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## Flying Horse North Master Development Drainage Plan

March 09, 2022

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.

---

Chris McFarland, PE                      Date

State of Colorado No. 44947

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.

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Jennifer Irvine, P.E.

County Engineer/ECM Administrator

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Date

# 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 and 1571 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.

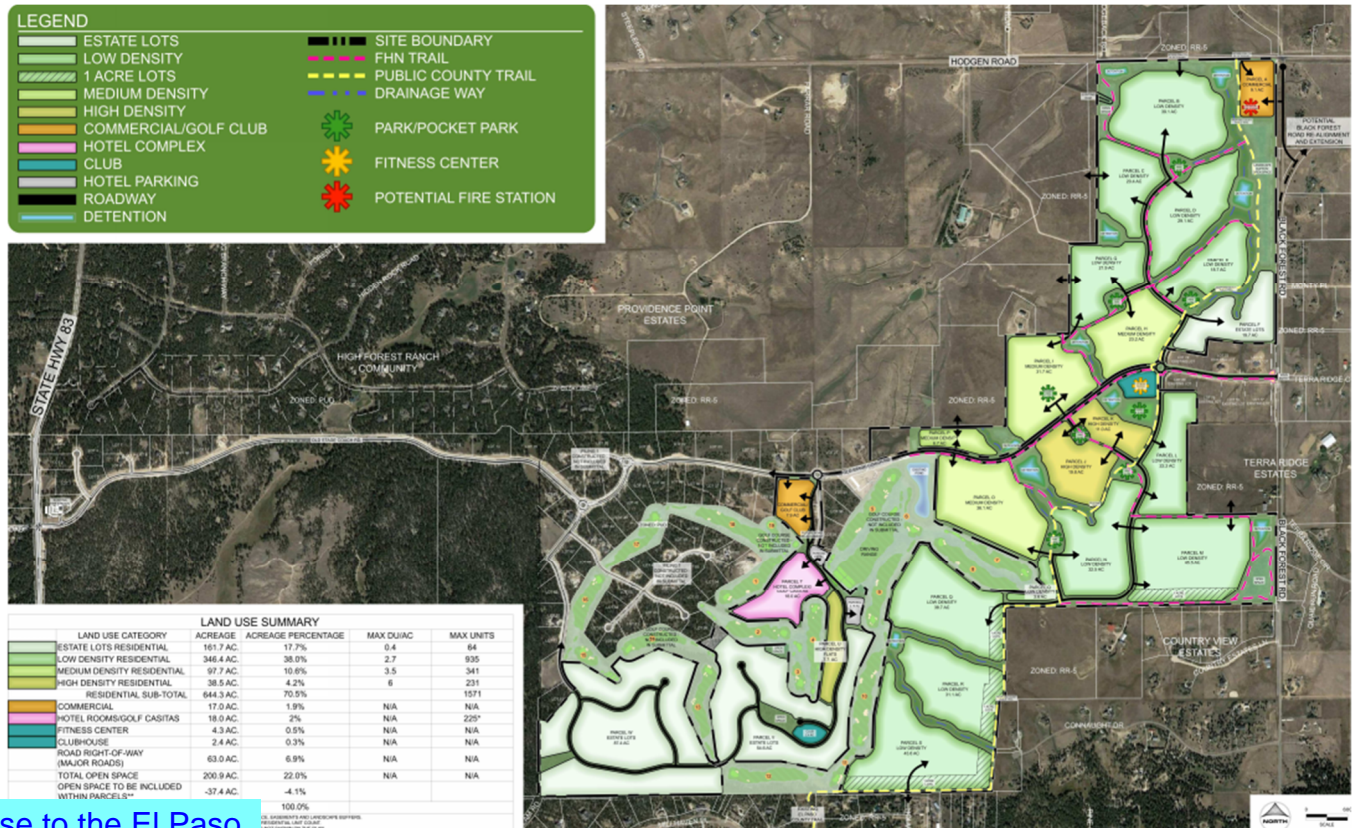


Figure 1 - Site Map

Revise to the El Paso County DCM

## f. Data Sources

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

City of Colorado Springs Drainage Criteria Manual (DCM), Volumes 1 and 2

Mile High Flood District

NOAA Atlas 14

NRCS Soil Survey for El Paso County Area, Colorado

FEMA FIRM 08041C0305G and FIRM 08041C0315G (eff. 1

spelling.

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 River 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 River basin, 4 drainage basins are conveyed onto the site on the south western 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	15.02	43.23
C	36.39	24.22	70.30
F	25.25	17.53	50.93
Q	72.29	46.69	135.90

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 North 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 low, medium, and high density residential, along with a future hotel site and multiple green spaces and small parks. The current land plan assumes approximately 1,571 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)	0.4
Low	2.7
Medium	3.5
High	6

### 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 no major channels within its boundaries.
- 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.

##### Subbasin Description

The site's flows are split by the major ridgeline into the Arkansas River Basin and South Platte Basin. Within the South Platte Basin, flow is split by the ridgeline, the Arkansas River Basin is on the north side of the site. 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.

Update to identify this is Proposed Condition Subbasin Description and provide a subsection for the Existing Condition 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 15.02 cfs and 43.23 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 25.78% and runoff rates for the 5 and 100 year of 59.13 cfs and 163.37 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 22.97% and runoff rates for the 5 and 100 year of 38.72 cfs and 110.42 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 25.59cfs and 74.26 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 42.44% and runoff rates for the 5 and 100 year of 50.30 cfs and 125.58 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 12.46% and runoff rates for the 5 and 100 year of 128.26 cfs and 346.92 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 17.53 cfs and 50.93 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 13.98% and runoff rates for the 5 and 100 year of 37.59 cfs and 107.75 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 16.25% and runoff rates for the 5 and 100 year of 13.74 cfs and 38.52 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. Current planning documents call for a commercial golf club. The basin is 28.99 acres, with a composite impervious value of 29.73% and runoff rates for the 5 and 100 year of 26.84cfs and 71.19 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 River. 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 17.72 cfs and 50.49 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 41.33% and runoff rates for the 5 and 100 year of 159.05 cfs and 395.37 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 7. Current planning documents call for medium density dwelling units. The basin is 15.89 acres, with a composite impervious value of 35.49% and runoff rates for the 5 and 100 year of 15.11 cfs and 39.52 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 37.27% and runoff rates for the 5 and 100 year of 36.75 cfs and 91.76 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

Discuss proposed stormwater WQ treatment for subbasin I. Will flows be directed to Existing Detention Pond 12? Does Detention Pond 12 have capacity for developed flows from subbasin I?

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 40.57 and runoff rates for the 5 and 100 year of 65.41 cfs and 159.57 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 44.67% and runoff rates for the 5 and 100 year of 62.67 cfs and 156.19 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 34.3% and runoff rates for the 5 and 100 year of 39.34 cfs and 103.06 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek River 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 46.69 cfs and 135.9 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 34.6% and runoff rates for the 5 and 100 year of 98.48 cfs and 273.3 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek River 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 34.08% and runoff rates for the 5 and 100 year of 20.17 cfs and 52.94 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 2.92 cfs and 8.56 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 10.00% and runoff rates for the 5 and 100 year of 3.63 cfs and 10.37 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 C5 via culvert. Current planning documents call for low density dwelling units. The basin is 11.57 acres, with a composite impervious value of 38.1% and runoff rates for the 5 and 100 year of 10.41 cfs and 27.11 cfs respectively.
- Subbasin V2 is located south of subbasin X3 and proposed Stagecoach Rd. The basin drains towards the north and towards subbasin C5. The flow are directed through a culvert and

should this be subbasin X3?

4?

eventually to Detention Pond 5. 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 10.00% and runoff rates for the 5 and 100 year of 11.32 cfs and 31.98 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 34.6% and runoff rates for the 5 and 100 year of 67.88 cfs and 177.48 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek River 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 33.29% and runoff rates for the 5 and 100 year of 30.87 cfs and 81.30 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 23.17% and runoff rates for the 5 and 100 year of 59.32 cfs and 163.53 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 28.57 cfs and 80.08 cfs and 4.74 cfs and 13.39 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 29.52 cfs and 83.01 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 42.26 cfs and 120.76 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 42.6 cfs and 154.16 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 27.82 cfs and 62.84 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 7.88 cfs and 19.08 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. The basin is 10.55 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 11.25 cfs and 32.04 cfs respectively.
- Subbasin GG located towards an existing 2.5-acre estate lots. The basin is 10.55 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 11.25 cfs and 32.04 cfs respectively.
- Subbasin HH is located on the west side of the site. The basin drains towards the west and to an 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 9.86 cfs and 27.77 cfs respectively.
- 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 25.77 cfs and 73.38 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 40.9 cfs and 114.68 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 20.65 cfs and 57.86 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 34.6% and runoff rates for the 5 and 100 year of 11.06 cfs and 28.04 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

Expand on the narrative for Basin HH. The plan does not identify WQCV, so explain or identify the specific exclusion from WQCV. See Engineering Criteria Manual Appendix I Section I.7.1.B for the type of sites excluded from permanent WQ.

Also explain why flow rate in the developed condition is lower when imperviousness is higher than predevelopment condition.

1-acre dwelling units. The basin is 6.2 acres, with a composite impervious value of 21.5% and runoff rates for the 5 and 100 year of 5.85 cfs and 15.68 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 5.91 cfs and 16.72 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 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	15.02	43.23
C	C	36.39	Pond 11	25.59	74.26
F	F	25.25	Irr. Pond	17.53	50.93
Q	Q	72.29	Pond 9	46.69	135.9

Revise to NOAA Atlas 2 per the 2014 City DCM adopted by the County.  
Revise rainfall depths per Table 6-2 of the City DCM

## b. Methodology

Design rainfall was determined utilizing figures from the NOAA Atlas 14, Volume 8, Version 2 to determine the 5-year and 100-year rainfall values for 1, 6 and 24-hour events. The 1-hour rainfall depths are 1.2 and 2.49 in/hr respectively, 6 hour 1.76 and 3.86 in/hr respectively and 2.46 and 5.07 in/hr for the 24-hour event. The rainfall 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 used 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 rates. The results from these models along with the design parameters used for modeling such as the c-values or percent impervious for each of the land use categories presented on the sketch plan.

Identify the design parameters used for modeling such as the c-values or percent impervious for each of the land use categories presented on the sketch plan.

provide the summary  
table for the  
predeveloped  
condition

### 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.

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	34.3%	39.34	103.06		
Pond 1					1.11	2.2
X1	76.38	34.6%	67.88	177.48		
Pond 2					3.01	6.12
O	52.52	44.7%	62.67	156.19		
Pond 3					3.12	6.5
X2	36.33	33.3%	30.87	81.3		
X3	61.99	23.2%	59.32	163.53		
V2	15.34	10.0%	11.32	31.98		
V1	11.57	10.0%	10.41	27.11		
Pond 4					2.56	4.96
N	41.57	40.6%	65.41	159.57		
Pond 5					2.2	4.6
M	26.83	37.3%	36.75	91.76		
Pond 6					1.15	2.44
K	114.73	41.3%	159.05	395.37		
Pond 7					4.77	11.62
L	15.89	38.1%	15.11	39.52		
Pond 8					0.27	0.32
S	21.67	34.1%	20.17	52.94		
R	56.16	34.1%	98.48	273.3		
Q	72.29	2.0%	46.69	135.9		
Pond 9					3.38	7.75
H	21.96	16.3%	13.74	38.52		
Pond 10					0.37	.51
B2	19.99	23.0%	38.72	110.42		
B1	59.74	25.8%	59.13	163.37		
A	18.99	2.0%	15.02	43.23		
C	36.39	2.0%	25.59	74.26		
Pond 11					2.38	7.5
J	28.07	10.0%	11.06	50.49		
I	28.99	29.8%	26.84	71.19		
Pond 12					1.36	1.83
EE2	16.36	75.0%	27.82	62.84		
EE3	6.67	55.0%	7.88	19.08		
Pond 13					1.13	1.78
DD	69.5	10.0%	42.26	120.76		

II3	23.97	10.0%	20.65	57.86	
II2	23.13	10.0%	40.9	114.68	
II1	50.43	10.0%	25.77	73.38	
<b>Pond 14</b>					1.05 3.98
D	40.87	42.4%	50.3	125.58	
<b>Pond 15</b>					1.65 3.3
E	106.53	12.5%	128.26	346.92	
G	31.45	14.0%	37.69	107.75	
F	25.25	2.0%	17.53	50.93	
<b>Irrigation Pond</b>					
JJ	8.90	34.6%	11.06	28.04	
LL	6.2	21.5%	5.85	15.68	
KK	8.4	10.0%	5.9	16.72	
<b>Natural Drainage Way</b>					
CC	6.33	10.0%	4.74	13.39	
DD	69.5	10.0%	42.26	120.76	
EE1	50.87	10.0%	42.6	154.16	
FF	18.1	10.0%	100.02	325.29	
<b>Existing Pond</b>					
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	
<b>Existing Pond</b>					
HH	12.7	10.0%	9.86	27.77	
<b>Natural Drainage Way</b>					
T	5.24	2.0%	2.92	8.56	
U	5.86	10.0%	3.63	10.37	
W	3.76	10.0%	2.6	7.36	
<b>Natural Drainage Way</b>					

Update label for consistency with drainage map. Is this "Existing Flying Horse North Detention Pond 8"?

## 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 within 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 impervious 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 will be required. The final report will include a detailed description of the BMPs and their location. The final report will also include a detailed description of the BMPs and their location. The final report will also include a detailed description of the BMPs and their location.

Ponds are designed in a series. Explain how the system will be analyzed as detailed UD-Detention modeling is provided with subsequent preliminary and final drainage report for the pond design and ensuring the downstream ponds maintain compliance with Senate Bill 15-212 to drain the ponds within 72 hours for 5yr storm or within 120 hours for storm events greater than the 5yr storm.

## VI. Alternatives

The current plan includes 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 14 separate full spectrum detention facilities and utilize the capacity of 2 existing full spectrum detention facilities.

- 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 2.2 ac-ft during the 100 year event and have a peak outflow of 80.7 cfs which is slightly below the pre development peak outflow of 81 cfs. The 5 year storage volume is 1.11 ac-ft with a peak outflow of 27.9 cfs.
- Pond 2 is located to the east of Pond 1 and discharges into another unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 6.12 ac-ft during the 100 year event and have a peak outflow of 342.1 cfs which is slightly below the pre development peak outflow of 352.0 cfs. The 5 year storage volume is 3.01 ac-ft with a peak outflow of 107.8 cfs.

- Pond 3 is located on the eastern portion of the site and south of Pond 1. The pond discharges into a swale to be designed and discharges into Pond 1, which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 6.5 ac-ft during the 100 year event and have a peak outflow of 47.4 cfs which is slightly below the pre development peak outflow of 47.8 cfs. The 5 year storage volume is 3.12 ac-ft with a peak outflow of 17.8 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 that discharges into Pond 2, which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 4.96 ac-ft during the 100 year event and have a peak outflow of 224.4 cfs which is slightly below the predevelopment peak flow rate of 231.6 cfs. The 5 year storage volume is 2.56 ac-ft with a peak outflow of 69.7 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 4.6 ac-ft during the 100 year event and have a peak outflow of 121.6 cfs which is greater than the pre development peak outflow of 117.6 cfs. The 5 year storage volume is 2.2ac-ft with a peak outflow of 29.7 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 discharges into Pond 5. The pond is planned to store a maximum of 1.92 ac-ft during the 100 year event and have a peak outflow of 46.7 cfs which is greater than the pre development peak outflow of 46.6 cfs. The 5 year storage volume is 1.15 ac-ft with a peak outflow of 8.2 cfs.
- Pond 7 is located in the central portion of site. The pond discharges into a natural drainageway that eventually discharges to Pond 8. The pond is planned to store a maximum of 11.62 ac-ft during the 100 year event and have a peak outflow of 172.9 cfs which is slightly lower than the pre development peak outflow of 192.8 cfs. The 5 year storage volume is 4.77 ac-ft with a peak outflow of 67.6 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 .323 ac-ft during the 100 year event and have a peak outflow of 203.5 cfs which lower than the predevelopment peak outflow of 225.6. The 5 year storage volume is .274 ac-ft with a peak outflow of 78.4 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 just south of East Cherry Creek. The pond is planned to store a maximum of 7.75 ac-ft during the 100 year event and have a peak outflow of 250.1 cfs which is lower than the pred development peak outflow of 282.3 cfs. The 5 year storage volume is 3.379 ac-ft with a peak outflow of 91.0cfs.
- 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 0.513 ac-ft during the 100 year event and have a peak outflow of 37.5 cfs which is lower than the predevelopment peak outflow of 39.4 cfs. The 5 year storage volume is 0.374 ac-ft with a peak outflow of 12.9 cfs.

- Pond 11 is located near the central portion of the site. The pond discharges into a natural drainageway which eventually discharges into Pond 15. The pond is planned to store a maximum of 7.5 ac-ft during the 100 year event and have a peak outflow of 208.8 cfs which is lower than the predevelopment peak outflow of 222.3 cfs. The 5 year storage volume is 2.38 ac-ft with a peak outflow of 75.7 cfs.
- Existing Pond 12 is 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 store a maximum of 1.83 ac-ft during the 100 year event and have a peak outflow of 116.1 cfs which is lower than the predevelopment peak outflow of 118.7 cfs. The 5 year storage volume is 1.36 ac-ft with a peak outflow of 36.5 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 1.78 ac-ft during the 100 year event and have a peak outflow of 51.8 cfs which lower than the predevelopment peak outflow of 55.0. The 5 year storage volume is 1.132 ac-ft with a peak outflow of 11.0 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 3.98 ac-ft during the 100 year event and have a peak outflow of 752.3 cfs which is slightly lower than the predevelopment peak outflow of 173.0 cfs. The 5 year storage volume is 1.05 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 3.3 ac-ft during the 100 year event and have a peak outflow of 69.0 cfs which is slightly above the predevelopment peak of 66.9 cfs. The 5 year storage volume is 1.65 ac-ft with a peak outflow of 22.5 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 263.28 cfs and the 5 year storage volume is 19.67 ac-ft with a peak outflow of 64.13 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 57.86 cfs, where the pipe is 70% full.
- Culvert 2 carries flow from Subbasin II2 to Subbasin II3 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 114.67 cfs, where the pipe is 68% full.

The culverts sizes should be refined at 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	231.98	713.55	202.1	624.16
2	105.04	306.73	98.8	273.21
3	122.16	356.64	108.31	343.11
4	252.39	723.98	230.07	638.06
5	17.37	50.18	22.38	59.47

\*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, 14 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.

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.

Add a section for drainage problems anticipated and their solutions.

- Example: comment on the proposed drainage map regarding Basin L, or comment on page 15 regard drain time for the ponds in a series.
- Is there potential issues with Pond 9 location? Existing house is directly downstream.
- Review Land Development Code Chapter 8 Section 8.4.2.B.1.e.i, Per this section approved Base Flood Elevation data shall be shown on the plat when this portion of the sketch plan develops. Establishing the BFE likely involves a LOMR process.
- Pond 1 appears to be located within the FEMA floodplain. Identify anticipated drainage problems and design considerations.
- Some of the MHFD-Detention worksheet show outflow greater than predevelopment Q for certain design storm. Criteria requires that ponds release at below historic. Additionally some of these ponds are in a series which may exacerbate the problem with compliance to Senate Bill 15-212.



