPRINGS, CO 80908

MAYNARD MARCI L TWOMBLY
6745 COUNTRY ESTATES LANE
COLORADO SPRINGS, CO 80908

KEVIN J VIDER
6365 CONNAUGHT DRIVE
COLORADO SPRINGS, CO 80908

COUNTY FILE NUMBER: SKP223

HR GREEN Xrefs: xgt-1-ARCH DH01; BUBBLE-PLAN; EX-Parcels

DRAWN BY: JAG	JOB DATE: 3/1/2022	BAR IS ONE INCH ON OFFICIAL DRAWINGS.	
APPROVED: PLS	JOB NUMBER: 211030	0 1"	
CAD DATE: 9/15/2022		IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.	
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Sketch-Plan\ADJACENT-PROPERTY			

NO.	DATE	BY	REVISION DESCRIPTION

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HRGreen

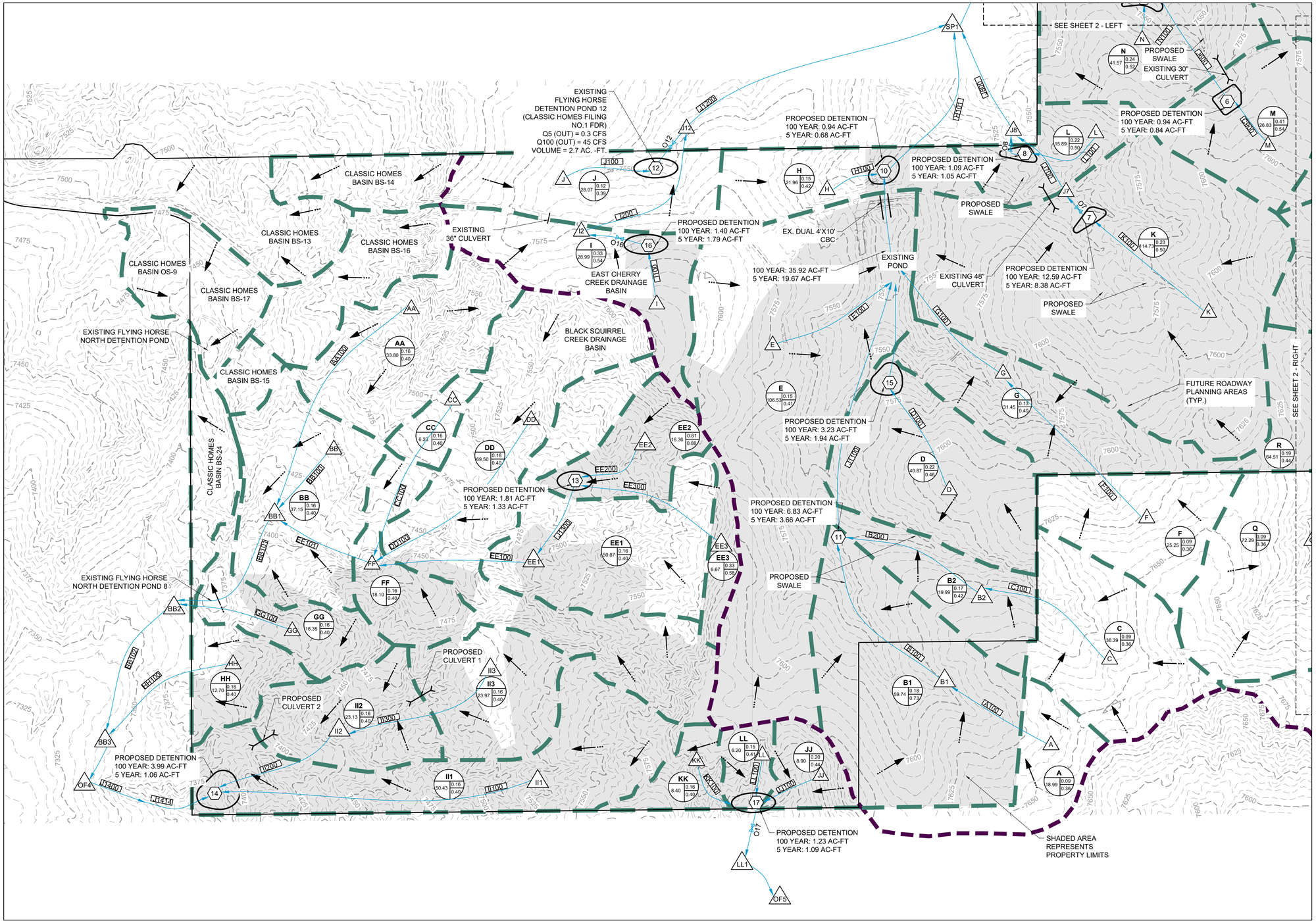
FLYING HORSE NORTH
DEVELOPMENT, LLC.
EL PASO COUNTY, COLORADO