## 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

Elbert County

Lincoln County

Pueblo County

Teller County  
Fremont County

## Drainage Basins

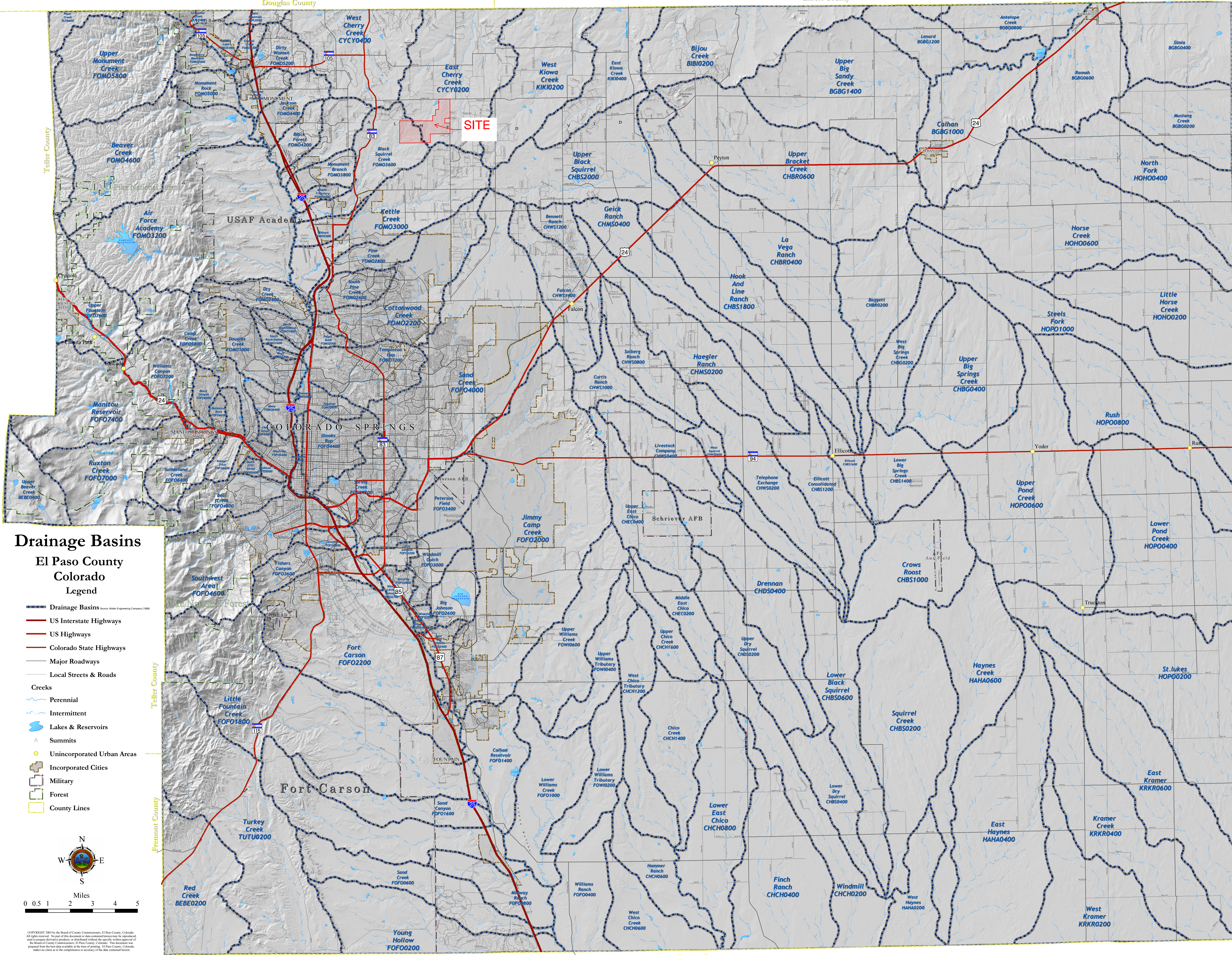
### El Paso County Colorado Legend

- Drainage Basins (Source: Muter Engineering Company 1988)
- 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

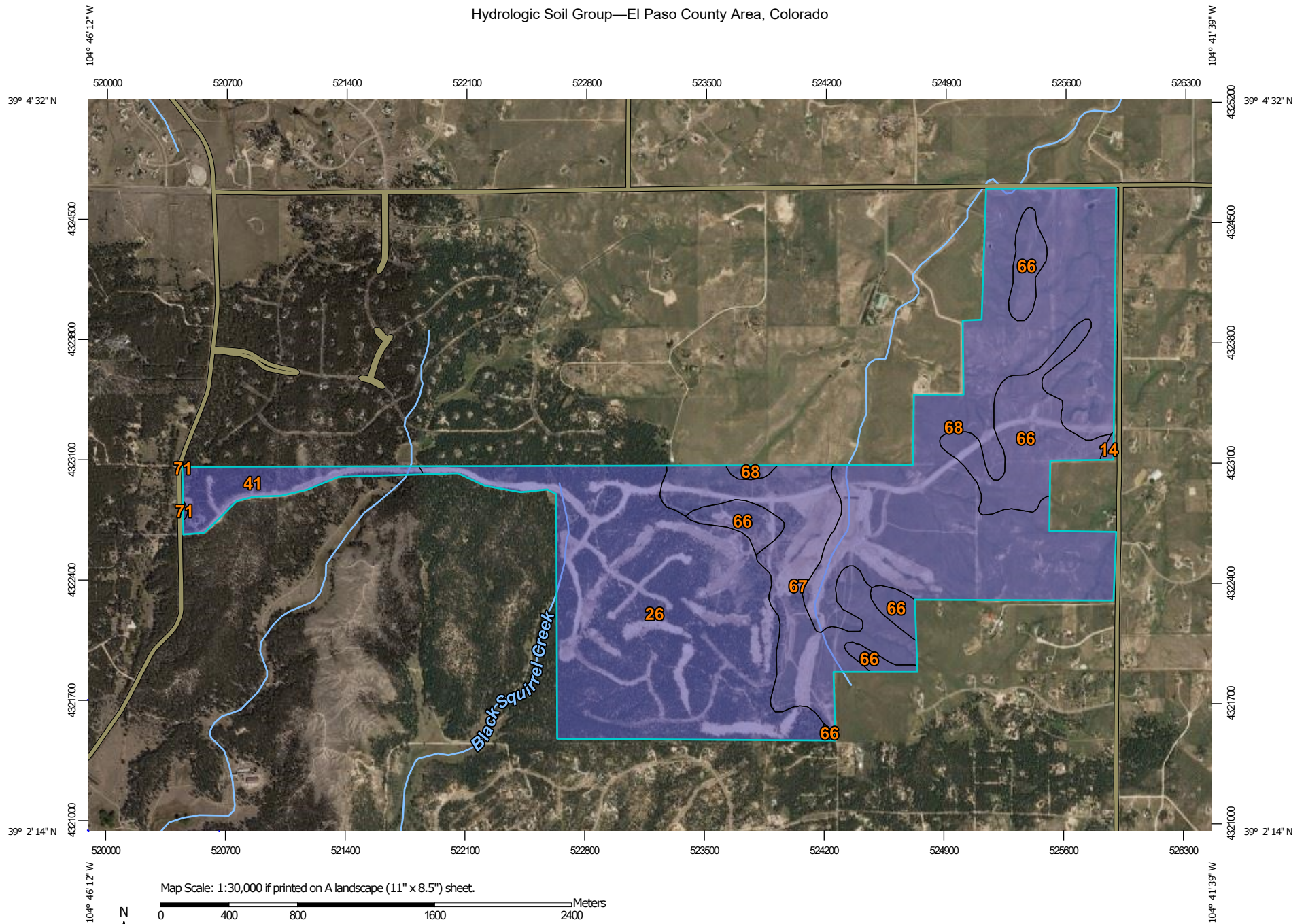


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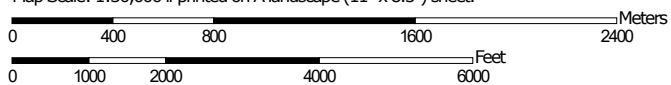
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# Hydrologic Soil Group—El Paso County Area, Colorado



Map Scale: 1:30,000 if printed on A landscape (11" x 8.5") sheet.



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




**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

1/27/2022  
Page 1 of 4

## 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%
<b>Totals for Area of Interest</b>			<b>1,407.3</b>	<b>100.0%</b>

## 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

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **Floodway Data** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only to landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

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

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, projection or UTM zone zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

NGS Information Services  
NOAA, NGS12  
National Geodetic Survey  
SSMC-3, #9002  
1315 East-West Highway  
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (201) 713-3342 or visit its website at <http://www.ngs.noaa.gov/>.

**Base Map** information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

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

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

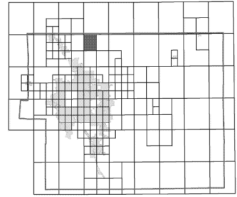
Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eExchange (FMIX) 1-877-336-3627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.fema.gov/>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or use the FEMA website at <http://www.fema.gov/business/firm/>.

### 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	

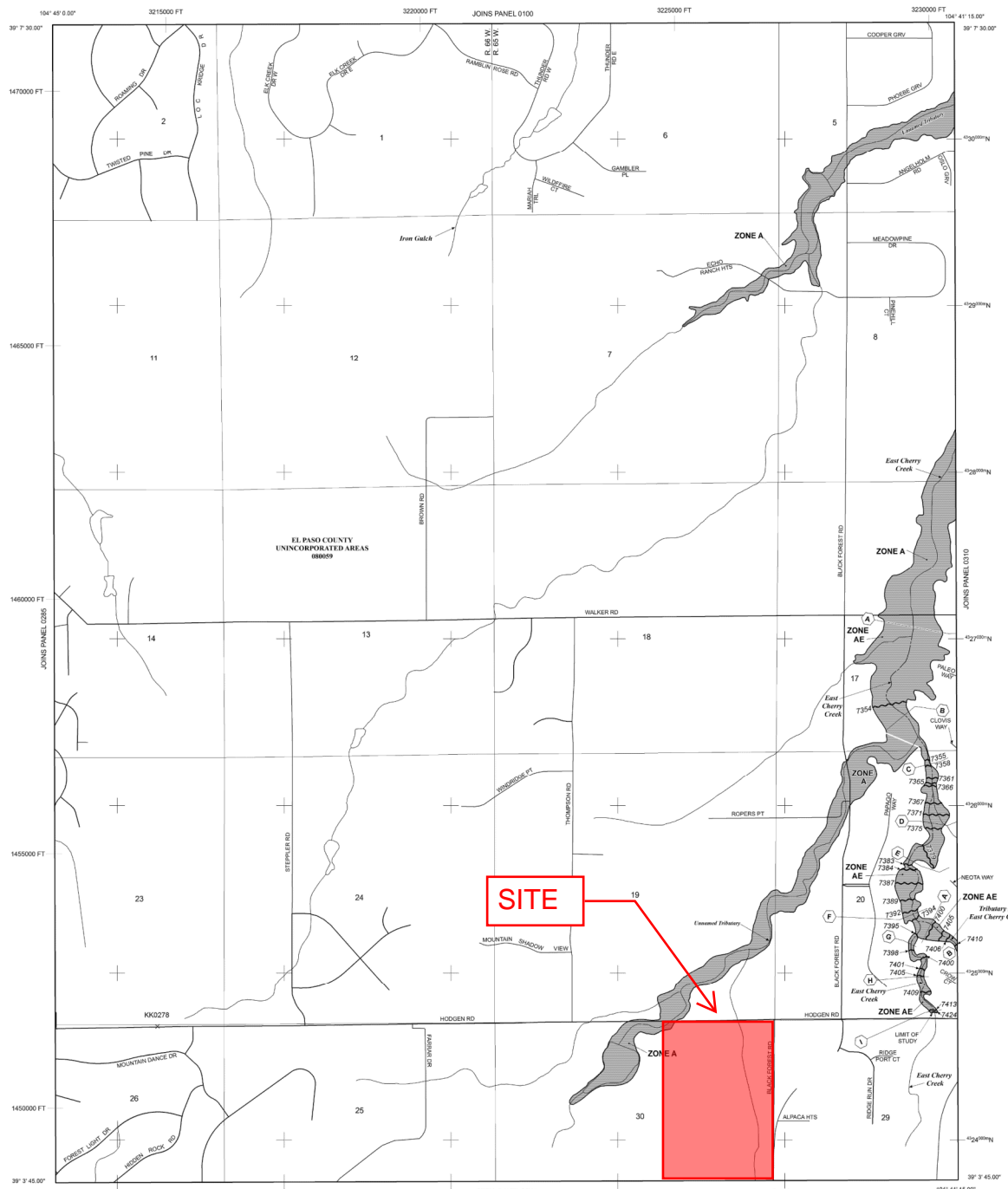
### Panel Location Map



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.



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, 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, vehicles also determined.
- ZONE AR:** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that is no longer in existence. 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:** Areas 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); no 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 depth of less than 1 foot or with velocity hazard 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

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

— Base Flood Elevation value where uniform within zone; elevation in feet\*

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

— Cross section line

— Transect line

— Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

— 100-meter Universal Transverse Mercator grid, zone 13

— 1000-foot grid lines; Colorado State Plane coordinate system, central zone; Lambert Conformal Conic Projection

— Bench mark (see explanation in Notes to Users section of this FIS report)

— 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 1, 2018: To update information to the 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

500 0 1000 2000 METERS

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	0305G	0305G	0

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

## NOTES TO USERS

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zone numbers used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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NOAA, NGS12  
National Geodetic Survey  
SSMC-3, #9022  
1315 East-West Highway  
Silver Spring, MD 20910-3282

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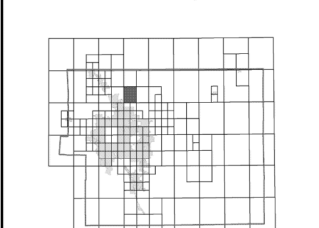
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### El Paso County Vertical Datum Offset Table

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	

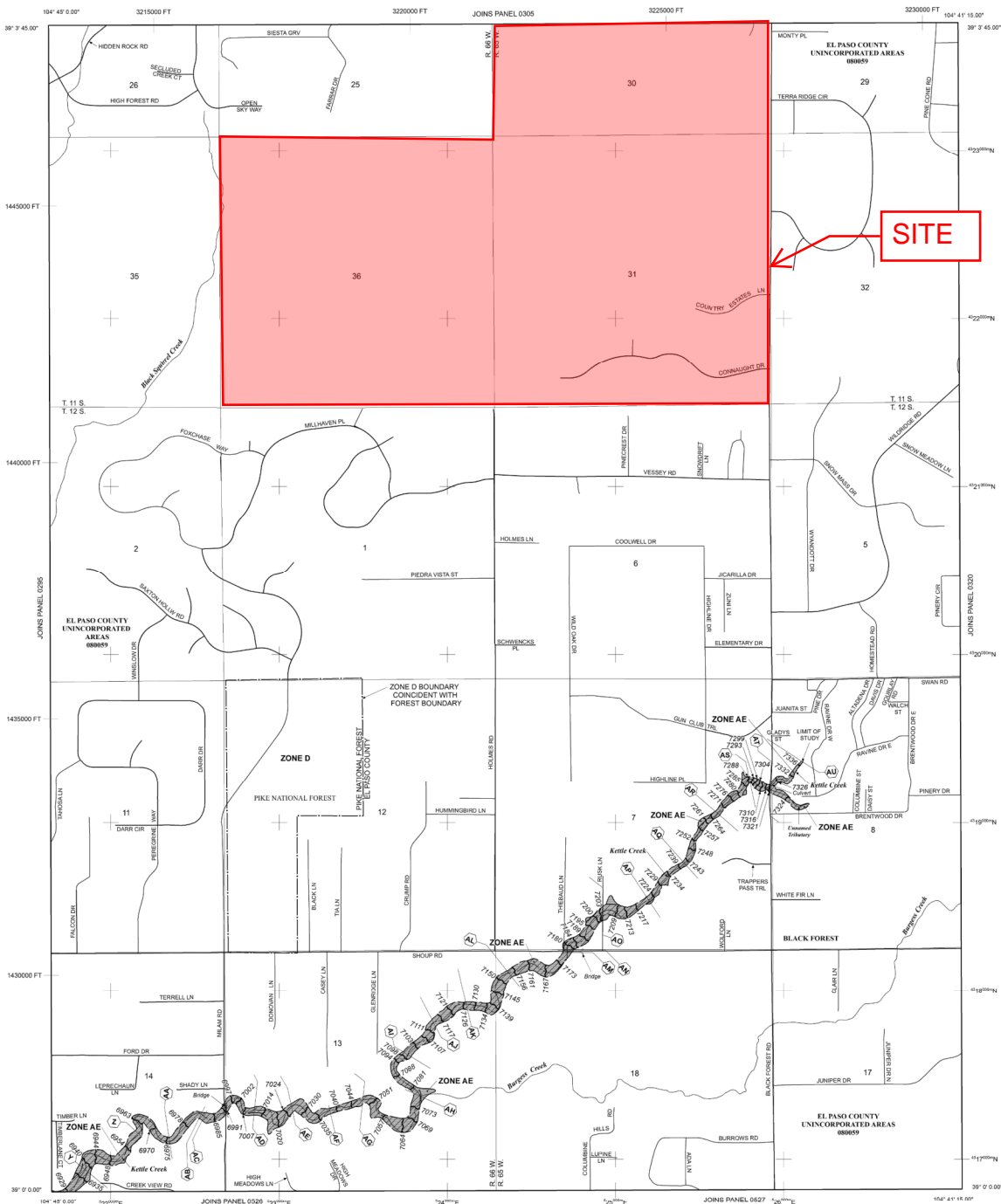
### Panel Location Map



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## LEGEND

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

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- 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, vehicles also determined.
- ZONE AR**  
Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently abandoned. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE AV**  
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 2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with wave heights 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. Areas in which flood hazards are undetermined, but possible.

**ZONE D**  
Floodway boundary.

**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.

**BOUNDARY**  
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**  
Base Flood Elevation line and value; elevation in feet\*  
Base Flood Elevation value where uniform within zone; elevation in feet\*

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

**CROSS SECTION**  
Cross section line

**TRANSIT LINE**  
Transit line

**COORDINATES**  
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)  
1000-meter Universal Transverse Mercator grid ticks, zone 13

**1000-FOOT GRID TICS**  
Colorado State Plane coordinate system, central meridian (PROJCS: NAD83)  
Lambert Conformal Conic Projection

**BENCH MARK**  
Bench mark (see explanation in Notes to Users section of this FIRM panel)

**MAP REPOSITORIES**  
Refer to Map Repositories list on Map Index

**EFFECTIVE DATE OF COUNTRYWIDE FLOOD INSURANCE RATE MAP**  
MARCH 17, 1997

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
DECEMBER 7, 2018: In update incorporates minor changes to 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'**

**FEET**  
0 1000 2000

**METERS**  
0 300 600

**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	0315	0315	G

**MAP NUMBER**  
08041C0315G

**MAP REVISED**  
**DECEMBER 7, 2018**  
Federal Emergency Management Agency

Dam Overview

Dam Name

Administration Type

NID ID

WDID

Physical Status

Hazard Class

Stream

Last Inspection Result

FRANKTOWN PARKER FPE-2 (080130)

Jurisdictional Dam

CO00274

Active

Low

EAST CHERRY CR

Conditionally Satisfactory (04/11/2018)

▼ Location

Division

Water District

County

Downstream Town

Town Distance


1

8

EL PASO

FRANKTOWN

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

EAP

EAP Date

Primary Contact

EAP Inundation Map

Inundation Map Date

EL PASO COUNTY

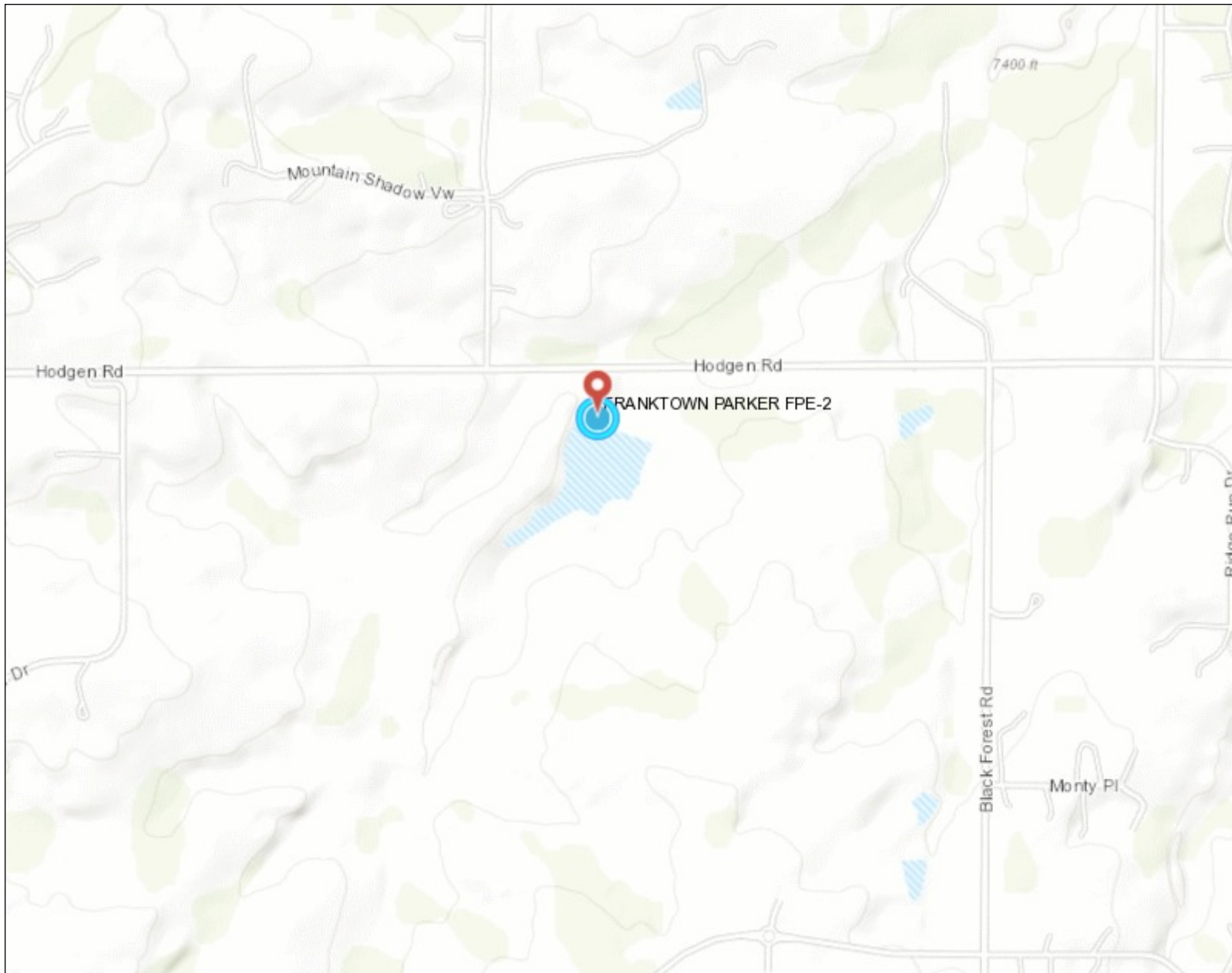
Not Required

STEVE JACOBSEN

No



## Map Viewer



### Legend

#### Jurisdictional Dam

- High
- Significant
- Low
- NPH

■ Non Jurisdictional 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	High Density/Schools	Med Density	Low Density	Commercial	1 Acre	2.5 Acre	Total Impervious	Total Acreage	Composite Percent Impervious	Predominant Soil Group	5 Year C Factor	100 Year C Factor
Impervious Percentage	10%	65%	55%	45%	75%	20%	10%						
P	13.36	0.00	0.00	30.35	0.00	0.00	0.00	14.99	43.71	34.30%	B	0.19	0.44
					<b>Pond 1</b>				<b>43.71</b>	<b>34.30%</b>			
X1	29.99	0.00	0.00	37.85	8.54	0.00	0.00	26.44	76.38	34.61%	B	0.25	0.48
					<b>Pond 2</b>				<b>76.38</b>	<b>34.61%</b>			
O	10.98	0.00	36.71	4.83	0.00	0.00	0.00	23.46	52.52	44.67%	B	0.26	0.53
					<b>Pond 3</b>				<b>52.52</b>	<b>44.67%</b>			
X2	12.16	0.00	0.00	24.17	0.00	0.00	0.00	12.09	36.33	33.29%	B	0.19	0.44
X3	38.66	0.00	0.00	23.33	0.00	0.00	0.00	14.36	61.99	23.17%	B	0.16	0.42
V2	0.00	0.00	0.00	0.00	0.00	0.00	15.34	1.53	15.34	10.00%	B	0.16	0.40
V1	2.28	0.00	0.00	9.29	0.00	0.00	0.00	4.41	11.57	38.10%	B	0.20	0.45
					<b>Pond 4</b>				<b>125.23</b>	<b>26.91%</b>			
N	13.33	0.00	28.24	0.00	0.00	0.00	0.00	16.87	41.57	40.57%	B	0.24	0.52
					<b>Pond 5</b>				<b>41.57</b>	<b>40.57%</b>			
M	12.35	0.00	10.48	0.00	4.00	0.00	0.00	10.00	26.83	37.27%	B	0.41	0.54
					<b>Pond 6</b>				<b>26.83</b>	<b>37.27%</b>			
K	27.73	0.00	55.00	32.00	0.00	0.00	0.00	47.42	114.73	41.33%	B	0.23	0.50
					<b>Pond 7</b>				<b>114.73</b>	<b>41.33%</b>			
L	6.89	0.00	9.00	0.00	0.00	0.00	0.00	5.64	15.89	35.49%	B	0.22	0.50
					<b>Pond 8</b>				<b>15.89</b>	<b>35.49%</b>			
S	4.46	0	0	17.21	0.00	0.00	0.00	8.19	21.67	37.80%	B	0.20	0.45
R	10.94	0.00	0.00	38.54	0.00	6.68	0.00	19.77	56.16	35.21%	B	0.20	0.44
					<b>Pond 9</b>				<b>77.83</b>	<b>35.21%</b>			
H	18.91	0.00	3.05	0.00	0.00	0.00	0.00	3.57	21.96	16.25%	B	0.15	0.42
					<b>Pond 10</b>				<b>21.96</b>	<b>16.25%</b>			
B2	12.24	0.00	0.00	7.75	0.00	4.05	0.00	5.52	24.04	22.97%	B	0.17	0.42
B1	6.82	0.00	0.00	7.83	0.00	7.41	0.00	5.69	22.06	25.78%	B	0.18	0.73
					<b>Pond 11</b>				<b>46.10</b>	<b>24.31%</b>			
J	28.07	0.00	0.00	0.00	0.00	0.00	0.00	2.81	28.07	10.00%	B	0.12	0.39
I	20.19	0.00	0.00	0.00	8.80	0.00	0.00	8.62	28.99	29.73%	B	0.33	0.54
					<b>Pond 12</b>				<b>57.06</b>	<b>20.02%</b>			
EE2	0.00	0.00	0.00	0.00	16.36	0.00	0.00	12.27	16.36	75.00%	B	0.81	0.88
EE3	0.00	0.00	6.67	0.00	0.00	0.00	0.00	3.67	6.67	55.00%	B	0.33	0.58
					<b>Pond 13</b>				<b>23.03</b>	<b>69.21%</b>			
DD	0.00	0.00	0.00	0.00	0.00	0.00	23.13	2.31	23.13	10.00%	B	0.16	0.40
II3	0.00	0.00	0.00	0.00	0.00	0.00	23.97	2.40	23.97	10.00%	B	0.16	0.40
II2	0.00	0.00	0.00	0.00	0.00	0.00	50.43	5.04	50.43	10.00%	B	0.16	0.40
					<b>Pond 14</b>				<b>97.53</b>	<b>10.00%</b>			
D	0.47	0.00	0.00	36.88	0.00	3.52	0.00	17.35	40.87	42.44%	B	0.22	0.46
					<b>Pond 15</b>				<b>40.87</b>	<b>42.44%</b>			
E	102.50	0.00	0.00	0.00	4.03	0.00	0.00	13.27	106.53	12.46%	B	0.15	0.41
G	31.45	0.00	0.00	4.04	0.00	0.00	0.00	4.96	35.49	13.98%	B	0.13	0.40
					<b>Irrigation Pond</b>				<b>142.02</b>	<b>12.84%</b>			
JJ	1.50	0.00	0.00	5.83	0.00	1.57	0.00	3.09	8.90	34.69%	B	0.12	0.27
LL	4.15	0.00	0.00	2.05	0.00	0.00	0.00	1.34	6.20	21.57%	B	0.15	0.41
KK	0.00	0.00	0.00	0.00	0.00	0.00	8.4	3.36	8.40	40.00%	B	0.16	0.4
					<b>Natural Drainageway</b>				<b>14.60</b>	<b>32.17%</b>			
AA	0.00	0.00	0.00	0.00	0.00	0.00	33.88	3.39	33.88	10.00%	B	0.16	0.4
BB	0.00	0.00	0.00	0.00	0.00	0.00	37.15	3.72	37.15	10.00%	B	0.16	0.4
CC	0.00	0.00	0.00	0.00	0.00	0.00	6.33	0.63	6.33	10.00%	B	0.16	0.4
DD	0.00	0.00	0.00	0.00	0.00	0.00	69.5	6.95	69.50	10.00%	B	0.16	0.4
FF	0.00	0.00	0.00	0.00	0.00	0.00	18.1	1.81	18.10	10.00%	B	0.16	0.4
GG	0.00	0.00	0.00	0.00	0.00	0.00	16.35	1.64	16.35	10.00%	B	0.16	0.4
HH	0.00	0.00	0.00	0.00	0.00	0.00	12.7	1.27	12.70	10.00%	B	0.16	0.4
					<b>Existing Ponds</b>				<b>29.05</b>	<b>10.00%</b>			

\*2% imperviousness for all offsite basins (A,C,F,Q and T), 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)**

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		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	1.02	161,488	40.0	28	161,156	0.64
2	X	0.156	0.249	50.8	11.22	26.4	7.93	18.7	176	692,894	1.02	703,763	55.0	101	703,790	0.53
3	O	0.156	0.108	34.9	4.39	18.2	3.10	7.3	33	89,879	1.02	91,289	40.0	16	91,090	0.66
4	N	0.156	0.147	25.7	4.39	13.4	3.10	7.3	89	177,870	1.02	180,660	35.0	41	180,199	0.84
5	W	0.156	0.046	33.7	2.70	17.5	1.90	4.5	5	13,649	1.02	13,863	35.0	2	13,661	0.66
6	M	0.156	0.083	40.0	4.05	20.8	2.86	6.7	16	50,348	1.02	51,138	40.0	8	50,999	0.60
7	V	0.156	0.132	45.0	6.05	23.4	4.27	10.1	40	140,009	1.02	142,205	45.0	22	142,148	0.56
8	U	0.156	0.055	44.5	3.37	23.2	2.38	5.6	6	19,892	1.02	20,204	45.0	3	20,132	0.55
9	L	0.156	0.090	32.6	3.74	17.0	2.64	6.2	24	59,496	1.02	60,429	40.0	11	60,161	0.69
10	K	0.156	0.196	32.6	6.40	17.0	4.52	10.7	134	338,098	1.02	343,401	40.0	67	343,560	0.72
11	S	0.156	0.107	28.6	3.85	14.9	2.72	6.4	40	88,427	1.02	89,814	35.0	19	89,504	0.77
12	R	0.156	0.154	42.5	6.54	22.1	4.62	10.9	61	199,577	1.02	202,708	45.0	32	202,743	0.59
13	G	0.156	0.151	29.3	4.89	15.2	3.46	8.2	83	189,450	1.02	192,421	35.0	39	191,676	0.75
14	D	0.156	0.132	41.6	5.71	21.6	4.04	9.5	44	140,989	1.02	143,201	45.0	23	143,126	0.59
15	B	0.156	0.160	40.3	6.46	20.9	4.56	10.8	70	216,856	1.02	220,258	45.0	36	220,315	0.61
16	E	0.156	0.221	50.4	10.04	26.2	7.10	16.7	119	464,132	1.02	471,412	50.0	68	471,206	0.53
17	H	0.156	0.099	35.7	4.22	18.6	2.98	7.0	27	74,887	1.02	76,062	40.0	13	75,882	0.65
18	J	0.156	0.115	42.2	5.22	21.9	3.69	8.7	32	103,346	1.02	104,967	45.0	17	104,791	0.58
19	I	0.156	0.121	28.1	4.11	14.6	2.90	6.8	53	115,906	1.02	117,724	35.0	25	117,324	0.78
20	JJ	0.156	0.067	26.0	2.84	13.5	2.01	4.7	16	31,654	1.02	32,150	35.0	7	31,688	0.81
21	LL	0.156	0.057	25.2	2.61	13.1	1.84	4.4	11	22,143	1.02	22,490	35.0	5	22,014	0.81
22	KK	0.156	0.065	33.9	3.20	17.6	2.26	5.3	11	29,476	1.02	29,938	40.0	5	29,742	0.67
23	EE	0.126	0.142	26.2	4.37	13.6	3.09	7.3	124	252,176	1.03	260,908	35.0	59	260,139	0.85
24	DD	0.126	0.143	41.4	6.04	21.5	4.27	10.1	79	254,318	1.03	263,124	45.0	43	263,159	0.61
25	CC	0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	1.03	23,774	35.0	5	23,375	0.75
26	AA	0.126	0.102	26.1	3.55	13.6	2.51	5.9	60	121,569	1.03	125,778	35.0	28	125,228	0.84
27	BB	0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	1.03	139,524	35.0	30	139,038	0.79
28	FF	0.156	0.092	26.9	3.41	14.0	2.41	5.7	31	63,961	1.02	64,964	35.0	14	64,618	0.80
29	II	0.156	0.200	40.7	7.75	21.2	5.48	12.9	112	354,034	1.02	359,587	45.0	60	359,368	0.61
30	HH	0.156	0.080	29.6	3.31	15.4	2.34	5.5	20	45,774	1.02	46,492	35.0	9	46,220	0.74
31	GG	0.156	0.089	34.8	3.89	18.1	2.75	6.5	22	59,351	1.02	60,281	40.0	11	60,129	0.66
(OS1) 32	A	0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	1.02	70,015	35.0	15	69,651	0.79
(OS2) 33	C	0.156	0.126	32.9	4.68	17.1	3.31	7.8	50	126,578	1.02	128,564	40.0	24	128,222	0.69
(OS3) 34	F	0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	1.02	93,095	40.0	18	92,780	0.69
(OS4) 35	Q	0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	1.02	266,529	40.0	47	266,432	0.65
(OS5) 36	T	0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	1.02	19,320	40.0	3	19,232	0.56

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	(CS) 32	(CS) 33	(CS) 34	(CS) 35	(CS) 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		
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
15	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.10	0.02	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
20	0.20	0.25	0.14	0.39	0.03	0.07	0.13	0.03	0.11	0.41	0.19	0.18	0.33	0.15	0.21	0.20	0.12	0.12	0.24	0.08	0.06	0.06	0.27	0.15	0.25	1.46	1.44	0.15	0.27	0.10	0.10	0.16	0.20	0.16	0.28	
25	11.30	14.47	8.24	22.16	1.50	4.24	7.58	1.63	6.43	23.71	10.72	10.48	19.05	8.76	12.20	11.52	6.89	6.85	13.78	4.52	3.25	3.21	33.46	16.63	3.07	17.91	17.72	8.63	15.67	5.67	5.88	9.08	11.75	9.22	15.95	1.60
30	21.77	43.37	13.91	37.17	2.27	6.93	15.61	2.52	10.10	50.94	17.02	22.86	34.06	17.29	26.36	32.71	11.43	12.76	22.45	6.73	4.81	4.89	53.92	32.43	4.46	26.71	27.19	13.16	38.34	8.64	9.42	13.97	20.50	15.28	34.57	2.47
35	26.37	70.55	16.02	41.03	2.48	7.95	19.41	2.85	11.26	63.60	18.69	29.00	39.36	21.18	33.27	50.75	13.10	15.37	24.87	7.03	4.96	5.38	59.00	39.70	4.74	28.22	29.52	14.06	52.02	9.36	10.63	15.02	23.77	17.36	43.56	2.78
40	27.87	87.60	16.46	39.92	2.48	8.32	21.06	3.00	11.29	66.68	18.38	31.57	39.03	22.73	35.98	60.63	13.48	16.42	24.43	6.84	4.83	5.41	57.27	42.46	4.66	27.34	28.88	13.73	57.99	9.23	10.84	14.68	24.22	17.53	46.69	2.92
45	27.44	96.63	16.12	37.84	2.43	8.21	21.57	3.01	11.02	64.88	17.70	32.20	37.77	22.91	36.30	65.61	13.22	16.53	23.47	6.51	4.58	5.30	54.28	42.70	4.50	25.90	27.68	13.11	59.52	8.92	10.61	14.05	23.62	17.09	46.23	2.91
50	27.03	100.81	15.81	35.89	2.39	8.15	21.36	3.00	10.77	62.93	16.98	31.76	36.38	22.62	35.72	67.68	13.00	16.36	22.46	6.22	4.38	5.20	51.40	42.01	4.34	24.63	26.48	12.51	58.43	8.61	10.42	13.41	23.02	16.68	45.36	2.90
55	26.43	100.91	15.29	34.10	2.30	8.00	21.12	2.96	10.31	60.45	16.23	31.29	34.72	22.26	35.07	67.12	12.60	16.11	21.45	5.92	4.15	5.00	48.80	41.22	4.15	23.37	25.25	11.93	57.36	8.24	10.07	12.80	22.10	15.97	44.28	2.87
60	25.59	99.29	14.79	32.39	2.23	7.81	20.85	2.92	10.00	58.14	15.61	30.71	33.41	21.80	34.22	66.28	12.20	15.81	20.60	5.63	3.94	4.86	46.38	40.26	4.00	22.20	24.22	11.42	56.08	7.95	9.75	12.27	21.37	15.47	42.81	2.82
65	24.99	98.18	14.46	30.61	2.18	7.65	20.50	2.87	9.75	56.47	15.00	30.02	32.19	21.26	33.29	65.64	11.93	15.44	19.75	5.34	3.71	4.75	43.86	39.19	3.85	20.99	23.20	10.88	54.52	7.68	9.54	11.72	20.82	15.07	41.71	2.77
70	24.57	97.14	14.16	28.72	2.13	7.55	20.14	2.84	9.50	54.90	14.36	29.51	30.92	20.95	32.76	64.93	11.71	15.23	18.85	5.02	3.47	4.44	41.26	38.53	3.70	19.73	22.12	10.31	53.51	7.38	9.34	11.14	20.28	14.68	40.94	2.74
75	23.95	95.55	13.68	26.97	2.05	7.38	19.81	2.79	9.08	52.77	13.42	29.00	29.14	20.57	32.14	63.80	11.33	14.95	17.58	4.71	3.27	4.46	38.56	37.77	3.48	18.46	20.64	9.61	52.53	6.94	9.01	10.35	19.46	14.05	39.91	2.69
80	23.04	93.48	13.02	25.44	1.94	7.13	19.37	2.72	8.54	49.84	12.55	28.25	27.10	19.99	31.17	62.50	10.82	14.54	16.48	4.44	3.09	4.22	36.31	36.66	3.23	17.39	19.30	9.05	51.09	6.46	8.56	9.75	18.36	13.23	38.39	2.62
85	22.02	91.64	12.31	24.10	1.82	6.87	18.86	2.65	8.00	46.56	11.94	27.38	25.68	19.33	30.05	61.27	10.27	14.08	15.68	4.22	2.93	3.97	34.42	35.39	3.07	16.50	18.34	8.61	49.33	6.14	8.09	9.28	17.18	12.37	36.64	2.54
90	20.95	89.83	11.62	22.91	1.73	6.59	18.33	2.57	7.65	44.25	11.44	26.46	24.62	18.64	28.86	60.02	9.70	13.60	15.01	4.02	2.78	3.78	32.74	34.05	2.95	15.70	17.57	8.23	47.44	5.90	7.65	8.88	16.38	11.82	34.80	2.46
95	19.88	87.92	11.19	21.80	1.68	6.31	17.78	2.49	7.41	42.67	11.01	25.51	23.71	17.93	27.65	58.72	9.31	13.10	14.42	3.84	2.65	3.65	31.18	32.69	2.84	14.96	16.87	7.88	45.49	5.69	7.37	8.51	15.83	11.44	33.01	2.38
100	18.90	85.54	10.64	20.09	1.59	5.93	17.01	2.36	7.01	40.68	10.28	24.24	22.30	16.95	26.06	57.05	8.85	12.40	13.45	3.53	2.42	3.46	28.80	30.89	2.66	13.76	15.73	7.29	43.05	5.33	7.00	7.90	15.03	10.84	31.44	2.25
105	17.98	82.50	10.10	18.30	1.50	5.63	16.09	2.23	6.62	38.39	9.56	22.74	20.79	15.97	24.67	54.92	8.41	11.66	12.47	3.22	2.19	3.28	26.31	29.10	2.49	12.57	14.59	6.71	40.65	4.98	6.65	7.29	14.20	10.23	29.91	2.12
110	17.16	79.07	9.60	16.58	1.43	5.39	15.17	2.12	6.25	36.18	8.87	21.65	19.35	15.23	23.56	52.55	8.00	11.12	11.53	2.93	1.98	3.11	23.93	27.75	2.32	11.43	13.51	6.16	38.73	4.65	6.32	6.71	13.41	9.66	28.50	2.02
115	16.39	75.47	9.13	14.98	1.36	5.17	14.52	2.03	5.91	34.11	8.22	20.78	18.01	14.63	22.58	50.10	7.63	10.69	10.66	2.66	1.78	2.95	21.70	26.62	2.17	10.37	12.49	5.64	37.10	4.34	6.01	6.17	12.68	9.13	27.19	1.94
120	15.61	71.68	8.63	13.56	1.27	4.94	13.94	1.95	5.54	32.00	7.52	19.93	16.58	14.01	21.61	47.52	7.23	10.25	9.71	2.40	1.63	2.78	19.45	25.49	1.99	9.30	11.39	5.08	35.51	3.99	5.67	5.57	11.90	8.56	25.87	1.87
125	14.22	67.41	7.69	11.40	1.12	4.50	13.00	1.79	4.83	28.59	6.26	18.55	14.14	12.95	19.99	44.73	6.46	9.45	8.05	1.97	1.34	2.44	16.31	23.59	1.68	7.71	9.45	4.17	33.11	3.36	5.03	4.56	10.50	7.50	23.69	1.71
130	12.63	62.82	6.71	9.30	0.96	4.04	11.88	1.63	4.13	24.48	5.07	16.84	11.50	11.71	18.00	41.60	5.67	8.56	6.55	1.62	1.09	2.11	13.36	21.32	1.37	6.31	7.66	3.41	30.00	2.74	4.39	3.73	9.01	6.41	21.01	1.55
135	11.11	58.01	5.79	7.53	0.82	3.60	10.79	1.48	3.47	20.52	4.15	15.18	9.34	10.51	16.07	38.31	4.92	7.71	5.36	1.32	0.89	1.80	10.86	19.13	1.11	5.14	6.27	2.80	26.84	2.23	3.78	3.06	7.59	5.38	18.42	1.41
140	9.69	53.25	4.94	6.10	0.69	3.20	9.77	1.34	2.87	16.85	3.43	13.62	7.72	9.40	14.26	35.13	4.24	6.91	4.42	1.07	0.72	1.52	8.84	17.08	0.92	4.19	5.18	2.29	23.85	1.84	3.22	2.51	6.29	4.44	16.00	1.27
145	8.41	48.71	4.16	4.93	0.57	2.83	8.83	1.22	2.33	13.70	2.83	12.17	6.38	8.37	12.60	32.12	3.61	6.18	3.64	0.87	0.58	1.26	7.18	15.20	0.76	3.40	4.27	1.87	21.09	1.53	2.71	2.06	5.10	3.61	13.82	1.14
150	7.21	44.49	3.43	3.97	0.47	2.49	7.97	1.10	1.93	11.34	2.33	10.86	5.28	7.43	11.09	29.34	3.02	5.51	2.99	0.70	0.47	1.03	5.81	13.46	0.64	2.75	3.52	1.53	18.60	1.27	2.23					

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	(OS) 32	(OS) 33	(OS) 34	(OS) 35	(OS) 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						3.67								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)**

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		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	2.50	398,018	45.0	81	397,199	1.85
2	X	0.156	0.249	50.8	11.22	26.4	7.93	18.7	176	692,894	2.50	1,734,560	55.0	295	1,734,627	1.54
3	O	0.156	0.108	34.9	4.39	18.2	3.10	7.3	33	89,879	2.50	224,998	45.0	48	224,509	1.93
4	N	0.156	0.147	25.7	4.39	13.4	3.10	7.3	89	177,870	2.50	445,271	40.0	118	444,136	2.40
5	W	0.156	0.046	33.7	2.70	17.5	1.90	4.5	5	13,649	2.50	34,168	45.0	7	33,670	1.92
6	M	0.156	0.083	40.0	4.05	20.8	2.86	6.7	16	50,348	2.50	126,039	45.0	24	125,697	1.75
7	V	0.156	0.132	45.0	6.05	23.4	4.27	10.1	40	140,009	2.50	350,492	50.0	63	350,351	1.63
8	U	0.156	0.055	44.5	3.37	23.2	2.38	5.6	6	19,892	2.50	49,798	50.0	9	49,620	1.61
9	L	0.156	0.090	32.6	3.74	17.0	2.64	6.2	24	59,496	2.50	148,939	45.0	33	148,279	2.00
10	K	0.156	0.196	32.6	6.40	17.0	4.52	10.7	134	338,098	2.50	846,379	45.0	193	846,771	2.07
11	S	0.156	0.107	28.6	3.85	14.9	2.72	6.4	40	88,427	2.50	221,364	40.0	54	220,600	2.21
12	R	0.156	0.154	42.5	6.54	22.1	4.62	10.9	61	199,577	2.50	499,613	50.0	94	499,700	1.71
13	G	0.156	0.151	29.3	4.89	15.2	3.46	8.2	83	189,450	2.50	474,260	40.0	114	472,424	2.18
14	D	0.156	0.132	41.6	5.71	21.6	4.04	9.5	44	140,989	2.50	352,946	50.0	67	352,762	1.72
15	B	0.156	0.160	40.3	6.46	20.9	4.56	10.8	70	216,856	2.50	542,868	50.0	106	543,010	1.77
16	E	0.156	0.221	50.4	10.04	26.2	7.10	16.7	119	464,132	2.50	1,161,886	55.0	197	1,161,378	1.54
17	H	0.156	0.099	35.7	4.22	18.6	2.98	7.0	27	74,887	2.50	187,468	45.0	39	187,025	1.90
18	J	0.156	0.115	42.2	5.22	21.9	3.69	8.7	32	103,346	2.50	258,712	50.0	48	258,277	1.70
19	I	0.156	0.121	28.1	4.11	14.6	2.90	6.8	53	115,906	2.50	290,153	40.0	72	289,167	2.24
20	JJ	0.156	0.067	26.0	2.84	13.5	2.01	4.7	16	31,654	2.50	79,240	40.0	20	78,102	2.32
21	LL	0.156	0.057	25.2	2.61	13.1	1.84	4.4	11	22,143	2.50	55,432	40.0	14	54,258	2.34
22	KK	0.156	0.065	33.9	3.20	17.6	2.26	5.3	11	29,476	2.50	73,788	45.0	16	73,305	1.94
23	EE	0.126	0.142	26.2	4.37	13.6	3.09	7.3	124	252,176	2.52	634,578	40.0	165	632,707	2.38
24	DD	0.126	0.143	41.4	6.04	21.5	4.27	10.1	79	254,318	2.52	639,967	50.0	122	640,051	1.74
25	CC	0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	2.52	57,822	40.0	13	56,853	2.11
26	AA	0.126	0.102	26.1	3.55	13.6	2.51	5.9	60	121,569	2.52	305,916	40.0	79	304,578	2.36
27	BB	0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	2.52	339,349	40.0	83	338,166	2.23
28	FF	0.156	0.092	26.9	3.41	14.0	2.41	5.7	31	63,961	2.50	160,116	40.0	40	159,263	2.30
29	II	0.156	0.200	40.7	7.75	21.2	5.48	12.9	112	354,034	2.50	886,272	50.0	173	885,731	1.78
30	HH	0.156	0.080	29.6	3.31	15.4	2.34	5.5	20	45,774	2.50	114,589	40.0	27	113,917	2.14
31	GG	0.156	0.089	34.8	3.89	18.1	2.75	6.5	22	59,351	2.50	148,575	45.0	32	148,198	1.93
(OS1) 32	A	0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	2.50	172,565	40.0	43	171,667	2.28
(OS2) 33	C	0.156	0.126	32.9	4.68	17.1	3.31	7.8	50	126,578	2.50	316,870	45.0	70	316,027	2.02
(OS3) 34	F	0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	2.50	229,451	45.0	51	228,673	2.02
(OS4) 35	Q	0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	2.50	656,912	45.0	136	656,674	1.88
(OS5) 36	T	0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	2.50	47,617	45.0	9	47,400	1.63