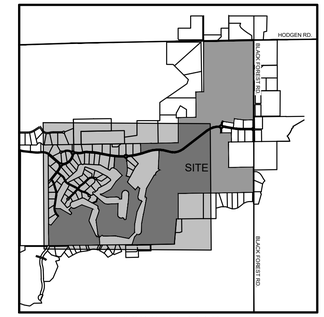
FLYING HORSE NORTH SKETCH PLAN
ADJACENT PROPERTY DATA OWNERS

SHEET
SP.5

5

FERNANDEZ, SARAH, 9/9/2022 9:13 AM





VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION — A
- POTENTIAL WATER QUALITY LOCATION — WQ
- SWMM CONVEYANCE ELEMENT — SWMM
- PROPOSED PEAK FLOW RATE (CFS) — 850
- DESIGN POINT — X
- PROPOSED BASIN LABEL — XX BASIN DESIGNATION; AREA (AC.) XX; XX C5; XX C100

NOTES:

SEE SHEET 2 FOR DESIGN FLOWS

NORTH

0 200 400

HRGreen

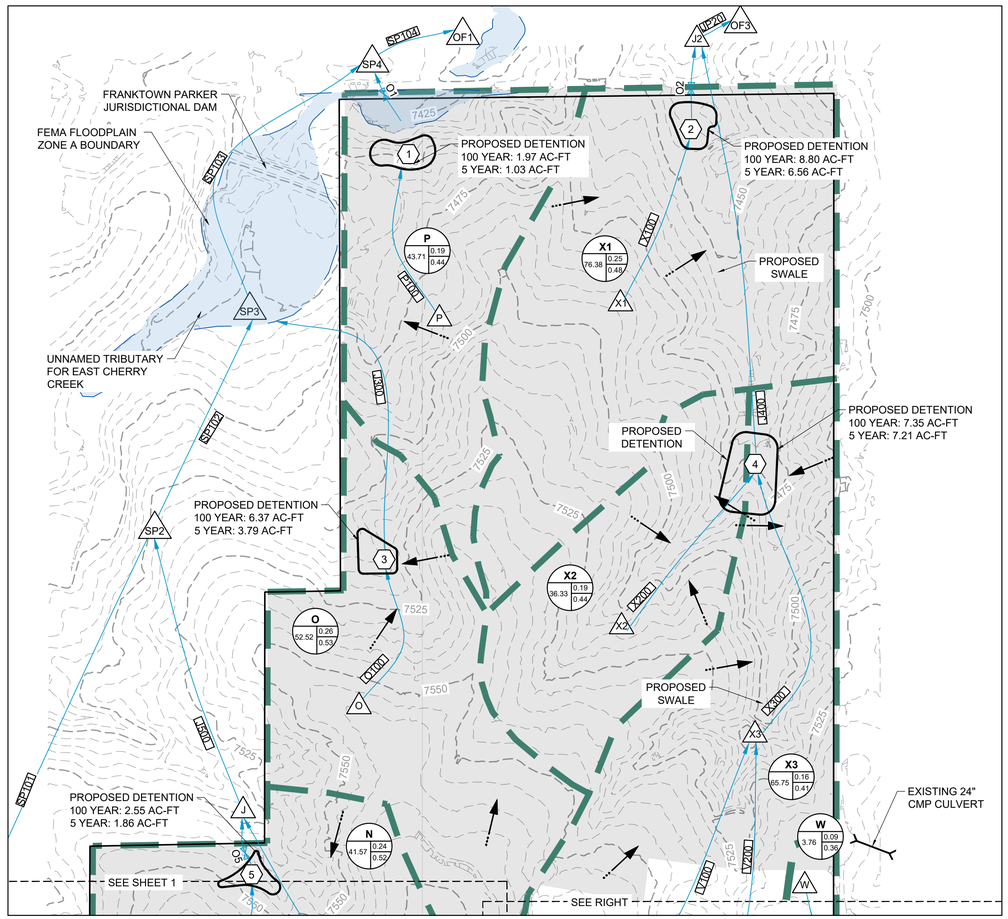
Job No.:	211030.01
Prepared By:	TBI
Date:	9/9/2022