[illegible]

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	(OS) 32	(OS) 33	(OS) 34	(OS) 35	(OS) 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						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						3.67					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)**

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		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	0.096	0.132	27.1	4.25	14.1	3.00	7.1	76	158,667	1.09	173,291	35.0	39	172,655	0.90
C2	X1	0.096	0.170	27.9	5.15	14.5	3.64	8.6	128	277,259	1.09	303,010	35.0	68	301,941	0.89
C3	O	0.091	0.167	19.1	3.96	10.0	2.80	6.6	129	190,648	1.12	212,900	30.0	63	211,812	1.19
C4	X2	0.097	0.119	29.1	4.16	15.1	2.94	6.9	59	131,878	1.09	143,717	35.0	31	143,225	0.85
C5	X3	0.106	0.127	43.1	5.70	22.4	4.03	9.5	67	225,024	1.07	239,833	45.0	38	239,711	0.62
C6	N	0.093	0.143	11.7	2.78	6.1	1.96	4.6	167	150,899	1.11	167,047	30.0	65	161,116	1.57
C7	V2	0.126	0.072	30.9	3.21	16.1	2.27	5.4	23	55,684	1.03	57,612	35.0	11	57,212	0.74
C8	U	0.126	0.047	39.1	2.90	20.3	2.05	4.8	7	21,272	1.03	22,008	40.0	4	21,814	0.62
C9	M	0.094	0.111	14.3	2.72	7.4	1.92	4.5	88	97,393	1.10	107,054	30.0	37	103,094	1.37
C10	V1	0.094	0.077	26.8	3.09	14.0	2.19	5.2	20	41,999	1.10	46,248	35.0	10	45,837	0.90
C11	L	0.095	0.085	24.2	3.09	12.6	2.18	5.1	31	57,681	1.09	63,159	35.0	15	62,463	0.95
C12	K	0.093	0.228	15.5	4.22	8.1	2.98	7.0	346	416,470	1.11	461,786	30.0	159	460,561	1.39
C13	R	0.096	0.147	24.3	4.24	12.6	3.00	7.1	108	203,861	1.09	222,544	35.0	55	221,915	0.97
C14	H	0.116	0.081	40.4	4.02	21.0	2.84	6.7	25	79,715	1.05	83,655	40.0	14	83,402	0.63
C15	J	0.126	0.095	38.9	4.33	20.2	3.06	7.2	34	101,894	1.03	105,422	40.0	18	105,171	0.63
C16	I	0.100	0.101	25.0	3.43	13.0	2.43	5.7	54	105,234	1.08	113,794	35.0	27	113,053	0.93
C17	E	0.122	0.169	54.7	8.59	28.4	6.07	14.3	91	386,704	1.04	402,347	50.0	54	402,102	0.51
C18	G	0.119	0.097	38.9	4.38	20.2	3.10	7.3	38	114,164	1.04	119,193	40.0	20	118,908	0.64
C19	D	0.092	0.145	18.2	3.54	9.5	2.50	5.9	105	148,358	1.11	164,891	30.0	50	163,739	1.23
C20	B2	0.107	0.076	39.0	3.78	20.3	2.67	6.3	24	72,564	1.07	77,305	40.0	13	77,096	0.66
C21	B1	0.104	0.128	33.6	4.80	17.5	3.39	8.0	83	216,856	1.07	232,468	40.0	44	232,038	0.74
C22	W	0.126	0.038	32.9	2.47	17.1	1.74	4.1	5	13,649	1.03	14,121	35.0	3	13,854	0.69
C23	S	0.096	0.096	25.3	3.36	13.1	2.37	5.6	40	78,662	1.09	85,871	35.0	20	85,293	0.93
B1	JJ	0.096	0.065	16.2	2.30	8.4	1.63	3.8	26	32,307	1.09	35,308	30.0	11	33,851	1.24
B2	LL	0.108	0.045	22.4	2.27	11.6	1.61	3.8	13	22,506	1.06	23,898	30.0	6	23,143	0.94
B3	KK	0.126	0.055	32.6	2.87	16.9	2.03	4.8	12	30,492	1.03	31,548	35.0	6	31,162	0.70
B4	EE1	0.126	0.124	30.2	4.37	15.7	3.09	7.3	79	184,658	1.03	191,052	35.0	39	190,222	0.76
B5	DD	0.126	0.142	41.6	6.04	21.6	4.27	10.1	78	252,285	1.03	261,021	45.0	42	261,061	0.61
B6	II3	0.126	0.088	25.0	3.19	13.0	2.25	5.3	45	87,011	1.03	90,024	35.0	21	89,196	0.86
B7	II2	0.126	0.087	23.9	3.09	12.4	2.18	5.1	45	83,962	1.03	86,869	35.0	20	85,839	0.88
B8	II1	0.126	0.123	53.3	6.54	27.7	4.62	10.9	44	183,061	1.03	189,400	50.0	26	189,444	0.51
B9	CC	0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	1.03	23,774	35.0	5	23,375	0.75
B10	AA	0.126	0.103	26.0	3.55	13.5	2.51	5.9	61	122,694	1.03	126,943	35.0	29	126,392	0.85
B11	BB	0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	1.03	139,524	35.0	30	139,038	0.79
B12	FF	0.126	0.078	26.0	3.05	13.5	2.15	5.1	33	65,703	1.03	67,978	35.0	15	67,294	0.84
B13	GG	0.126	0.074	33.9	3.43	17.6	2.43	5.7	23	59,351	1.03	61,406	40.0	11	61,128	0.69
B14	HH	0.126	0.066	28.7	2.96	14.9	2.09	4.9	21	46,101	1.03	47,697	35.0	10	47,179	0.78
B15	EE2	0.078	0.121	11.6	2.58	6.0	1.83	4.3	66	59,387	1.19	70,583	30.0	28	67,589	1.70
B16	EE3	0.086	0.073	19.8	2.61	10.3	1.84	4.3	16	24,212	1.14	27,630	30.0	8	26,925	1.18
OS1	A	0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	1.02	70,015	35.0	15	69,651	0.79
OS2	C	0.156	0.128	32.3	4.68	16.8	3.31	7.8	53	132,096	1.02	134,168	40.0	26	133,785	0.70
OS3	F	0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	1.02	93,095	40.0	18	92,780	0.69
OS4	Q	0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	1.02	266,529	40.0	47	266,432	0.65
OS5	T	0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	1.02	19,320	40.0	3	19,232	0.56

## Printouts for Unit Hydrographs

flow in cfs

time in minutes	new iras																		
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
5	66.46	97.21	118.11	52.19	46.73	166.68	23.13	7.03	88.02	20.18	30.71	305.93	95.42	23.20	29.37	53.14	37.80	32.68	101.62
10	74.22	127.80	121.32	57.62	67.47	114.23	22.61	6.89	66.35	19.35	29.08	316.79	105.87	25.26	33.58	52.12	79.78	37.69	95.93
15	65.92	117.16	91.46	52.14	65.97	76.25	20.42	6.49	48.01	16.67	23.87	219.67	90.02	24.14	32.06	43.89	91.32	36.01	71.55
20	53.73	94.78	71.44	42.90	61.96	51.72	17.10	5.82	35.89	13.86	19.88	160.34	72.71	22.06	29.12	36.19	89.86	32.71	54.55
25	45.72	81.27	56.96	37.16	55.46	31.33	15.00	5.09	25.44	11.75	16.29	121.80	59.70	19.06	25.06	30.01	86.13	28.13	43.94
30	37.73	67.77	45.55	31.41	48.71	23.15	12.91	4.60	16.75	9.83	13.81	83.25	49.86	17.31	22.63	25.21	80.11	25.40	34.21
35	33.07	58.47	34.15	27.17	44.27	14.98	11.15	4.11	13.27	8.58	11.70	61.05	42.36	15.56	20.21	21.60	71.80	22.67	24.47
40	28.41	50.71	24.73	23.81	39.83	6.80	9.91	3.61	9.79	7.34	9.59	48.20	34.85	13.82	17.78	17.98	65.30	19.94	18.91
45	23.75	42.95	20.93	20.45	35.39	0.00	8.66	3.28	6.30	6.09	7.49	35.35	27.34	12.34	15.99	14.36	60.49	17.93	15.67
50	19.08	35.19	17.12	17.10	32.10		7.42	2.99	2.82	4.85	5.89	22.50	21.06	11.30	14.55	10.83	55.68	16.31	12.42
55	14.88	27.42	13.32	13.74	29.50		6.18	2.69	0.00	3.89	5.19	9.65	18.56	10.26	13.11	9.62	50.87	14.70	9.18
60	13.32	23.67	9.52	11.27	26.89		4.94	2.40		3.48	4.49	0.00	16.06	9.22	11.68	8.41	46.05	13.09	5.93
65	11.77	21.08	5.72	10.15	24.29			4.33	2.10		3.06	3.78		13.56	8.19	10.24	7.21	43.10	2.69
70	10.22	18.49	1.92	9.03	21.68		3.92	1.81		2.65	3.08		11.05	7.15	8.81	6.00	40.30	9.86	0.00
75	8.66	15.90	0.00	7.91	19.07		3.51	1.51		2.23	2.38		8.55	6.11	7.37	4.79	37.50	8.25	
80	7.11	13.32		6.79	16.47		3.09	1.34		1.82	1.68		6.05	5.09	6.49	3.59	34.70	7.27	
85	5.56	10.73		5.67	13.86		2.68	1.25		1.40	0.98		3.55	4.74	6.01	2.38	31.91	6.73	
90	4.00	8.14		4.55	12.75		2.26	1.15		0.99	0.27		1.05	4.39	5.53	1.18	29.11	6.19	
95	2.45	5.55		3.43	11.88		1.85	1.05		0.57	0.00		0.00	4.05	5.05	0.00	26.31	5.65	
100	0.90	2.96		2.32	11.01		1.44	0.95		0.16				3.70	4.57		23.52	5.12	
105	0.00	0.38		1.20	10.14		1.02	0.85		0.00				3.36	4.09		20.72	4.58	
110		0.00		0.08	9.28		0.61	0.75						3.01	3.62		18.15	4.04	
115																			

C20	C21	C22	C23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
22.62	67.08	5.35	39.56	25.60	12.95	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
23.79	82.94	5.16	38.52	20.47	11.75	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
22.58	78.21	4.68	32.54	15.36	9.37	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
20.41	68.21	3.97	26.87	11.68	7.75	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
17.66	58.38	3.53	22.36	9.02	6.28	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
15.95	51.30	3.08	18.78	6.36	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
14.24	44.22	2.65	16.14	4.67	4.37	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
12.53	39.03	2.39	13.49	3.79	3.41	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
11.31	34.89	2.12	10.84	2.90	2.55	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
10.29	30.75	1.85	8.20	2.02	2.23	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
9.28	26.61	1.59	7.21	1.13	1.91	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
8.26	22.47	1.32	6.33	0.24	1.59	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
7.24	18.33	1.07	5.45	0.00	1.27	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
6.23	15.85	0.98	4.56		0.95	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
5.21	14.47	0.89	3.68		0.63	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
4.60	13.09	0.80	2.80		0.31	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
4.27	11.71	0.71	1.92		0.00	1.57	8.59	15.25	1.94	1.18	14.62	1.03	3.56	5.46	1.88	3.21	1.91		
3.93	10.33	0.62	1.04			1.37	7.14	14.20	0.94	0.12	13.24	0.84	2.26	4.27	1.18	2.84	1.52		
3.59	8.95	0.53	0.15			1.17	5.68	13.15	0.00	0.00	11.86	0.66	0.97	3.07	0.49	2.47	1.12		
3.25	7.57	0.44	0.00			0.96	4.23	12.10			10.48	0.48	0.00	1.87	0.00	2.11	0.72		
2.91	6.19	0.36				0.76	2.77	11.06			9.09	0.29		0.68		1.74	0.33		
2.57	4.81	0.27				0.55	1.32	10.01			8.49	0.11							

[illegible]

### 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
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
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	1.45	2.16	4.04	1.07	0.47	5.04	0.04	0.01	2.27	0.54	0.72	9.48	2.06	0.11	0.05	0.87	0.11	0.12	3.25	0.22	0.83	0.01	0.85	0.57	0.11	0.02	0.13	0.09	0.08
20	6.12	9.46	13.96	4.64	3.01	16.13	0.58	0.18	8.02	1.99	2.81	33.48	8.71	0.98	0.75	4.09	1.32	1.18	11.13	1.36	4.68	0.13	3.50	2.20	0.71	0.30	1.73	1.33	1.12
25	25.41	39.02	46.91	17.77	17.33	58.54	7.13	2.17	31.09	7.61	11.33	118.59	36.27	7.64	9.17	19.03	13.29	10.62	38.89	7.84	24.58	1.65	14.58	9.03	4.32	3.72	21.31	16.44	13.78
30	36.98	61.41	62.67	28.76	30.31	65.41	10.51	3.21	36.75	10.19	15.11	159.05	52.43	11.76	14.88	26.28	31.39	17.03	50.30	11.57	39.04	2.41	19.82	11.06	5.85	5.47	34.51	32.05	20.00
35	39.34	67.88	60.50	30.87	36.02	55.43	11.32	3.54	33.07	10.41	15.11	148.04	54.59	13.27	17.06	26.84	43.72	19.46	47.70	12.83	44.07	2.60	20.17	10.26	5.78	5.91	38.60	39.24	20.65
40	37.85	65.77	54.95	29.97	38.12	45.87	11.17	3.63	28.91	9.98	14.35	128.64	51.79	13.74	17.72	25.62	49.85	20.16	42.83	13.13	44.45	2.58	19.24	9.16	5.47	5.85	38.12	41.99	19.92
45	35.70	62.34	49.54	28.57	38.24	37.18	10.82	3.57	24.72	9.41	13.35	111.78	48.11	13.51	17.42	23.96	52.98	19.80	38.46	12.85	42.99	2.52	18.00	8.09	5.08	5.71	36.86	42.26	18.76
50	33.66	58.95	45.03	27.23	37.57	32.06	10.48	3.53	21.33	8.90	12.59	97.11	45.13	13.35	17.20	22.63	54.35	19.51	34.75	12.64	41.61	2.46	16.99	7.14	4.79	5.57	35.57	41.58	17.84
55	31.83	55.72	40.13	25.81	36.82	27.04	10.01	3.45	18.74	8.40	11.76	84.93	42.16	13.07	16.80	21.24	54.16	19.04	30.65	12.30	39.82	2.36	15.95	6.27	4.44	5.33	33.92	40.81	16.86
60	30.16	52.87	35.89	24.63	35.97	22.71	9.67	3.35	16.79	7.94	10.93	76.40	39.22	12.73	16.32	19.90	53.54	18.47	27.63	11.91	38.29	2.29	14.94	5.71	4.08	5.16	32.66	39.87	15.90
65	28.45	50.05	33.32	23.49	35.07	19.33	9.36	3.29	14.99	7.47	10.13	69.48	36.32	12.42	15.95	18.54	53.16	18.04	25.68	11.63	37.11	2.23	13.93	5.26	3.76	5.02	31.51	38.83	14.91
70	26.75	47.22	31.40	22.32	34.39	17.92	9.04	3.24	13.30	7.01	9.48	62.92	33.85	12.23	15.69	17.26	52.80	17.73	24.08	11.42	35.99	2.17	12.97	4.83	3.57	4.88	30.32	38.17	13.92
75	24.82	43.90	28.89	20.84	33.67	16.47	8.54	3.15	11.41	6.52	8.91	54.93	31.86	11.93	15.29	16.24	52.10	17.26	21.91	11.09	34.42	2.07	12.18	4.26	3.37	4.65	28.61	37.42	13.13
80	23.30	41.05	25.92	19.38	32.69	14.98	7.95	3.03	10.16	6.12	8.35	47.18	29.89	11.51	14.72	15.27	50.92	16.60	19.40	10.64	32.41	1.94	11.45	3.65	3.14	4.36	26.53	36.33	12.38
85	22.07	38.83	23.10	18.35	31.61	14.03	7.51	2.91	9.44	5.80	7.84	42.82	28.02	11.07	14.11	14.40	49.91	15.90	17.10	10.18	30.36	1.82	10.80	3.26	2.92	4.09	25.10	35.08	11.71
90	20.99	36.96	20.63	17.54	30.47	13.40	7.21	2.78	8.96	5.51	7.36	40.40	26.30	10.61	13.48	13.59	49.04	15.17	15.27	9.70	28.77	1.74	10.20	3.06	2.71	3.92	24.09	33.77	11.09
95	19.98	35.27	18.87	16.81	29.31	13.04	6.96	2.65	8.64	5.24	6.90	38.78	24.67	10.15	12.85	12.83	48.18	14.45	14.30	9.23	27.70	1.69	9.63	2.93	2.52	3.79	23.22	32.44	10.51
100	18.47	32.85	16.97	15.70	27.76	11.42	6.55	2.50	7.71	4.82	6.20	35.18	22.28	9.51	12.11	11.64	46.98	13.63	12.92	8.70	26.28	1.59	8.76	2.63	2.21	3.58	21.85	30.66	9.57
105	16.92	30.23	15.43	14.56	26.06	10.31	6.14	2.37	7.02	4.40	5.52	31.86	19.84	9.02	11.52	10.47	45.43	12.95	11.78	8.27	24.82	1.50	7.89	2.40	1.93	3.38	20.43	28.87	8.65
110	15.42	27.70	14.33	13.47	24.77	9.59	5.76	2.27	6.52	4.01	4.91	29.55	17.63	8.63	11.00	9.37	43.76	12.37	10.95	7.90	23.44	1.42	7.07	2.23	1.76	3.19	19.09	27.52	7.77
115	14.03	25.33	13.50	12.46	23.76	9.14	5.41	2.18	6.16	3.64	4.48	27.85	16.03	8.28	10.54	8.41	42.06	11.85	10.33	7.56	22.15	1.35	6.35	2.11	1.65	3.01	17.84	26.40	6.99
120	12.60	22.87	12.56	11.35	22.77	8.49	5.02	2.08	5.70	3.26	4.13	25.88	14.80	7.92	10.05	7.70	40.24	11.30	9.60	7.20	20.78	1.26	5.79	1.95	1.54	2.82	16.48	25.29	6.40
125	10.44	19.12	9.97	9.51	21.11	5.50	4.28	1.87	4.06	2.67	3.40	19.66	12.39	7.21	9.13	6.39	37.75	10.26	7.45	6.51	18.39	1.10	4.80	1.45	1.24	2.44	14.10	23.41	5.29
130	8.54	15.61	7.54	7.68	19.17	3.46	3.57	1.67	2.82	2.19	2.75	13.80	10.01	6.48	8.16	5.19	34.72	9.16	5.56	5.82	15.83	0.94	3.90	1.05	0.98	2.08	11.63	21.17	4.30
135	6.98	12.77	5.71	6.26	17.32	2.12	2.92	1.49	1.93	1.79	2.21	9.69	8.01	5.79	7.24	4.20	32.00	8.12	4.15	5.16	13.39	0.79	3.16	0.76	0.78	1.75	9.37	19.01	3.48
140	5.72	10.50	4.29	5.18	15.57	1.26	2.38	1.32	1.27	1.47	1.77	6.68	6.42	5.15	6.38	3.39	29.55	7.16	3.08	4.55	11.16	0.66	2.56	0.54	0.62	1.44	7.71	16.99	2.81
145	4.67	8.61	3.17	4.29	13.46	0.73	1.97	1.16	0.82	1.20	1.42	4.44	5.13	4.57	5.61	2.73	27.27	6.28	2.23	3.99	9.14	0.53	2.07	0.37	0.48	1.17	6.40	15.12	2.26
150	3.82	7.06	2.29	3.55	12.47	0.35	1.65	1.01	0.53	0.98	1.12	2.96	4.05	4.02	4.88	2.18	25.15	5.46	1.58	3.47	7.48	0.44	1.65	0.25	0.37	0.98	5.32	13.41	1.80
155	3.08	5.74	1.64	2.92	11.09	0.10	1.37	0.87	0.31	0.79	0.87	1.92	3.15	3.51	4.19	1.71	23.23	4.68	1.11	2.97	6.24	0.37	1.30	0.17	0.28	0.82	4.42	11.81	1.41
160	2.45	4.61	1.17	2.37	9.78	0.00	1.14	0.74	0.15	0.62	0.67	1.10	2.42	3.03	3.55	1.32	21.45	3.96	0.77	2.51	5.24	0.31	1.01	0.10	0.21	0.69	3.63	10.31	1.10
165	1.93	3.65	0.79	1.91	8.56	0.00	0.93	0.61	0.04	0.49	0.52	0.51	1.86	2.57	2.94	1.03	19.77	3.27	0.50	2.08	4.39	0.26	0.79	0.05	0.16	0.57	2.95	8.90	0.85
170	1.52	2.89	0.50	1.53	7.38	0.00	0.76	0.50	0.00	0.39	0.40	0.15	1.42	2.13	2.42	0.80	18.20	2.70	0.29	1.71	3.64	0.21	0.61	0.02	0.12	0.47	2.38	7.55	0.66
175	1.20	2.29	0.28	1.22	6.26	0.00	0.61	0.42	0.00	0.30	0.29	0.00	1.05	1.76	2.04	0.60	16.73	2.27	0.14	1.44	3.00	0.18	0.47	0.00	0.08	0.39	1.92	6.26	0.50
180	0.92	1.79	0.12	0.97	5.20	0.00	0.50	0.36	0.00	0.23	0.21	0.00	0.75	1.47	1.72	0.44	15.35	1.92	0.04	1.22	2.47	0.14	0.34	0.00	0.05	0.32	1.54	5.17	0.36
185	0.69	1.36	0.03	0.76	4.28	0.00	0.40	0.30	0.00	0.17	0.14	0.00	0.51	1.25	1.45	0.30	14.03	1.62	0.00	1.03	2.03	0.12	0.24	0.00	0.03	0.26	1.23	4.35	0.25
190	0.49	0.99	0.00	0.57	3.61	0.00	0.31	0.26	0.00	0.12	0.09	0.00	0.32	1.06	1.23	0.20	12.76	1.37	0.00	0.87	1.65	0.10	0.16	0.00	0.02	0.21	0.95	3.69	0.16
195	0.34	0.69	0.00	0.42	3.07	0.00	0.24	0.22	0.00	0.08	0.05	0.00	0.17	0.90	1.03	0.12	11.54	1.15	0.00	0.73	1.33	0.08	0.10	0.00	0.00	0.16	0.72	3.14	0.10
200	0.21	0.46	0.00	0.29	2.62	0.00	0.18	0.18	0.00	0.05	0.02	0.00	0.07	0.76	0.87	0.06	10.36	0.97	0.00	0.61	1.05	0.06	0.05	0.00	0.00	0.13	0.52	2.67	0.05
205	0.12	0.28	0.00	0.19	2.24	0.00	0.13	0.15	0.00	0.03	0.00	0.00	0.02	0.64	0.72	0.02	9.23	0.80	0.00	0.51	0.80	0.04	0.02	0.00	0.00	0.10	0.36	2.26	0.01
210	0.05	0.14	0.00	0.12	1.90	0.00	0.09	0.12	0.00	0.01	0.00	0.00	0.00	0.53	0.59	0.00	8.14	0.65	0.00	0.42	0.60	0.03	0.00	0.00	0.00	0.07	0.24	1.90	0.00
215	0.01	0.05	0.00	0.06	1.60	0.00	0.05	0.10	0.00	0.00	0.00	0.00	0.00	0.44	0.47	0.00	7.08	0.52	0.00	0.33	0.42	0.02	0.00	0.00	0.00	0.05	0.14	1.57	0.00

B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	C01	C02	C03	C04	C05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.08	0.05	0.02	0.11	0.11	0.06	0.04	0.04	4.24	0.71	0.00	0.00	0.00	0.00	0.00
1.13	0.70	0.25	1.48	1.44	0.82	0.55	0.52	11.67	2.21	0.16	0.22	0.16	0.28	0.03
13.93	8.61	3.07	18.16	17.72	10.05	6.82	6.37	26.60	6.40	9.08	12.50	9.22	15.95	1.60
20.06	17.68	4.46	27.06	27.19	14.56	10.22	9.29	27.82	7.88	13.97	21.80	15.28	34.57	2.47
20.40	22.21	4.74	28.57	29.52	15.14	11.21	9.86	23.05	7.47	15.02	25.23	17.36	43.56	2.78
19.59	24.36	4.66	27.66	28.88	14.66	11.25	9.65	18.75	6.81	14.68	25.59	17.53	46.69	2.92
18.34	25.43	4.50	26.19	27.68	13.89	10.97	9.27	15.09	6.17	14.05	24.92	17.09	46.23	2.91
17.43	25.77	4.34	24.90	26.48	13.23	10.73	8.88	12.80	5.63	13.41	24.26	16.68	45.36	2.90
16.39	25.51	4.15	23.62	25.25	12.55	10.31	8.49	10.57	5.03	12.80	23.22	15.97	44.28	2.87
15.34	25.31	4.00	22.42	24.22	11.92	9.98	8.16	8.73	4.51	12.27	22.46	15.47	42.81	2.82
14.26	25.18	3.85	21.18	23.20	11.25	9.74	7.83	7.42	4.19	11.72	21.86	15.07	41.71	2.77
13.42	24.99	3.70	19.90	22.12	10.56	9.50	7.48	6.89	3.96	11.14	21.25	14.68	40.94	2.74
12.67	24.59	3.48	18.63	20.64	9.90	9.11	6.98	6.33	3.65	10.35	20.33	14.05	39.91	2.69
11.90	24.05	3.23	17.55	19.30	9.33	8.60	6.53	5.76	3.29	9.75	19.13	13.23	38.39	2.62
11.20	23.60	3.07	16.65	18.34	8.86	8.09	6.21	5.39	2.95	9.28	17.89	12.37	36.64	2.54
10.55	23.17	2.95	15.84	17.57	8.43	7.69	5.95	5.15	2.64	8.88	17.09	11.82	34.80	2.46
9.94	22.75	2.84	15.08	16.87	8.02	7.42	5.73	5.01	2.38	8.51	16.53	11.44	33.01	2.38
8.95	22.09	2.66	13.86	15.73	7.36	7.03	5.34	4.39	2.11	7.90	15.67	10.84	31.44	2.25
7.98	21.28	2.49	12.65	14.59	6.72	6.65	4.96	3.97	1.92	7.29	14.78	10.23	29.91	2.12
7.09	20.46	2.32	11.50	13.51	6.10	6.31	4.61	3.69	1.79	6.71	13.93	9.66	28.50	2.02
6.51	19.61	2.17	10.42	12.49	5.53	5.98	4.27	3.52	1.69	6.17	13.15	9.13	27.19	1.94
6.03	18.70	1.99	9.36	11.39	4.97	5.63	3.90	3.27	1.57	5.57	12.31	8.56	25.87	1.87
4.95	17.36	1.68	7.76	9.45	4.10	4.94	3.23	2.11	1.23	4.56	10.80	7.50	23.69	1.71
3.99	15.98	1.37	6.35	7.66	3.36	4.27	2.61	1.33	0.94	3.73	9.20	6.41	21.01	1.55
3.20	14.75	1.11	5.17	6.27	2.74	3.65	2.14	0.82	0.73	3.06	7.69	5.38	18.42	1.41
2.56	13.61	0.92	4.21	5.18	2.23	3.07	1.77	0.49	0.55	2.51	6.30	4.44	16.00	1.27
2.04	12.54	0.76	3.41	4.27	1.81	2.54	1.47	0.28	0.41	2.06	5.15	3.61	13.82	1.14
1.60	11.56	0.64	2.76	3.52	1.46	2.07	1.21	0.13	0.30	1.69	4.27	2.99	11.78	1.03
1.24	10.67	0.53	2.20	2.88	1.16	1.73	0.99	0.04	0.22	1.36	3.58	2.51	9.86	0.92
0.95	9.83	0.43	1.73	2.33	0.91	1.45	0.81	0.00	0.16	1.09	2.99	2.10	8.08	0.82
0.73	9.03	0.35	1.35	1.86	0.71	1.22	0.65	0.00	0.11	0.86	2.48	1.75	6.71	0.72
0.55	8.29	0.28	1.06	1.48	0.56	1.01	0.52	0.00	0.07	0.68	2.04	1.44	5.66	0.63
0.40	7.60	0.23	0.82	1.18	0.43	0.84	0.41	0.00	0.04	0.54	1.66	1.18	4.76	0.54
0.28	6.94	0.18	0.61	0.93	0.32	0.69	0.33	0.00	0.02	0.42	1.36	0.96	3.99	0.46
0.19	6.31	0.14	0.44	0.72	0.23	0.57	0.25	0.00	0.01	0.31	1.11	0.79	3.33	0.38
0.11	5.70	0.11	0.30	0.53	0.16	0.47	0.19	0.00	0.00	0.22	0.89	0.64	2.78	0.31
0.06	5.12	0.08	0.20	0.38	0.10	0.38	0.14	0.00	0.00	0.15	0.70	0.50	2.32	0.27
0.02	4.56	0.06	0.11	0.26	0.06	0.30	0.10	0.00	0.00	0.10	0.54	0.39	1.91	0.23
0.00	4.01	0.04	0.05	0.17	0.03	0.23	0.06	0.00	0.00	0.06	0.40	0.29	1.55	0.20
0.00	3.49	0.03	0.01	0.09	0.01	0.17	0.04	0.00	0.00	0.03	0.28	0.21	1.24	0.17
0.00	2.98	0.01	0.00	0.04	0.00	0.12	0.02	0.00	0.00	0.01	0.19	0.14	0.97	0.14
0.00	2.49	0.01	0.00	0.01	0.00	0.09	0.01	0.00	0.00	0.00	0.12	0.09	0.73	0.12
0.00	2.10	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.07	0.05	0.54	0.10
0.00	1.81	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03	0.03	0.38	0.08
0.00	1.56	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.25	0.06
0.00	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.05
0.00	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.04
0.00	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03
0.00	0.82	0.00	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	0.67	0.00	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	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.35	0.00	0.00	0.00	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	0.20	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
0.00	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	0.09	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	0.06	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
0.00	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	0.01	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		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		0.096	0.132	27.1	4.25	14.1	3.00	7.1	76	158,667	2.56	405,563	40.0	103	404,074	2.36
C2		0.096	0.170	27.9	5.15	14.5	3.64	8.6	128	277,259	2.56	708,827	40.0	177	706,326	2.32
C3		0.091	0.167	19.1	3.96	10.0	2.80	6.6	129	190,648	2.57	490,533	35.0	156	488,026	2.97
C4		0.097	0.119	29.1	4.16	15.1	2.94	6.9	59	131,878	2.55	336,870	40.0	81	335,717	2.24
C5		0.106	0.127	43.1	5.70	22.4	4.03	9.5	67	225,024	2.54	571,087	50.0	106	570,798	1.71
C6		0.093	0.143	11.7	2.78	6.1	1.96	4.6	167	150,899	2.57	387,251	35.0	160	373,501	3.84
C7		0.126	0.072	30.9	3.21	16.1	2.27	5.4	23	55,684	2.52	140,124	40.0	32	139,150	2.08
C8		0.126	0.047	39.1	2.90	20.3	2.05	4.8	7	21,272	2.52	53,529	45.0	10	53,055	1.77
C9		0.094	0.111	14.3	2.72	7.4	1.92	4.5	88	97,393	2.56	249,414	35.0	92	240,188	3.42
C10		0.094	0.077	26.8	3.09	14.0	2.19	5.2	20	41,999	2.56	107,613	40.0	27	106,657	2.34
C11		0.095	0.085	24.2	3.09	12.6	2.18	5.1	31	57,681	2.56	147,547	40.0	40	145,920	2.49
C12		0.093	0.228	15.5	4.22	8.1	2.98	7.0	346	416,470	2.57	1,069,300	35.0	395	1,066,461	3.45
C13		0.096	0.147	24.3	4.24	12.6	3.00	7.1	108	203,861	2.56	521,007	40.0	143	519,536	2.54
C14		0.116	0.081	40.4	4.02	21.0	2.84	6.7	25	79,715	2.53	201,408	45.0	39	200,799	1.75
C15		0.126	0.095	38.9	4.33	20.2	3.06	7.2	34	101,894	2.52	256,407	45.0	50	255,794	1.80
C16		0.100	0.101	25.0	3.43	13.0	2.43	5.7	54	105,234	2.55	268,199	40.0	71	266,453	2.46
C17		0.122	0.169	54.7	8.59	28.4	6.07	14.3	91	386,704	2.52	974,657	55.0	154	974,062	1.45
C18		0.119	0.097	38.9	4.38	20.2	3.10	7.3	38	114,164	2.52	288,023	45.0	57	287,335	1.81
C19		0.092	0.145	18.2	3.54	9.5	2.50	5.9	105	148,358	2.57	381,183	35.0	126	378,519	3.07
C20		0.107	0.076	39.0	3.78	20.3	2.67	6.3	24	72,564	2.54	184,136	45.0	36	183,638	1.81
C21		0.104	0.128	33.6	4.80	17.5	3.39	8.0	83	216,856	2.54	551,283	45.0	121	550,263	2.02
C22		0.126	0.038	32.9	2.47	17.1	1.74	4.1	5	13,649	2.52	34,346	40.0	7	33,695	1.96
C23		0.096	0.096	25.3	3.36	13.1	2.37	5.6	40	78,662	2.56	201,037	40.0	53	199,683	2.44
B1		0.096	0.065	16.2	2.30	8.4	1.63	3.8	26	32,307	2.56	82,594	35.0	28	79,188	3.15
B2		0.108	0.045	22.4	2.27	11.6	1.61	3.8	13	22,506	2.54	57,057	35.0	16	55,253	2.53
B3		0.126	0.055	32.6	2.87	16.9	2.03	4.8	12	30,492	2.52	76,730	40.0	17	75,792	1.99
B4		0.126	0.124	30.2	4.37	15.7	3.09	7.3	79	184,658	2.52	464,675	40.0	109	462,656	2.14
B5		0.126	0.142	41.6	6.04	21.6	4.27	10.1	78	252,285	2.52	634,852	50.0	121	634,948	1.74
B6		0.126	0.088	25.0	3.19	13.0	2.25	5.3	45	87,011	2.52	218,955	40.0	58	216,940	2.41
B7		0.126	0.087	23.9	3.09	12.4	2.18	5.1	45	83,962	2.52	211,282	40.0	57	208,775	2.47
B8		0.126	0.123	53.3	6.54	27.7	4.62	10.9	44	183,061	2.52	460,656	55.0	73	460,762	1.46
B9		0.126	0.048	29.8	2.61	15.5	1.84	4.3	10	22,978	2.52	57,822	40.0	13	56,853	2.11
B10		0.126	0.103	26.0	3.55	13.5	2.51	5.9	61	122,694	2.52	308,748	40.0	80	307,410	2.37
B11		0.126	0.107	28.4	3.84	14.8	2.72	6.4	61	134,855	2.52	339,349	40.0	83	338,166	2.23
B12		0.126	0.078	26.0	3.05	13.5	2.15	5.1	33	65,703	2.52	165,336	40.0	42	163,672	2.35
B13		0.126	0.074	33.9	3.43	17.6	2.43	5.7	23	59,351	2.52	149,350	45.0	32	148,676	1.96
B14		0.126	0.066	28.7	2.96	14.9	2.09	4.9	21	46,101	2.52	116,009	40.0	28	114,748	2.19
B15		0.078	0.121	11.6	2.58	6.0	1.83	4.3	66	59,387	2.62	155,740	35.0	63	149,133	3.84
B16		0.086	0.073	19.8	2.61	10.3	1.84	4.3	16	24,212	2.59	62,705	35.0	19	61,105	2.86
OS1		0.156	0.096	27.3	3.51	14.2	2.48	5.8	33	68,934	2.50	172,565	40.0	43	171,667	2.28
OS2		0.156	0.128	32.3	4.68	16.8	3.31	7.8	53	132,096	2.50	330,682	45.0	74	329,739	2.04
OS3		0.156	0.109	32.6	4.22	17.0	2.98	7.0	36	91,658	2.50	229,451	45.0	51	228,673	2.02
OS4		0.156	0.175	37.1	6.48	19.3	4.58	10.8	91	262,413	2.50	656,912	45.0	136	656,674	1.88
OS5		0.156	0.054	43.6	3.29	22.7	2.33	5.5	6	19,021	2.50	47,617	45.0	9	47,400	1.63

## Printouts for Unit Hydrographs

flow in cfs

time in minutes	new iras																		
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
5	66.46	97.21	118.11	52.19	46.73	166.68	23.13	7.03	88.02	20.18	30.71	305.93	95.42	23.20	29.37	53.14	37.80	32.68	101.62
10	74.22	127.80	121.32	57.62	67.47	114.23	22.61	6.89	66.35	19.35	29.08	316.79	105.87	25.26	33.58	52.12	79.78	37.69	95.93
15	65.92	117.16	91.46	52.14	65.97	76.25	20.42	6.49	48.01	16.67	23.87	219.67	90.02	24.14	32.06	43.89	91.32	36.01	71.55
20	53.73	94.78	71.44	42.90	61.96	51.72	17.10	5.82	35.89	13.86	19.88	160.34	72.71	22.06	29.12	36.19	89.86	32.71	54.55
25	45.72	81.27	56.96	37.16	55.46	31.33	15.00	5.09	25.44	11.75	16.29	121.80	59.70	19.06	25.06	30.01	86.13	28.13	43.94
30	37.73	67.77	45.55	31.41	48.71	23.15	12.91	4.60	16.75	9.83	13.81	83.25	49.86	17.31	22.63	25.21	80.11	25.40	34.21
35	33.07	58.47	34.15	27.17	44.27	14.98	11.15	4.11	13.27	8.58	11.70	61.05	42.36	15.56	20.21	21.60	71.80	22.67	24.47
40	28.41	50.71	24.73	23.81	39.83	6.80	9.91	3.61	9.79	7.34	9.59	48.20	34.85	13.82	17.78	17.98	65.30	19.94	18.91
45	23.75	42.95	20.93	20.45	35.39	0.00	8.66	3.28	6.30	6.09	7.49	35.35	27.34	12.34	15.99	14.36	60.49	17.93	15.67
50	19.08	35.19	17.12	17.10	32.10		7.42	2.99	2.82	4.85	5.89	22.50	21.06	11.30	14.55	10.83	55.68	16.31	12.42
55	14.88	27.42	13.32	13.74	29.50		6.18	2.69	0.00	3.89	5.19	9.65	18.56	10.26	13.11	9.62	50.87	14.70	9.18
60	13.32	23.67	9.52	11.27	26.89		4.94	2.40		3.48	4.49	0.00	16.06	9.22	11.68	8.41	46.05	13.09	5.93
65	11.77	21.08	5.72	10.15	24.29			4.33	2.10		3.06	3.78		13.56	8.19	10.24	7.21	43.10	2.69
70	10.22	18.49	1.92	9.03	21.68		3.92	1.81		2.65	3.08		11.05	7.15	8.81	6.00	40.30	9.86	0.00
75	8.66	15.90	0.00	7.91	19.07		3.51	1.51		2.23	2.38		8.55	6.11	7.37	4.79	37.50	8.25	
80	7.11	13.32		6.79	16.47		3.09	1.34		1.82	1.68		6.05	5.09	6.49	3.59	34.70	7.27	
85	5.56	10.73		5.67	13.86		2.68	1.25		1.40	0.98		3.55	4.74	6.01	2.38	31.91	6.73	
90	4.00	8.14		4.55	12.75		2.26	1.15		0.99	0.27		1.05	4.39	5.53	1.18	29.11	6.19	
95	2.45	5.55		3.43	11.88		1.85	1.05		0.57	0.00		0.00	4.05	5.05	0.00	26.31	5.65	
100	0.90	2.96		2.32	11.01		1.44	0.95		0.16				3.70	4.57		23.52	5.12	
105	0.00	0.38		1.20	10.14		1.02	0.85		0.00				3.36	4.09		20.72	4.58	
110		0.00		0.08	9.28		0.61	0.75						3.01	3.62		18.15	4.04	
115																			

C20	C21	C22	C23	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
22.62	67.08	5.35	39.56	25.60	12.95	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
23.79	82.94	5.16	38.52	20.47	11.75	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
22.58	78.21	4.68	32.54	15.36	9.37	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
20.41	68.21	3.97	26.87	11.68	7.75	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
17.66	58.38	3.53	22.36	9.02	6.28	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
15.95	51.30	3.08	18.78	6.36	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
14.24	44.22	2.65	16.14	4.67	4.37	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
12.53	39.03	2.39	13.49	3.79	3.41	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
11.31	34.89	2.12	10.84	2.90	2.55	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
10.29	30.75	1.85	8.20	2.02	2.23	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
9.28	26.61	1.59	7.21	1.13	1.91	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
8.26	22.47	1.32	6.33	0.24	1.59	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
7.24	18.33	1.07	5.45	0.00	1.27	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
6.23	15.85	0.98	4.56		0.95	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
5.21	14.47	0.89	3.68		0.63	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
4.60	13.09	0.80	2.80		0.31	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
4.27	11.71	0.71	1.92		0.00	1.57	8.59	15.25	1.94	1.18	14.62	1.03	3.56	5.46	1.88	3.21	1.91		
3.93	10.33	0.62	1.04			1.37	7.14	14.20	0.94	0.12	13.24	0.84	2.26	4.27	1.18	2.84	1.52		
3.59	8.95	0.53	0.15			1.17	5.68	13.15	0.00	0.00	11.86	0.66	0.97	3.07	0.49	2.47	1.12		
3.25	7.57	0.44	0.00			0.96	4.23	12.10			10.48	0.48	0.00	1.87	0.00	2.11	0.72		
2.91	6.19	0.36				0.76	2.77	11.06			9.09	0.29		0.68		1.74	0.33		
2.57	4.81	0.27				0.55	1.32	10.01			8.49	0.11							

[illegible]