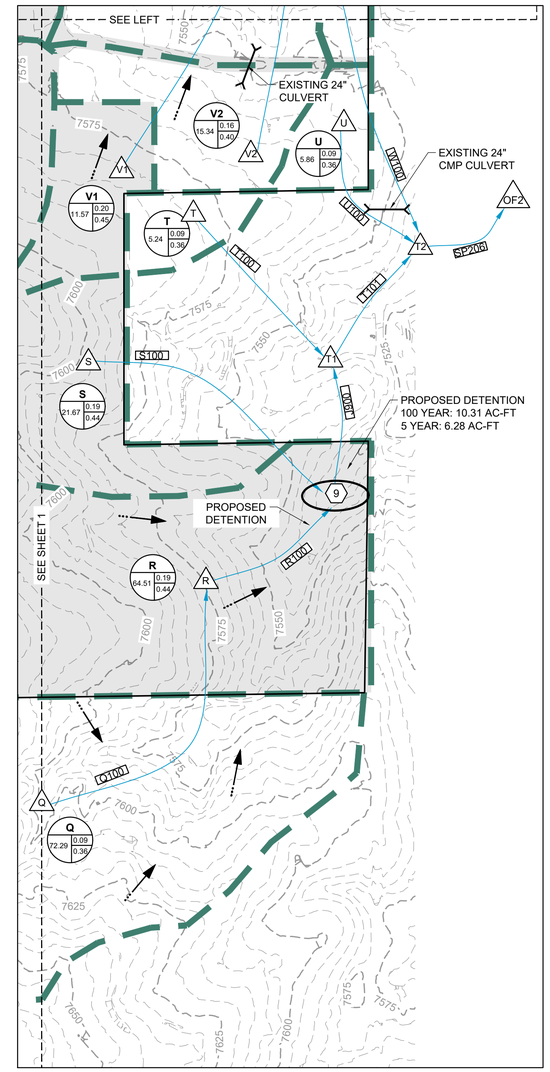
PROPOSED DRAINAGE BASINS

FIG.1

HRGreen DRAWING PATH:J:\2021\211030.01\CAD\Dwgs\MDDP Exhibits\01_MDDP_PR_DRAINAGE_BASINS.dwg

BASIN	DESIGN POINT	5 YEAR POST DEVELOPMENT	100 YEAR POST DEVELOPMENT
A	A	20.84	43.83
AA	AA	39.23	81.18
B1	B1	66.93	133.69
B2	B2	17.99	37.14
BB	BB	40.62	84.15
	BB1	214.28	483.72
	BB2	229.61	515.49
	BB3	307.27	646.46
C	C	35.31	75.28
CC	CC	6.53	13.57
D	D	61.12	117.38
DD	DD	57.78	122.41
E	E	74.68	157.91
EE1	EE1	53.25	156.68
EE2	EE2	35.71	63.62
EE3	EE3	10.38	19.33
F	F	24.27	51.63
FF	FF	20.78	330.28
G	G	27.18	108.76
GG	GG	15.49	32.48
H	H	17.86	37.80
HH	HH	13.56	28.16
I	I	40.37	78.06
II1	II1	34.94	74.39
II2	II2	28.04	116.26
II3	II3	28.32	58.65
	IRR_J	114.18	274.80
	IRR_POND	243.77	550.27
J	J	24.45	51.19
JJ	JJ	11.49	22.80
K	K	200.94	382.30
KK	KK	8.14	16.95
L	L	15.97	32.40
LL	LL	7.36	15.07
	LL1	0	49.55
M	M	46.54	89.08
N	N	73.48	141.24
O	O	63.86	127.40
	OF1	240.43	705.93
	OF2	104.34	242.18
	OF3	95.68	271.49
	OF4	307.27	646.46
	OF5	16.85	49.55
P	P	40	82.83
Q	Q	64.68	137.80
R	R	56.59	253.86
S	S	30.83	58.96
	SP1	189.85	511.89
	SP2	223.43	618.35
	SP3	212.45	641.31
	SP4	240.49	706.05
T	T	4.04	8.68
	T1	98.27	228.33
	T2	104.34	242.18
U	U	4.81	10.51
V1	V1	13.99	27.67
V2	V2	16.15	33.25
W	W	3.45	7.46
X1	X1	80.91	163.27
X2	X2	41.46	82.46
X3	X3	47.59	100.73





VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100–YR FLOODWAY
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX) — BASIN DESIGNATION; AREA (AC.) (XX) — C5 (XX), C100 (XX)

NOTES:

NORTH

0 200 400

HRGreen

Job No.:	211030.01
Prepared By:	TBI
Date:	9/9/2022

PROPOSED DRAINAGE BASINS

FIG.1