Printouts for Storm Hydrographs

time in minutes	flow in cfs																												
	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
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	
10	0.37	0.54	1.02	0.27	0.12	1.27	0.01	0.00	0.57	0.14	0.18	2.38	0.52	0.03	0.01	0.22	0.03	0.03	0.82	0.06	0.21	0.00	0.21	0.14	0.03	0.01	0.03	0.02	0.02
15	2.11	3.25	5.77	1.56	0.72	6.78	0.06	0.02	3.09	0.77	1.01	13.57	2.99	0.16	0.08	1.24	0.19	0.17	4.58	0.32	1.23	0.01	1.21	0.78	0.16	0.03	0.18	0.15	0.12
20	9.18	14.13	19.34	7.04	5.13	22.95	1.53	0.47	11.73	2.90	4.17	47.18	13.08	1.96	1.96	6.44	2.95	2.56	15.63	2.35	7.71	0.35	5.26	3.29	1.26	0.80	4.55	3.46	2.96
25	32.47	50.22	58.59	25.30	23.06	72.56	9.51	2.89	38.88	9.60	14.34	148.82	46.35	10.13	12.41	24.39	18.98	14.22	48.60	10.22	32.17	2.20	18.52	11.37	5.60	4.97	28.82	22.88	18.36
30	74.57	118.38	127.17	58.29	58.75	151.09	23.51	7.17	82.84	21.25	31.88	325.77	106.16	25.06	31.95	55.64	57.69	36.01	105.09	24.40	78.22	5.41	41.58	24.63	12.93	12.26	74.04	63.82	44.97
35	97.72	163.97	156.19	76.50	86.64	159.57	30.23	9.34	91.76	26.34	39.08	395.37	137.63	33.78	44.01	69.53	100.62	49.57	125.58	32.27	108.31	6.94	51.73	28.04	15.68	15.75	100.72	97.55	56.46
40	103.06	177.48	153.05	81.30	100.00	140.05	31.98	10.15	84.80	27.11	39.52	373.43	142.61	37.42	49.07	71.19	128.98	55.24	121.15	35.36	119.56	7.36	52.94	26.55	15.65	16.72	108.79	113.94	57.86
45	100.64	174.55	142.34	80.07	105.32	118.87	31.75	10.37	75.59	26.39	38.07	334.12	137.40	38.52	50.49	68.84	144.44	56.81	111.59	36.16	120.96	7.35	51.22	24.19	14.97	16.69	108.14	120.33	56.11
50	95.87	167.22	130.12	77.02	105.76	99.01	30.81	10.25	65.47	25.12	35.86	294.16	129.28	38.16	49.93	65.06	152.33	56.16	101.44	35.68	118.02	7.19	48.44	21.54	14.03	16.29	104.84	120.76	53.15
55	89.82	157.35	116.57	72.77	103.51	82.46	29.32	9.97	55.70	23.53	33.33	252.83	120.05	37.25	48.63	60.64	154.37	54.67	90.01	34.68	113.14	6.88	45.17	18.68	12.95	15.58	99.64	118.09	49.66
60	84.83	148.49	104.24	69.05	101.05	69.97	28.03	9.69	49.28	22.23	31.10	222.33	111.81	36.29	47.21	56.82	152.90	53.05	80.09	33.65	108.22	6.61	42.37	16.61	11.95	14.94	94.87	115.03	46.65
65	80.36	140.90	94.76	65.92	98.60	59.64	27.01	9.43	44.24	21.04	28.99	201.40	104.14	35.33	45.85	53.21	151.07	51.50	73.16	32.68	104.28	6.40	39.73	15.20	11.01	14.46	91.09	111.94	43.77
70	72.73	128.90	82.81	60.39	94.03	44.29	24.92	8.89	35.36	18.89	25.56	168.88	92.37	33.42	43.38	47.14	147.81	48.72	63.37	30.85	97.79	5.96	35.25	12.76	9.62	13.43	84.22	106.66	38.73
75	64.88	115.48	71.97	54.56	89.06	35.62	22.80	8.40	28.05	16.85	22.66	137.06	81.61	31.62	40.94	41.71	142.41	45.97	54.53	29.10	90.63	5.51	31.21	10.64	8.57	12.40	76.69	100.95	34.30
80	56.94	101.59	60.59	48.17	83.68	27.35	20.28	7.79	21.07	14.81	19.94	105.83	71.81	29.46	38.00	36.76	135.56	42.66	45.08	26.97	82.22	4.96	27.51	8.32	7.50	11.15	68.01	94.69	30.25
85	50.77	90.33	50.19	42.83	78.12	22.03	18.06	7.19	16.72	13.22	17.64	81.50	63.45	27.32	35.05	32.68	128.27	39.33	36.65	24.87	73.85	4.45	24.48	6.46	6.55	9.98	60.34	88.08	26.91
90	45.69	81.26	41.14	38.68	72.78	18.85	16.33	6.62	13.99	11.91	15.67	66.66	56.24	25.27	32.23	29.18	121.70	36.15	29.43	22.86	66.34	4.00	21.88	5.22	5.73	8.98	54.50	81.72	24.06
95	41.38	73.72	33.53	35.30	67.66	16.71	14.98	6.06	12.23	10.78	13.89	57.53	49.83	23.26	29.49	26.07	115.72	33.06	23.96	20.92	60.38	3.67	19.59	4.47	4.96	8.24	49.89	75.60	21.53
100	37.46	66.98	28.18	32.31	62.67	15.37	13.83	5.56	11.02	9.75	12.24	51.34	43.89	21.36	27.02	23.20	110.18	30.29	20.69	19.19	55.79	3.41	17.48	3.97	4.25	7.64	45.91	69.67	19.19
105	33.83	60.78	24.96	29.58	57.91	14.58	12.79	5.17	10.21	8.79	10.69	47.13	38.32	19.72	25.07	20.49	104.91	28.10	18.59	17.81	51.90	3.17	15.48	3.62	3.60	7.11	42.31	64.21	16.98
110	30.37	54.93	22.79	27.02	53.74	14.29	11.84	4.86	9.65	7.87	9.27	44.22	33.20	18.50	23.55	17.93	99.83	26.39	17.12	16.74	48.42	2.96	13.60	3.38	3.09	6.62	38.99	59.77	14.89
115	27.10	49.37	21.28	24.58	50.56	14.16	10.94	4.60	9.32	7.01	8.07	42.18	28.89	17.51	22.25	15.63	94.84	24.94	16.08	15.82	45.20	2.76	11.89	3.21	2.78	6.17	35.83	56.37	12.98
120	24.07	44.14	20.18	22.27	48.01	14.16	10.08	4.37	9.19	6.21	7.23	41.02	25.85	16.63	21.09	13.76	89.91	23.63	15.33	14.99	42.16	2.57	10.46	3.10	2.58	5.74	32.83	53.51	11.43
125	19.43	36.40	15.94	18.54	44.39	9.29	8.58	3.94	6.57	4.93	5.81	31.66	21.16	15.14	19.14	11.08	83.95	21.45	11.83	13.56	37.30	2.24	8.38	2.30	2.05	4.97	27.97	49.44	9.18
130	15.27	28.58	11.87	14.76	40.37	5.96	7.12	3.53	4.63	3.88	4.59	22.23	16.74	13.64	17.14	8.79	76.89	19.20	8.73	12.14	32.13	1.91	6.66	1.68	1.60	4.23	22.85	44.77	7.28
135	12.09	22.50	8.93	11.51	36.53	3.74	5.73	3.14	3.22	3.08	3.62	15.82	13.13	12.21	15.23	6.96	70.17	17.05	6.53	10.79	27.16	1.61	5.27	1.22	1.24	3.53	18.07	40.28	5.77
140	9.65	17.98	6.73	9.16	32.91	2.23	4.53	2.78	2.17	2.46	2.84	11.14	10.29	10.89	13.46	5.49	64.50	15.06	4.88	9.54	22.51	1.32	4.17	0.88	0.96	2.88	14.16	36.06	4.55
145	7.68	14.35	5.04	7.34	29.58	1.31	3.57	2.45	1.43	1.96	2.22	7.59	8.03	9.69	11.83	4.31	59.46	13.23	3.60	8.38	18.21	1.05	3.28	0.62	0.74	2.28	11.29	32.18	3.58
150	6.11	11.45	3.71	5.89	26.54	0.64	2.87	2.14	0.94	1.56	1.72	5.16	6.23	8.54	10.29	3.36	54.88	11.49	2.60	7.28	14.38	0.82	2.57	0.43	0.57	1.80	9.08	28.62	2.79
155	4.81	9.07	2.72	4.71	23.65	0.20	2.31	1.83	0.55	1.22	1.34	3.38	4.82	7.45	8.80	2.60	50.74	9.82	1.89	6.23	11.39	0.66	1.99	0.29	0.44	1.44	7.30	25.22	2.16
160	3.75	7.10	2.00	3.73	20.90	0.00	1.85	1.54	0.27	0.95	1.04	1.97	3.73	6.40	7.38	2.03	46.94	8.22	1.34	5.22	9.16	0.53	1.55	0.18	0.34	1.16	5.83	21.98	1.68
165	2.93	5.54	1.39	2.93	18.26	0.00	1.48	1.26	0.08	0.75	0.81	0.94	2.91	5.38	6.01	1.58	43.38	6.68	0.88	4.25	7.39	0.43	1.21	0.10	0.26	0.94	4.62	18.86	1.31
170	2.33	4.39	0.89	2.30	15.69	0.00	1.17	1.00	0.00	0.59	0.64	0.28	2.30	4.40	4.76	1.27	40.07	5.28	0.52	3.36	5.93	0.34	0.97	0.04	0.20	0.75	3.63	15.82	1.05
175	1.87	3.53	0.50	1.85	13.18	0.00	0.93	0.79	0.00	0.48	0.49	0.00	1.75	3.48	3.75	0.98	36.98	4.18	0.25	2.66	4.75	0.28	0.76	0.01	0.14	0.60	2.88	12.86	0.82
180	1.48	2.83	0.22	1.50	10.75	0.00	0.75	0.63	0.00	0.38	0.36	0.00	1.28	2.74	3.02	0.74	34.05	3.36	0.08	2.14	3.80	0.22	0.57	0.00	0.09	0.48	2.35	10.17	0.61
185	1.14	2.21	0.06	1.20	8.52	0.00	0.61	0.51	0.00	0.29	0.25	0.00	0.89	2.21	2.45	0.53	31.21	2.73	0.00	1.73	3.07	0.18	0.41	0.00	0.06	0.39	1.90	8.04	0.43
190	0.84	1.67	0.00	0.94	6.71	0.00	0.49	0.42	0.00	0.21	0.16	0.00	0.56	1.79	1.99	0.35	28.43	2.22	0.00	1.41	2.50	0.15	0.28	0.00	0.03	0.32	1.52	6.48	0.29
195	0.59	1.20	0.00	0.70	5.42	0.00	0.39	0.34	0.00	0.14	0.09	0.00	0.31	1.47	1.63	0.21	25.70	1.81	0.00	1.15	2.03	0.12	0.17	0.00	0.01	0.26	1.18	5.28	0.17
200	0.38	0.81	0.00	0.51	4.43	0.00	0.30	0.28	0.00	0.09	0.04	0.00	0.13	1.21	1.34	0.10	23.02	1.49	0.00	0.95	1.64	0.09	0.09	0.00	0.00	0.20	0.88	4.33	0.09
205	0.22	0.50	0.00	0.34	3.66	0.00	0.22	0.23	0.00	0.05	0.01	0.00	0.03	0.99	1.09	0.03	20.41	1.21	0.00	0.77	1.29	0.07	0.03	0.00	0.00	0.16</			



## Appendix C

# 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 <sup>6</sup> 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 .....	123.606	40.279
External Outflow .....	111.561	36.354
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 .....	12.037	3.922
Continuity Error (%) .....	0.006	

## \*\*\*\*\*

Highest Flow Instability Indexes

\*\*\*\*\*

Link SP101 (4)  
Link SP102 (4)  
Link SP103 (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

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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	1.87	2.72	7532.72	0	02:22	2.72

\*\*\*\*\*  
Node Inflow Summary  
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Total Flow		Maximum Lateral		Maximum Total		Lateral Inflow	
Inflow Balance		Inflow		Time of Max Occurrence		Volume	
Volume Node gal	Error Percent	Type	CFS	CFS	days hr:min	10^6 gal	10^6
A		JUNCTION	15.02	15.02	0 00:35	0.521	

0.521	0.000						
AA		JUNCTION	28.22	28.22	0 00:35	0.937	
0.937	0.000						
B		JUNCTION	36.30	74.88	0 00:40	1.65	
3.13	0.000						
BB		JUNCTION	29.52	29.52	0 00:35	1.04	
1.04	0.000						
BB1		JUNCTION	0.00	175.24	0 00:35	0	
6.55	0.000						
BB2		JUNCTION	0.00	185.88	0 00:35	0	
7	0.000						
C		JUNCTION	24.22	24.22	0 00:40	0.959	
0.959	0.000						
CC		JUNCTION	4.74	4.74	0 00:35	0.175	
0.175	0.000						
D		JUNCTION	22.91	22.91	0 00:45	1.07	
1.07	0.000						
DD		JUNCTION	42.70	42.70	0 00:45	1.97	
1.97	0.000						
E		JUNCTION	67.68	162.48	0 00:45	3.52	
7.72	0.000						
EE		JUNCTION	59.00	59.00	0 00:35	1.95	
1.95	0.000						
F		JUNCTION	17.53	17.53	0 00:40	0.694	
0.694	0.000						
FF		JUNCTION	14.06	118.12	0 00:40	0.483	
4.57	0.000						
G		JUNCTION	39.36	56.73	0 00:35	1.43	
2.13	0.000						
GG		JUNCTION	10.84	10.84	0 00:40	0.45	
0.45	0.000						
H1		JUNCTION	0.00	80.56	0 02:18	0	
6.49	0.000						
HH		JUNCTION	9.36	9.36	0 00:35	0.346	
0.346	0.000						
I		JUNCTION	24.87	24.87	0 00:35	0.878	
0.878	0.000						
II		JUNCTION	59.52	59.52	0 00:45	2.69	
2.69	0.000						
II1		JUNCTION	0.00	59.52	0 00:45	0	
2.69	0.000						
BB3		JUNCTION	0.00	252.39	0 00:40	0	
10	0.000						
J		JUNCTION	16.53	40.85	0 00:40	0.784	
1.66	0.000						
JJ		JUNCTION	7.03	7.03	0 00:35	0.237	
0.237	0.000						
K		JUNCTION	66.68	66.68	0 00:40	2.57	
2.57	0.000						
KK		JUNCTION	5.41	5.41	0 00:40	0.222	

0.222	0.000					
L		JUNCTION	11.29	77.97	0 00:40	0.45
3.02	0.000					
LL		JUNCTION	4.96	4.96	0 00:35	0.165
0.165	0.000					
LL1		JUNCTION	0.00	17.37	0 00:35	0
0.624	0.000					
M		JUNCTION	8.32	8.32	0 00:40	0.381
0.381	0.000					
N		JUNCTION	41.03	48.98	0 00:35	1.35
1.73	0.000					
O		JUNCTION	16.46	16.46	0 00:40	0.681
0.681	0.000					
P		JUNCTION	27.87	27.87	0 00:40	1.21
1.21	0.000					
Q		JUNCTION	46.69	46.69	0 00:40	1.99
1.99	0.000					
R		JUNCTION	32.20	78.43	0 00:45	1.52
3.51	0.000					
S		JUNCTION	18.69	18.69	0 00:35	0.669
0.669	0.000					
SP1		JUNCTION	0.00	139.42	0 00:40	0
11.2	0.000					
SP2		JUNCTION	0.00	204.11	0 00:40	0
13.6	0.000					
SP3		JUNCTION	0.00	231.98	0 00:40	0
14.8	0.000					
T		JUNCTION	2.92	2.92	0 00:40	0.144
0.144	0.000					
T1		JUNCTION	0.00	99.56	0 00:40	0
4.32	0.000					
U		JUNCTION	3.01	3.01	0 00:45	0.151
0.151	0.000					
T2		JUNCTION	0.00	105.04	0 00:40	0
4.58	0.000					
V		JUNCTION	21.57	21.57	0 00:45	1.06
1.06	0.000					
X		JUNCTION	100.91	122.16	0 00:50	5.26
6.33	0.000					
W		JUNCTION	2.48	2.48	0 00:35	0.102
0.102	0.000					
H		JUNCTION	13.48	13.48	0 00:40	0.568
0.568	0.000					
OF2		OUTFALL	0.00	105.04	0 00:40	0
4.58	0.000					
OF1		OUTFALL	0.00	231.98	0 00:40	0
14.8	0.000					
OF3		OUTFALL	0.00	122.16	0 00:50	0
6.33	0.000					
OF5		OUTFALL	0.00	17.37	0 00:35	0

0.624	0.000						
OF4		OUTFALL	0.00	252.39	0	00:40	0
10	0.000						
IRR_POND		STORAGE	0.00	217.34	0	00:45	0
9.85	0.026						

\*\*\*\*\*

#### Node Flooding Summary

\*\*\*\*\*

No nodes were flooded.

\*\*\*\*\*

#### Storage Volume Summary

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of Max		Maximum	Average	Avg	Evap	Exfil	Maximum	Max	Time
Occurrence	Storage Unit	Outflow	Volume	Pcnt	Pcnt	Pcnt	Volume	Pcnt	
hr:min		CFS	1000 ft3	Full	Loss	Loss	1000 ft3	Full	days
IRR_POND			615.379	28	0	0	906.757	42	0
02:22		76.32							

\*\*\*\*\*

#### Outfall Loading Summary

\*\*\*\*\*

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OF2	74.86	37.83	105.04	4.576
OF1	97.08	94.31	231.98	14.791
OF3	83.06	47.15	122.16	6.328
OF5	64.03	6.03	17.37	0.624
OF4	73.33	84.68	252.39	10.033
System	78.47	270.01	715.15	36.351

\*\*\*\*\*

# 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	15.02	0 00:35			
AA100	DUMMY	28.22	0 00:35			
B100	DUMMY	74.88	0 00:40			
BB100	DUMMY	29.52	0 00:35			
BB101	DUMMY	175.24	0 00:35			
BB102	DUMMY	185.88	0 00:35			
C100	DUMMY	24.22	0 00:40			
CC100	DUMMY	4.74	0 00:35			
D100	DUMMY	22.91	0 00:45			
DD100	DUMMY	42.70	0 00:45			
E100	DUMMY	162.48	0 00:45			
EE100	DUMMY	59.00	0 00:35			
EE101	DUMMY	118.12	0 00:40			
F100	DUMMY	17.53	0 00:40			
G100	DUMMY	56.73	0 00:35			
GG100	DUMMY	10.84	0 00:40			
H101	DUMMY	80.56	0 02:18			
HH100	DUMMY	9.36	0 00:35			
I100	DUMMY	24.87	0 00:35			
II100	DUMMY	59.52	0 00:45			
II101	DUMMY	59.52	0 00:45			
J100	DUMMY	40.85	0 00:40			
JJ100	DUMMY	7.03	0 00:35			
K100	DUMMY	66.68	0 00:40			
KK100	DUMMY	5.41	0 00:40			
L100	DUMMY	77.97	0 00:40			
LL100	DUMMY	4.96	0 00:35			
M100	DUMMY	8.32	0 00:40			
N100	DUMMY	48.98	0 00:35			
O100	DUMMY	16.46	0 00:40			
BB103	DUMMY	252.39	0 00:40			
OF5	DUMMY	17.37	0 00:35			
P100	DUMMY	27.87	0 00:40			
Q100	DUMMY	46.69	0 00:40			
R100	DUMMY	78.43	0 00:45			
S100	DUMMY	18.69	0 00:35			
SP101	DUMMY	139.42	0 00:40			
SP102	DUMMY	204.11	0 00:40			
SP103	DUMMY	231.98	0 00:40			

T100	DUMMY	2.92	0	00:40
T101	DUMMY	99.56	0	00:40
U100	DUMMY	3.01	0	00:45
U101	DUMMY	105.04	0	00:40
V100	DUMMY	21.57	0	00:45
W100	DUMMY	2.48	0	00:35
X100	DUMMY	122.16	0	00:50
H100	DUMMY	13.48	0	00:40
IRR_OUTLET	DUMMY	76.32	0	02:22

\*\*\*\*\*

# Conduit Surcharge Summary

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No conduits were surcharged.

Analysis begun on: Tue Mar 08 16:22:21 2022

Analysis ended on: Tue Mar 08 16:22:21 2022

Total elapsed time: < 1 sec

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.  
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\*\*\*\*\*  
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 <sup>6</sup> 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 .....	304.047	99.078
External Outflow .....	289.905	94.470
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 .....	14.114	4.599
Continuity Error (%) .....	0.009	

\*\*\*\*\*  
Highest Flow Instability Indexes

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All links are stable.

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#### Routing Time Step Summary

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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

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#### Node Depth Summary

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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	2.88	4.78	7534.78	0	01:52	4.77

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Node Inflow Summary

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Total	Flow		Maximum	Maximum		Lateral	
Inflow	Balance		Lateral	Total	Time of Max	Inflow	
Volume	Error		Inflow	Inflow	Occurrence	Volume	
Node		Type	CFS	CFS	days hr:min	10^6 gal	10^6
gal	Percent						
-----							
-----							
A		JUNCTION	43.23	43.23	0 00:40	1.28	
1.28	0.000						
AA		JUNCTION	79.13	79.13	0 00:40	2.28	

2.28	0.000						
B		JUNCTION	105.87	218.25	0 00:45	4.06	
7.71	0.000						
BB		JUNCTION	83.01	83.01	0 00:40	2.53	
2.53	0.000						
BB1		JUNCTION	0.00	496.39	0 00:40	0	
15.9	0.000						
BB2		JUNCTION	0.00	527.53	0 00:40	0	
17.1	0.000						
C		JUNCTION	70.30	70.30	0 00:45	2.36	
2.36	0.000						
CC		JUNCTION	13.39	13.39	0 00:40	0.425	
0.425	0.000						
D		JUNCTION	66.91	66.91	0 00:50	2.64	
2.64	0.000						
DD		JUNCTION	122.02	122.02	0 00:50	4.79	
4.79	0.000						
E		JUNCTION	197.07	476.51	0 00:50	8.69	
19	0.000						
EE		JUNCTION	165.17	165.17	0 00:40	4.73	
4.73	0.000						
F		JUNCTION	50.93	50.93	0 00:45	1.71	
1.71	0.000						
FF		JUNCTION	40.46	335.83	0 00:45	1.19	
11.1	0.000						
G		JUNCTION	113.61	164.20	0 00:40	3.53	
5.24	0.000						
GG		JUNCTION	31.55	31.55	0 00:45	1.11	
1.11	0.000						
H1		JUNCTION	0.00	317.66	0 01:49	0	
21.1	0.000						
HH		JUNCTION	27.05	27.05	0 00:40	0.852	
0.852	0.000						
I		JUNCTION	71.63	71.63	0 00:40	2.16	
2.16	0.000						
II		JUNCTION	173.21	173.21	0 00:50	6.63	
6.63	0.000						
II1		JUNCTION	0.00	173.21	0 00:50	0	
6.63	0.000						
BB3		JUNCTION	0.00	723.98	0 00:45	0	
24.5	0.000						
J		JUNCTION	48.32	118.82	0 00:45	1.93	
4.09	0.000						
JJ		JUNCTION	20.22	20.22	0 00:40	0.584	
0.584	0.000						
K		JUNCTION	192.76	192.76	0 00:45	6.33	
6.33	0.000						
KK		JUNCTION	15.77	15.77	0 00:45	0.548	
0.548	0.000						
L		JUNCTION	32.85	225.60	0 00:45	1.11	

7.44	0.000						
LL		JUNCTION	14.28	14.28	0	00:40	0.406
0.406	0.000						
LL1		JUNCTION	0.00	50.18	0	00:40	0
1.54	0.000						
M		JUNCTION	24.27	24.27	0	00:45	0.94
0.94	0.000						
N		JUNCTION	117.60	141.14	0	00:40	3.32
4.26	0.000						
O		JUNCTION	47.87	47.87	0	00:45	1.68
1.68	0.000						
P		JUNCTION	81.04	81.04	0	00:45	2.97
2.97	0.000						
Q		JUNCTION	135.90	135.90	0	00:45	4.91
4.91	0.000						
R		JUNCTION	93.96	228.93	0	00:45	3.74
8.65	0.000						
S		JUNCTION	53.89	53.89	0	00:40	1.65
1.65	0.000						
SP1		JUNCTION	0.00	506.60	0	01:16	0
32.6	0.000						
SP2		JUNCTION	0.00	642.43	0	01:09	0
38.6	0.000						
SP3		JUNCTION	0.00	713.55	0	01:06	0
41.5	0.000						
T		JUNCTION	8.56	8.56	0	00:45	0.355
0.355	0.000						
T1		JUNCTION	0.00	290.68	0	00:45	0
10.7	0.000						
U		JUNCTION	8.82	8.82	0	00:50	0.371
0.371	0.000						
T2		JUNCTION	0.00	306.73	0	00:45	0
11.3	0.000						
V		JUNCTION	63.05	63.05	0	00:50	2.62
2.62	0.000						
X		JUNCTION	294.63	356.64	0	00:55	13
15.6	0.000						
W		JUNCTION	7.23	7.23	0	00:45	0.252
0.252	0.000						
H		JUNCTION	39.24	39.24	0	00:45	1.4
1.4	0.000						
OF2		OUTFALL	0.00	306.73	0	00:45	0
11.3	0.000						
OF1		OUTFALL	0.00	713.55	0	01:06	0
41.5	0.000						
OF3		OUTFALL	0.00	356.64	0	00:55	0
15.6	0.000						
OF5		OUTFALL	0.00	50.18	0	00:40	0
1.54	0.000						
OF4		OUTFALL	0.00	723.98	0	00:45	0

24.5	0.000						
IRR_POND		STORAGE	0.00	635.60	0	00:50	0
24.3	0.037						

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# Node Flooding Summary

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No nodes were flooded.

\*\*\*\*\*

# Storage Volume Summary

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of Max	Maximum	Average	Avg	Evap	Exfil	Maximum	Max	Time
Occurrence	Outflow	Volume	Pcnt	Pcnt	Pcnt	Volume	Pcnt	
Storage Unit		1000 ft3	Full	Loss	Loss	1000 ft3	Full	days
hr:min	CFS							
IRR_POND		980.929	45	0	0	1681.419	77	0
01:51	300.75							

\*\*\*\*\*

# Outfall Loading Summary

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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OF2	76.39	91.37	306.73	11.277
OF1	98.33	261.36	713.55	41.521
OF3	83.61	115.45	356.64	15.596
OF5	64.58	14.74	50.18	1.538
OF4	74.86	202.81	723.98	24.530
System	79.56	685.74	2087.19	94.463

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# Link Flow Summary

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Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:min	Maximum  Veloc  ft/sec	Max/ Full Flow	Max/ Full Depth
A100	DUMMY	43.23	0 00:40			
AA100	DUMMY	79.13	0 00:40			
B100	DUMMY	218.25	0 00:45			
BB100	DUMMY	83.01	0 00:40			
BB101	DUMMY	496.39	0 00:40			
BB102	DUMMY	527.53	0 00:40			
C100	DUMMY	70.30	0 00:45			
CC100	DUMMY	13.39	0 00:40			
D100	DUMMY	66.91	0 00:50			
DD100	DUMMY	122.02	0 00:50			
E100	DUMMY	476.51	0 00:50			
EE100	DUMMY	165.17	0 00:40			
EE101	DUMMY	335.83	0 00:45			
F100	DUMMY	50.93	0 00:45			
G100	DUMMY	164.20	0 00:40			
GG100	DUMMY	31.55	0 00:45			
H101	DUMMY	317.66	0 01:49			
HH100	DUMMY	27.05	0 00:40			
I100	DUMMY	71.63	0 00:40			
II100	DUMMY	173.21	0 00:50			
II101	DUMMY	173.21	0 00:50			
J100	DUMMY	118.82	0 00:45			
JJ100	DUMMY	20.22	0 00:40			
K100	DUMMY	192.76	0 00:45			
KK100	DUMMY	15.77	0 00:45			
L100	DUMMY	225.60	0 00:45			
LL100	DUMMY	14.28	0 00:40			
M100	DUMMY	24.27	0 00:45			
N100	DUMMY	141.14	0 00:40			
O100	DUMMY	47.87	0 00:45			
BB103	DUMMY	723.98	0 00:45			
OF5	DUMMY	50.18	0 00:40			
P100	DUMMY	81.04	0 00:45			
Q100	DUMMY	135.90	0 00:45			
R100	DUMMY	228.93	0 00:45			
S100	DUMMY	53.89	0 00:40			
SP101	DUMMY	506.60	0 01:16			
SP102	DUMMY	642.43	0 01:09			
SP103	DUMMY	713.55	0 01:06			
T100	DUMMY	8.56	0 00:45			
T101	DUMMY	290.68	0 00:45			

U100	DUMMY	8.82	0	00:50
U101	DUMMY	306.73	0	00:45
V100	DUMMY	63.05	0	00:50
W100	DUMMY	7.23	0	00:45
X100	DUMMY	356.64	0	00:55
H100	DUMMY	39.24	0	00:45
IRR_OUTLET	DUMMY	300.75	0	01:52

\*\*\*\*\*

# Conduit Surcharge Summary

\*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Tue Mar 08 16:21:18 2022

Analysis ended on: Tue Mar 08 16:21:18 2022

Total elapsed time: < 1 sec

# 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 ..... 01/01/2005 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 <sup>6</sup> 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 .....	129.534	42.211
External Outflow .....	103.384	33.689
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 .....	26.793	8.731
Continuity Error (%) .....	-0.496	

## \*\*\*\*\*

Highest Flow Instability Indexes

\*\*\*\*\*

Link J1300 (2)  
Link N100 (1)  
Link SP101 (1)  
Link II300 (1)  
Link B100 (1)

\*\*\*\*\*

#### 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	0.47	1.45	7576.45	0 00:40	1.45
B2	JUNCTION	0.48	1.39	7576.39	0 00:40	1.39
BB	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
BB1	JUNCTION	0.47	1.21	7386.21	0 00:52	1.20
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	0.77	1.74	7573.74	0 01:06	1.74
EE1	JUNCTION	0.37	0.86	7475.86	0 01:01	0.86
EE2	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
EE3	JUNCTION	0.15	0.64	7575.64	0 00:30	0.63
F	JUNCTION	0.00	0.00	7633.00	0 00:00	0.00
FF	JUNCTION	0.47	1.21	7431.21	0 00:51	1.21
G	JUNCTION	0.39	1.09	7566.09	0 00:40	1.09
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	0.29	0.65	7495.65	0	00:50	0.65
II2	JUNCTION	0.28	0.98	7450.98	0	00:36	0.98
II3	JUNCTION	0.17	0.62	7515.62	0	00:35	0.61
IRR_J	JUNCTION	0.00	0.00	7528.00	0	00:00	0.00
J	JUNCTION	0.00	0.00	7560.00	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	0.10	0.28	7545.28	0	01:00	0.28
J13	JUNCTION	0.27	0.61	7520.61	0	01:08	0.61
J14	JUNCTION	0.00	0.00	7375.00	0	00:00	0.00
J15	JUNCTION	0.38	0.95	7552.95	0	01:14	0.95
J2	JUNCTION	0.00	0.00	7435.00	0	00:00	0.00
J3	JUNCTION	0.36	0.64	7495.64	0	01:38	0.64
J4	JUNCTION	0.48	1.24	7466.24	0	01:18	1.24
J5	JUNCTION	0.00	0.00	7525.00	0	00:00	0.00
J6	JUNCTION	0.25	0.58	7570.58	0	01:09	0.58
J7	JUNCTION	0.48	1.17	7546.17	0	01:07	1.17
J8	JUNCTION	0.00	0.00	7525.00	0	00:00	0.00
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	0.28	1.32	7586.32	0	00:30	1.31
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	0.18	0.86	7590.86	0	00:30	0.85
N	JUNCTION	0.30	1.54	7536.54	0	00:30	1.54
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	0.40	0.68	7510.68	0	01:15	0.68
SP2	JUNCTION	0.67	1.18	7496.18	0	01:19	1.18
SP3	JUNCTION	0.65	1.16	7491.16	0	01:33	1.16
SP4	JUNCTION	0.44	0.79	7420.79	0	01:34	0.79
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	0.16	0.51	7565.51	0	00:35	0.51
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	0.26	0.87	7505.87	0	00:35	0.86
X3	JUNCTION	0.32	0.89	7500.89	0	00:40	0.89
OF3	OUTFALL	0.00	0.00	7431.00	0	00:00	0.00
OF1	OUTFALL	0.43	0.79	7415.79	0	01:35	0.79
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	1.74	2.58	7532.58	0	02:40	2.58
P1	STORAGE	2.42	3.23	7428.23	0	01:07	3.23
P10	STORAGE	2.67	3.39	7528.39	0	00:59	3.39
P11	STORAGE	2.69	3.95	7573.95	0	01:19	3.94
P12	STORAGE	3.49	4.71	7554.71	0	01:00	4.71
P13	STORAGE	2.75	3.66	7528.66	0	01:08	3.65
P14	STORAGE	2.79	3.78	7403.78	0	00:59	3.78
P15	STORAGE	2.67	3.89	7558.89	0	01:14	3.89
P2	STORAGE	2.94	4.63	7440.63	0	01:26	4.63
P3	STORAGE	3.73	5.00	7515.00	0	01:38	5.00
P4	STORAGE	3.25	4.48	7473.48	0	01:18	4.48
P5	STORAGE	3.41	4.62	7534.62	0	01:18	4.62
P6	STORAGE	3.25	4.49	7578.49	0	01:09	4.49
P7	STORAGE	2.97	4.08	7554.08	0	01:07	4.08
P8	STORAGE	5.88	6.63	7540.63	0	01:06	6.63
P9	STORAGE	2.58	3.76	7573.76	0	01:07	3.76

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Node Inflow Summary  
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Total	Flow		Maximum	Maximum		Lateral	
Inflow	Balance		Lateral	Total	Time of Max	Inflow	
Volume	Error		Inflow	Inflow	Occurrence	Volume	
Node		Type	CFS	CFS	days hr:min	10^6 gal	10^6
gal	Percent						
-----							
-----							
A		JUNCTION	15.02	15.02	0 00:35	0.521	
0.521	0.000						
AA		JUNCTION	28.57	28.57	0 00:35	0.945	
0.945	0.000						
B1		JUNCTION	44.45	59.13	0 00:40	1.74	
2.26	0.000						
B2		JUNCTION	13.13	38.72	0 00:40	0.577	
1.58	0.000						
BB		JUNCTION	29.52	29.52	0 00:35	1.04	
1.04	0.000						
BB1		JUNCTION	0.00	155.72	0 00:40	0	
6.57	0.000						

BB2		JUNCTION	0.00	166.97	0 00:40	0
7.02	0.000					
BB3		JUNCTION	0.00	230.07	0 00:46	0
9.92	0.000					
C		JUNCTION	25.59	25.59	0 00:40	1
1	0.000					
CC		JUNCTION	4.74	4.74	0 00:35	0.175
0.175	0.000					
D		JUNCTION	50.30	50.30	0 00:30	1.22
1.22	0.000					
DD		JUNCTION	42.26	42.26	0 00:45	1.95
1.95	0.000					
E		JUNCTION	54.35	128.26	0 01:06	3.01
6.55	0.000					
EE1		JUNCTION	38.60	42.60	0 01:01	1.42
1.95	0.000					
EE2		JUNCTION	27.82	27.82	0 00:30	0.506
0.506	0.000					
EE3		JUNCTION	7.88	7.88	0 00:30	0.201
0.201	0.000					
F		JUNCTION	17.53	17.53	0 00:40	0.694
0.694	0.000					
FF		JUNCTION	15.14	100.04	0 00:51	0.503
4.58	0.000					
G		JUNCTION	20.16	37.69	0 00:40	0.889
1.58	0.000					
GG		JUNCTION	11.25	11.25	0 00:40	0.457
0.457	0.000					
H		JUNCTION	13.74	13.74	0 00:40	0.624
0.624	0.000					
HH		JUNCTION	9.86	9.86	0 00:35	0.353
0.353	0.000					
I		JUNCTION	26.84	26.84	0 00:35	0.846
0.846	0.000					
II1		JUNCTION	25.77	25.77	0 00:50	1.42
1.42	0.000					
II2		JUNCTION	20.40	40.90	0 00:36	0.642
1.31	0.000					
II3		JUNCTION	20.65	20.65	0 00:35	0.667
0.667	0.000					
IRR_J		JUNCTION	0.00	64.13	0 02:40	0
5.15	0.000					
J		JUNCTION	17.72	17.72	0 00:40	0.787
0.787	0.000					
J10		JUNCTION	0.00	68.01	0 02:36	0
5.71	0.000					
J11		JUNCTION	0.00	75.69	0 01:19	0
3.55	0.000					
J12		JUNCTION	0.00	36.41	0 01:00	0
1.45	0.000					

J13		JUNCTION	0.00	11.34	0	01:08	0
0.53	0.000						
J14		JUNCTION	0.00	58.70	0	00:59	0
2.55	0.000						
J15		JUNCTION	0.00	22.57	0	01:14	0
1.02	0.000						
J2		JUNCTION	0.00	108.31	0	01:26	0
5.16	0.000						
J3		JUNCTION	0.00	18.11	0	01:38	0
1.15	0.000						
J4		JUNCTION	0.00	69.67	0	01:18	0
3.2	0.000						
J5		JUNCTION	0.00	29.94	0	01:18	0
1.49	0.000						
J6		JUNCTION	0.00	14.05	0	01:09	0
0.608	0.000						
J7		JUNCTION	0.00	67.84	0	01:07	0
2.85	0.000						
J8		JUNCTION	0.00	77.79	0	01:06	0
3.24	0.000						
J9		JUNCTION	0.00	90.57	0	01:07	0
3.91	0.000						
JJ		JUNCTION	11.06	11.06	0	00:30	0.253
0.253	0.000						
K		JUNCTION	159.05	159.05	0	00:30	3.44
3.44	0.000						
KK		JUNCTION	5.91	5.91	0	00:35	0.233
0.233	0.000						
L		JUNCTION	15.11	15.11	0	00:35	0.467
0.467	0.000						
LL		JUNCTION	5.85	5.85	0	00:30	0.173
0.173	0.000						
LL1		JUNCTION	0.00	22.38	0	00:30	0
0.659	0.000						
M		JUNCTION	36.75	36.75	0	00:30	0.771
0.771	-0.000						
N		JUNCTION	65.41	65.41	0	00:30	1.21
1.21	0.000						
O		JUNCTION	62.67	62.67	0	00:30	1.58
1.58	0.000						
P		JUNCTION	39.34	39.34	0	00:35	1.29
1.29	0.000						
Q		JUNCTION	46.69	46.69	0	00:40	1.99
1.99	0.000						
R		JUNCTION	54.59	98.48	0	00:40	1.66
3.65	0.000						
S		JUNCTION	20.17	20.17	0	00:35	0.638
0.638	0.000						
SP1		JUNCTION	0.00	137.11	0	01:15	0
10.4	0.000						

SP2		JUNCTION	0.00	166.63	0	01:19	0
11.8	0.000						
SP3		JUNCTION	0.00	161.89	0	01:33	0
11.5	0.000						
SP4		JUNCTION	0.00	202.13	0	01:34	0
13.7	0.000						
T		JUNCTION	2.92	2.92	0	00:40	0.144
0.144	0.000						
T1		JUNCTION	0.00	93.32	0	01:07	0
4.06	0.000						
T2		JUNCTION	0.00	98.80	0	01:07	0
4.32	0.000						
U		JUNCTION	3.63	3.63	0	00:40	0.163
0.163	0.000						
V1		JUNCTION	10.41	10.41	0	00:35	0.343
0.343	0.000						
V2		JUNCTION	11.32	11.32	0	00:35	0.428
0.428	0.000						
W		JUNCTION	2.60	2.60	0	00:35	0.104
0.104	0.000						
X1		JUNCTION	67.88	67.88	0	00:35	2.26
2.26	0.000						
X2		JUNCTION	30.87	30.87	0	00:35	1.07
1.07	0.000						
X3		JUNCTION	38.24	59.32	0	00:40	1.79
2.56	0.000						
OF3		OUTFALL	0.00	108.31	0	01:26	0
5.16	0.000						
OF1		OUTFALL	0.00	202.10	0	01:35	0
13.6	0.000						
OF2		OUTFALL	0.00	98.80	0	01:07	0
4.32	0.000						
OF4		OUTFALL	0.00	230.07	0	00:46	0
9.92	0.000						
OF5		OUTFALL	0.00	22.38	0	00:30	0
0.659	0.000						
IRR_POND		STORAGE	0.00	184.14	0	01:05	0
9.17	0.015						
P1		STORAGE	0.00	39.34	0	00:35	0
1.29	0.194						
P10		STORAGE	0.00	13.74	0	00:40	0
0.624	0.175						
P11		STORAGE	0.00	97.43	0	00:42	0
3.84	0.124						
P12		STORAGE	0.00	43.90	0	00:35	0
1.63	0.201						
P13		STORAGE	0.00	34.69	0	00:30	0
0.706	0.124						
P14		STORAGE	0.00	63.76	0	00:42	0
2.73	0.208						

P15		STORAGE	0.00	50.30	0	00:30	0
1.22	0.088						
P2		STORAGE	0.00	121.45	0	00:58	0
5.47	0.075						
P3		STORAGE	0.00	62.67	0	00:30	0
1.58	0.050						
P4		STORAGE	0.00	89.58	0	00:41	0
3.64	0.148						
P5		STORAGE	0.00	64.41	0	00:32	0
1.81	0.109						
P6		STORAGE	0.00	36.48	0	00:31	0
0.771	0.138						
P7		STORAGE	0.00	158.57	0	00:31	0
3.45	0.146						
P8		STORAGE	0.00	77.79	0	01:06	0
3.32	0.199						
P9		STORAGE	0.00	118.32	0	00:35	0
4.29	0.151						

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#### Node Flooding Summary

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No nodes were flooded.

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#### Storage Volume Summary

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of Max Occurrence		Maximum Outflow	Average Volume	Avg Pcnt Full	Evap Loss	Exfil Loss	Maximum Volume	Max Pcnt Full	Time days
Storage Unit	hr:min	CFS	1000 ft3				1000 ft3		
IRR_POND			571.315	26	0	0	856.789	39	0
02:40	64.13								
P1			29.721	10	0	0	49.157	16	0
01:07	27.89								
P10			11.154	10	0	0	16.343	15	0
00:58	12.86								
P11			53.472	12	0	0	104.027	23	0

01:18	75.69							
P12		37.461	18	0	0	59.259	29	0
01:00	36.41							
P13		30.832	12	0	0	49.895	20	0
01:08	11.34							
P14		28.356	13	0	0	45.774	20	0
00:58	58.70							
P15		37.592	12	0	0	72.111	22	0
01:14	22.57							
P2		64.914	15	0	0	132.017	31	0
01:26	108.31							
P3		87.562	22	0	0	137.051	34	0
01:37	18.11							
P4		68.081	9	0	0	111.269	15	0
01:17	69.67							
P5		60.065	18	0	0	96.174	29	0
01:18	29.94							
P6		33.045	16	0	0	54.793	27	0
01:09	14.05							
P7		113.009	13	0	0	208.499	24	0
01:07	67.84							
P8		9.739	29	0	0	11.960	36	0
01:05	77.79							
P9		77.062	12	0	0	147.018	23	0
01:07	90.57							

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 Outfall Loading Summary  
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OF3	97.08	32.91	108.31	5.162
OF1	93.75	89.94	202.10	13.620
OF2	97.08	27.56	98.80	4.322
OF4	97.08	63.27	230.07	9.924
OF5	63.19	6.46	22.38	0.659
System	89.64	220.13	584.83	33.687

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 Link Flow Summary  
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Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:min	Maximum  Veloc  ft/sec	Max/ Full Flow	Max/ Full Depth
A100	DUMMY	15.02	0 00:35			
AA100	DUMMY	28.57	0 00:35			
B100	CONDUIT	59.17	0 00:41	4.19	0.19	0.48
B200	CONDUIT	38.46	0 00:43	3.27	0.17	0.46
BB100	DUMMY	29.52	0 00:35			
BB101	DUMMY	155.72	0 00:40			
BB102	DUMMY	166.97	0 00:40			
BB103	DUMMY	230.07	0 00:46			
C100	DUMMY	25.59	0 00:40			
C900	CONDUIT	36.48	0 00:31	6.65	0.06	0.29
CC100	DUMMY	4.74	0 00:35			
D100	DUMMY	50.30	0 00:30			
DD100	DUMMY	42.26	0 00:45			
E100	CONDUIT	128.26	0 01:11	7.38	0.28	0.58
EE100	CONDUIT	42.59	0 01:02	7.66	0.06	0.29
EE101	CONDUIT	100.03	0 00:52	9.41	0.13	0.40
EE200	DUMMY	27.82	0 00:30			
EE300	CONDUIT	7.65	0 00:34	9.14	0.21	0.31
F100	DUMMY	17.53	0 00:40			
G100	CONDUIT	36.84	0 00:48	4.69	0.10	0.36
GG100	DUMMY	11.25	0 00:40			
H100	DUMMY	13.74	0 00:40			
H101	DUMMY	68.01	0 02:36			
HH100	DUMMY	9.86	0 00:35			
I100	DUMMY	26.84	0 00:35			
II100	CONDUIT	25.71	0 00:52	7.15	0.09	0.32
II200	CONDUIT	40.75	0 00:38	7.03	0.19	0.49
II300	CONDUIT	20.59	0 00:36	7.53	0.07	0.31
IRR_J100	DUMMY	64.13	0 02:40			
J100	DUMMY	17.72	0 00:40			
J1100	DUMMY	75.69	0 01:19			
J1200	CONDUIT	33.60	0 01:18	2.39	0.01	0.07
J1300	CONDUIT	11.30	0 01:14	4.18	0.07	0.31
J1400	DUMMY	58.70	0 00:59			
J1500	CONDUIT	22.56	0 01:15	11.78	0.22	0.32
J300	CONDUIT	18.07	0 01:43	5.16	0.03	0.21
J400	CONDUIT	69.66	0 01:22	5.75	0.15	0.41
J500	DUMMY	29.94	0 01:18			
J600	CONDUIT	14.04	0 01:11	5.64	0.06	0.29
J700	CONDUIT	67.84	0 01:08	19.33	0.12	0.23
J800	DUMMY	77.79	0 01:06			
J900	DUMMY	90.57	0 01:07			
JJ100	DUMMY	11.06	0 00:30			
JP20	DUMMY	108.31	0 01:26			
K100	CONDUIT	158.57	0 00:31	12.92	0.16	0.44
KK100	DUMMY	5.91	0 00:35			

L100	DUMMY	15.11	0	00:35			
LL100	DUMMY	5.85	0	00:30			
N100	CONDUIT	64.33	0	00:32	4.21	0.22	0.51
O100	DUMMY	62.67	0	00:30			
OF5	DUMMY	22.38	0	00:30			
P100	DUMMY	39.34	0	00:35			
Q100	DUMMY	46.69	0	00:40			
R100	DUMMY	98.48	0	00:40			
S100	DUMMY	20.17	0	00:35			
SP101	CONDUIT	136.71	0	01:20	3.53	0.04	0.17
SP102	CONDUIT	161.89	0	01:33	2.26	0.10	0.29
SP103	CONDUIT	161.76	0	01:36	6.15	0.01	0.10
SP104	CONDUIT	202.10	0	01:35	4.33	0.03	0.16
SP206	DUMMY	98.80	0	01:07			
T100	DUMMY	2.92	0	00:40			
T101	DUMMY	93.32	0	01:07			
U100	DUMMY	3.63	0	00:40			
V100	DUMMY	10.41	0	00:35			
V200	CONDUIT	11.22	0	00:40	5.44	0.05	0.26
W100	DUMMY	2.60	0	00:35			
X100	DUMMY	67.88	0	00:35			
X200	CONDUIT	30.46	0	00:39	5.52	0.06	0.29
X300	CONDUIT	59.27	0	00:41	8.74	0.07	0.30
IRR_OUTLET	DUMMY	64.13	0	02:40			
01	DUMMY	27.89	0	01:07			
010	DUMMY	12.86	0	00:59			
011	DUMMY	75.69	0	01:19			
012	DUMMY	36.41	0	01:00			
013	DUMMY	11.34	0	01:08			
014	DUMMY	58.70	0	00:59			
015	DUMMY	22.57	0	01:14			
02	DUMMY	108.31	0	01:26			
03	DUMMY	18.11	0	01:38			
04	DUMMY	69.67	0	01:18			
05	DUMMY	29.94	0	01:18			
06	DUMMY	14.05	0	01:09			
07	DUMMY	67.84	0	01:07			
08	DUMMY	77.79	0	01:06			
09	DUMMY	90.57	0	01:07			

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#### Conduit Surcharge Summary

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No conduits were surcharged.

Analysis begun on: Tue Mar 08 16:23:49 2022

Analysis ended on: Tue Mar 08 16:23:49 2022

Total elapsed time: < 1 sec

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.  
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\*\*\*\*\*  
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 <sup>6</sup> 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 .....	308.710	100.598
External Outflow .....	280.154	91.292
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 .....	29.837	9.723
Continuity Error (%) .....	-0.415	

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Highest Flow Instability Indexes

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Link J1300 (3)  
 Link J1500 (2)  
 Link B100 (1)  
 Link J300 (1)  
 Link N100 (1)

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#### Routing Time Step Summary

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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 : 1.01  
 Percent Not Converging : 0.00

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#### Node Depth Summary

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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	0.69	2.29	7577.29	0 00:45	2.29
B2	JUNCTION	0.70	2.20	7577.20	0 00:45	2.20
BB	JUNCTION	0.00	0.00	7410.00	0 00:00	0.00
BB1	JUNCTION	0.68	2.07	7387.07	0 00:52	2.06
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	1.14	2.67	7574.67	0 01:06	2.67
EE1	JUNCTION	0.52	1.56	7476.56	0 00:52	1.55
EE2	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
EE3	JUNCTION	0.23	1.04	7576.04	0 00:35	1.03
F	JUNCTION	0.00	0.00	7633.00	0 00:00	0.00
FF	JUNCTION	0.69	2.07	7432.07	0 00:51	2.07
G	JUNCTION	0.57	1.75	7566.75	0 00:45	1.75
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	1.07	7496.07	0	00:55	1.07
II2	JUNCTION	0.41	1.54	7451.54	0	00:40	1.54
II3	JUNCTION	0.25	0.99	7515.99	0	00:40	0.99
IRR_J	JUNCTION	0.00	0.00	7528.00	0	00:00	0.00
J	JUNCTION	0.00	0.00	7560.00	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	0.16	0.56	7545.56	0	00:50	0.56
J13	JUNCTION	0.38	1.24	7521.24	0	00:52	1.23
J14	JUNCTION	0.00	0.00	7375.00	0	00:00	0.00
J15	JUNCTION	0.60	1.78	7553.78	0	01:08	1.78
J2	JUNCTION	0.00	0.00	7435.00	0	00:00	0.00
J3	JUNCTION	0.56	1.01	7496.01	0	01:27	1.01
J4	JUNCTION	0.74	2.15	7467.15	0	01:01	2.15
J5	JUNCTION	0.00	0.00	7525.00	0	00:00	0.00
J6	JUNCTION	0.36	1.02	7571.02	0	01:02	1.02
J7	JUNCTION	0.75	1.90	7546.90	0	01:10	1.90
J8	JUNCTION	0.00	0.00	7525.00	0	00:00	0.00
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	2.01	7587.01	0	00:35	1.99
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	0.26	1.32	7591.32	0	00:35	1.31
N	JUNCTION	0.43	2.30	7537.30	0	00:35	2.30
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	0.74	1.34	7511.34	0	01:34	1.34
SP2	JUNCTION	1.20	2.22	7497.22	0	01:34	2.22
SP3	JUNCTION	1.19	2.22	7492.22	0	01:41	2.22
SP4	JUNCTION	0.80	1.50	7421.50	0	01:37	1.50
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	0.84	7565.84	0	00:40	0.84
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	1.36	7506.36	0	00:40	1.36
X3	JUNCTION	0.49	1.45	7501.45	0	00:45	1.45
OF3	OUTFALL	0.00	0.00	7431.00	0	00:00	0.00
OF1	OUTFALL	0.80	1.50	7416.50	0	01:38	1.50
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	2.74	4.48	7534.48	0	02:10	4.48
P1	STORAGE	2.79	4.84	7429.84	0	01:05	4.84
P10	STORAGE	2.87	4.04	7529.04	0	00:55	4.04
P11	STORAGE	3.90	8.18	7578.18	0	01:19	8.17
P12	STORAGE	3.77	5.64	7555.64	0	00:50	5.64
P13	STORAGE	3.00	4.79	7529.79	0	00:52	4.79
P14	STORAGE	3.97	8.55	7408.55	0	01:10	8.54
P15	STORAGE	3.14	5.94	7560.94	0	01:08	5.93
P2	STORAGE	3.69	7.35	7443.35	0	01:11	7.34
P3	STORAGE	4.82	8.00	7518.00	0	01:27	8.00
P4	STORAGE	3.99	6.84	7475.84	0	01:01	6.84
P5	STORAGE	4.02	7.32	7537.32	0	01:02	7.31
P6	STORAGE	3.59	6.25	7580.25	0	01:02	6.25
P7	STORAGE	3.70	6.96	7556.96	0	01:10	6.96
P8	STORAGE	6.06	7.07	7541.07	0	01:07	7.07
P9	STORAGE	3.20	6.42	7576.42	0	01:09	6.42

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Node Inflow Summary  
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Total Flow		Maximum Lateral		Maximum Total		Lateral Inflow	
Inflow Volume	Balance Error	Type	Inflow CFS	Inflow CFS	Time of Occurrence	Max hr:min	Volume 10^6 gal
Node gal	Percent				days		10^6
-----							
-----							
A		JUNCTION	43.23	43.23	0	00:40	1.28
1.28	0.000						
AA		JUNCTION	80.08	80.08	0	00:40	2.3
2.3	0.000						
B1		JUNCTION	120.96	163.37	0	00:45	4.12
5.4	0.000						
B2		JUNCTION	36.16	110.42	0	00:45	1.37
3.84	0.000						
BB		JUNCTION	83.01	83.01	0	00:40	2.53
2.53	0.000						
BB1		JUNCTION	0.00	476.52	0	00:50	0
16.1	0.000						

BB2		JUNCTION	0.00	507.87	0	00:50	0
17.2	0.000						
BB3		JUNCTION	0.00	638.06	0	00:51	0
24.5	0.000						
C		JUNCTION	74.26	74.26	0	00:45	2.47
2.47	0.000						
CC		JUNCTION	13.39	13.39	0	00:40	0.425
0.425	0.000						
D		JUNCTION	125.58	125.58	0	00:35	2.83
2.83	0.000						
DD		JUNCTION	120.76	120.76	0	00:50	4.75
4.75	0.000						
E		JUNCTION	154.37	346.92	0	01:06	7.29
16.2	0.000						
EE1		JUNCTION	108.79	154.16	0	00:52	3.46
4.85	0.000						
EE2		JUNCTION	62.84	62.84	0	00:35	1.12
1.12	0.000						
EE3		JUNCTION	19.08	19.08	0	00:35	0.457
0.457	0.000						
F		JUNCTION	50.93	50.93	0	00:45	1.71
1.71	0.000						
FF		JUNCTION	42.48	325.29	0	00:51	1.22
11.3	0.000						
G		JUNCTION	56.81	107.75	0	00:45	2.15
3.86	-0.000						
GG		JUNCTION	32.04	32.04	0	00:45	1.11
1.11	0.000						
H		JUNCTION	38.52	38.52	0	00:45	1.5
1.5	0.000						
HH		JUNCTION	27.77	27.77	0	00:40	0.858
0.858	0.000						
I		JUNCTION	71.19	71.19	0	00:40	1.99
1.99	0.000						
II1		JUNCTION	73.38	73.38	0	00:55	3.45
3.45	0.000						
II2		JUNCTION	57.10	114.68	0	00:40	1.56
3.18	0.000						
II3		JUNCTION	57.86	57.86	0	00:40	1.62
1.62	0.000						
IRR_J		JUNCTION	0.00	263.28	0	02:10	0
17.9	0.000						
J		JUNCTION	50.49	50.49	0	00:45	1.91
1.91	0.000						
J10		JUNCTION	0.00	278.55	0	02:07	0
19.4	0.000						
J11		JUNCTION	0.00	199.15	0	01:19	0
8.95	0.000						
J12		JUNCTION	0.00	115.30	0	00:50	0
3.72	0.000						

J13		JUNCTION	0.00	53.36	0	00:52	0
1.39	0.000						
J14		JUNCTION	0.00	151.63	0	01:10	0
6.45	0.000						
J15		JUNCTION	0.00	68.95	0	01:08	0
2.63	0.000						
J2		JUNCTION	0.00	343.11	0	01:11	0
13.2	0.000						
J3		JUNCTION	0.00	47.60	0	01:27	0
3.14	0.000						
J4		JUNCTION	0.00	223.47	0	01:01	0
8.18	0.000						
J5		JUNCTION	0.00	120.83	0	01:02	0
4.1	0.000						
J6		JUNCTION	0.00	48.42	0	01:02	0
1.63	0.000						
J7		JUNCTION	0.00	172.93	0	01:10	0
7.37	0.000						
J8		JUNCTION	0.00	199.58	0	01:07	0
8.37	0.000						
J9		JUNCTION	0.00	250.28	0	01:09	0
9.91	0.000						
JJ		JUNCTION	28.04	28.04	0	00:35	0.592
0.592	0.000						
K		JUNCTION	395.37	395.37	0	00:35	7.98
7.98	0.000						
KK		JUNCTION	16.72	16.72	0	00:40	0.567
0.567	0.000						
L		JUNCTION	39.52	39.52	0	00:40	1.09
1.09	0.000						
LL		JUNCTION	15.68	15.68	0	00:35	0.413
0.413	0.000						
LL1		JUNCTION	0.00	59.47	0	00:35	0
1.57	0.000						
M		JUNCTION	91.76	91.76	0	00:35	1.8
1.8	0.000						
N		JUNCTION	159.57	159.57	0	00:35	2.79
2.79	0.000						
O		JUNCTION	156.19	156.19	0	00:35	3.65
3.65	0.000						
P		JUNCTION	103.06	103.06	0	00:40	3.02
3.02	0.000						
Q		JUNCTION	135.90	135.90	0	00:45	4.91
4.91	0.000						
R		JUNCTION	142.61	273.30	0	00:45	3.89
8.8	0.000						
S		JUNCTION	52.94	52.94	0	00:40	1.49
1.49	0.000						
SP1		JUNCTION	0.00	453.51	0	01:34	0
31.5	0.000						

SP2		JUNCTION	0.00	531.76	0	01:34	0
35.5	0.000						
SP3		JUNCTION	0.00	530.35	0	01:41	0
35.3	0.000						
SP4		JUNCTION	0.00	624.19	0	01:37	0
41.2	0.000						
T		JUNCTION	8.56	8.56	0	00:45	0.355
0.355	0.000						
T1		JUNCTION	0.00	258.02	0	01:09	0
10.3	0.000						
T2		JUNCTION	0.00	273.21	0	01:08	0
10.9	0.000						
U		JUNCTION	10.37	10.37	0	00:45	0.397
0.397	0.000						
V1		JUNCTION	27.11	27.11	0	00:40	0.798
0.798	0.000						
V2		JUNCTION	31.98	31.98	0	00:40	1.04
1.04	0.000						
W		JUNCTION	7.36	7.36	0	00:40	0.252
0.252	0.000						
X1		JUNCTION	177.48	177.48	0	00:40	5.28
5.28	0.000						
X2		JUNCTION	81.30	81.30	0	00:40	2.51
2.51	0.000						
X3		JUNCTION	105.76	163.53	0	00:45	4.27
6.11	0.000						
OF3		OUTFALL	0.00	343.11	0	01:11	0
13.2	0.000						
OF1		OUTFALL	0.00	624.16	0	01:38	0
41.1	0.000						
OF2		OUTFALL	0.00	273.21	0	01:08	0
10.9	0.000						
OF4		OUTFALL	0.00	638.06	0	00:51	0
24.5	0.000						
OF5		OUTFALL	0.00	59.47	0	00:35	0
1.57	0.000						
IRR_POND		STORAGE	0.00	511.28	0	01:08	0
22.7	0.038						
P1		STORAGE	0.00	103.06	0	00:40	0
3.02	0.087						
P10		STORAGE	0.00	38.52	0	00:45	0
1.5	0.228						
P11		STORAGE	0.00	273.25	0	00:46	0
9.24	0.036						
P12		STORAGE	0.00	120.26	0	00:40	0
3.91	0.156						
P13		STORAGE	0.00	80.54	0	00:35	0
1.57	0.116						
P14		STORAGE	0.00	181.87	0	00:47	0
6.63	0.069						

P15		STORAGE	0.00	125.58	0	00:35	0
2.83	0.060						
P2		STORAGE	0.00	368.94	0	01:00	0
13.5	0.044						
P3		STORAGE	0.00	156.19	0	00:35	0
3.65	0.034						
P4		STORAGE	0.00	243.95	0	00:46	0
8.62	0.079						
P5		STORAGE	0.00	176.29	0	00:42	0
4.42	0.069						
P6		STORAGE	0.00	91.45	0	00:36	0
1.8	0.088						
P7		STORAGE	0.00	394.71	0	00:36	0
7.98	0.049						
P8		STORAGE	0.00	199.53	0	01:06	0
8.46	0.176						
P9		STORAGE	0.00	325.33	0	00:40	0
10.3	0.050						

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#### Node Flooding Summary

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No nodes were flooded.

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#### Storage Volume Summary

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of Max Occurrence		Maximum Outflow Storage Unit hr:min CFS	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time days
IRR_POND			928.712	43	0	0	1564.822	72	0
02:10	263.28								
P1			40.045	13	0	0	96.556	32	0
01:05	80.69								
P10			12.768	12	0	0	22.332	20	0
00:54	37.47								
P11			114.099	25	0	0	331.738	73	0

01:18	199.15							
P12		42.885	21	0	0	79.615	39	0
00:50	115.30							
P13		36.673	14	0	0	78.555	31	0
00:51	53.36							
P14		57.491	25	0	0	173.639	77	0
01:10	151.63							
P15		52.602	16	0	0	143.556	44	0
01:07	68.95							
P2		98.962	23	0	0	266.821	63	0
01:11	343.11							
P3		137.125	34	0	0	285.768	71	0
01:27	47.60							
P4		98.896	13	0	0	216.390	28	0
01:00	223.47							
P5		81.985	25	0	0	199.209	61	0
01:01	120.83							
P6		39.871	20	0	0	94.097	46	0
01:02	48.42							
P7		185.363	21	0	0	507.174	58	0
01:10	172.93							
P8		10.437	31	0	0	14.050	42	0
01:06	199.58							
P9		118.968	18	0	0	338.080	52	0
01:09	250.28							

\*\*\*\*\*  
 Outfall Loading Summary  
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Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
OF3	98.33	82.92	343.11	13.174
OF1	94.31	269.93	624.16	41.123
OF2	98.47	68.60	273.21	10.914
OF4	98.47	154.00	638.06	24.502
OF5	64.86	15.01	59.47	1.573
System	90.89	590.46	1808.31	91.286

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 Link Flow Summary  
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Link	Type	Maximum  Flow  CFS	Time of Max Occurrence days hr:min	Maximum  Veloc  ft/sec	Max/ Full Flow	Max/ Full Depth
A100	DUMMY	43.23	0 00:40			
AA100	DUMMY	80.08	0 00:40			
B100	CONDUIT	163.38	0 00:46	5.44	0.53	0.76
B200	CONDUIT	110.07	0 00:47	4.26	0.48	0.73
BB100	DUMMY	83.01	0 00:40			
BB101	DUMMY	476.52	0 00:50			
BB102	DUMMY	507.87	0 00:50			
BB103	DUMMY	638.06	0 00:51			
C100	DUMMY	74.26	0 00:45			
C900	CONDUIT	91.45	0 00:36	8.44	0.15	0.44
CC100	DUMMY	13.39	0 00:40			
D100	DUMMY	125.58	0 00:35			
DD100	DUMMY	120.76	0 00:50			
E100	CONDUIT	346.16	0 01:11	9.49	0.76	0.89
EE100	CONDUIT	154.10	0 00:53	10.71	0.22	0.52
EE101	CONDUIT	325.16	0 00:52	12.79	0.43	0.69
EE200	DUMMY	62.84	0 00:35			
EE300	CONDUIT	18.82	0 00:39	11.60	0.53	0.52
F100	DUMMY	50.93	0 00:45			
G100	CONDUIT	106.69	0 00:51	6.17	0.28	0.58
GG100	DUMMY	32.04	0 00:45			
H100	DUMMY	38.52	0 00:45			
H101	DUMMY	278.55	0 02:07			
HH100	DUMMY	27.77	0 00:40			
I100	DUMMY	71.19	0 00:40			
II100	CONDUIT	73.40	0 00:56	9.45	0.25	0.53
II200	CONDUIT	114.51	0 00:42	9.13	0.54	0.77
II300	CONDUIT	57.75	0 00:41	9.84	0.19	0.49
IRR_J100	DUMMY	263.28	0 02:10			
J100	DUMMY	50.49	0 00:45			
J1100	DUMMY	199.15	0 01:19			
J1200	CONDUIT	110.09	0 01:00	3.67	0.03	0.14
J1300	CONDUIT	52.91	0 00:55	6.28	0.32	0.62
J1400	DUMMY	151.63	0 01:10			
J1500	CONDUIT	68.95	0 01:09	15.76	0.66	0.59
J300	CONDUIT	47.56	0 01:29	6.67	0.08	0.34
J400	CONDUIT	222.97	0 01:04	7.67	0.47	0.72
J500	DUMMY	120.83	0 01:02			
J600	CONDUIT	48.41	0 01:04	7.77	0.21	0.51
J700	CONDUIT	172.92	0 01:11	25.17	0.31	0.38
J800	DUMMY	199.58	0 01:07			
J900	DUMMY	250.28	0 01:09			
JJ100	DUMMY	28.04	0 00:35			
JP20	DUMMY	343.11	0 01:11			
K100	CONDUIT	394.71	0 00:36	16.37	0.40	0.67
KK100	DUMMY	16.72	0 00:40			

L100	DUMMY	39.52	0	00:40			
LL100	DUMMY	15.68	0	00:35			
N100	CONDUIT	158.61	0	00:36	5.28	0.54	0.77
O100	DUMMY	156.19	0	00:35			
OF5	DUMMY	59.47	0	00:35			
P100	DUMMY	103.06	0	00:40			
Q100	DUMMY	135.90	0	00:45			
R100	DUMMY	273.30	0	00:45			
S100	DUMMY	52.94	0	00:40			
SP101	CONDUIT	453.15	0	01:38	5.24	0.12	0.33
SP102	CONDUIT	530.35	0	01:41	3.24	0.32	0.55
SP103	CONDUIT	530.28	0	01:43	9.28	0.04	0.19
SP104	CONDUIT	624.16	0	01:38	6.25	0.10	0.30
SP206	DUMMY	273.21	0	01:08			
T100	DUMMY	8.56	0	00:45			
T101	DUMMY	258.02	0	01:09			
U100	DUMMY	10.37	0	00:45			
V100	DUMMY	27.11	0	00:40			
V200	CONDUIT	31.85	0	00:44	7.15	0.13	0.42
W100	DUMMY	7.36	0	00:40			
X100	DUMMY	177.48	0	00:40			
X200	CONDUIT	80.77	0	00:43	7.10	0.16	0.45
X300	CONDUIT	163.44	0	00:46	11.45	0.20	0.48
IRR_OUTLET	DUMMY	263.28	0	02:10			
01	DUMMY	80.69	0	01:05			
010	DUMMY	37.47	0	00:55			
011	DUMMY	199.15	0	01:19			
012	DUMMY	115.30	0	00:50			
013	DUMMY	53.36	0	00:52			
014	DUMMY	151.63	0	01:10			
015	DUMMY	68.95	0	01:08			
02	DUMMY	343.11	0	01:11			
03	DUMMY	47.60	0	01:27			
04	DUMMY	223.47	0	01:01			
05	DUMMY	120.83	0	01:02			
06	DUMMY	48.42	0	01:02			
07	DUMMY	172.93	0	01:10			
08	DUMMY	199.58	0	01:07			
09	DUMMY	250.28	0	01:09			

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#### Conduit Surcharge Summary

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No conduits were surcharged.

Analysis begun on: Tue Mar 08 16:16:54 2022

Analysis ended on: Tue Mar 08 16:16:54 2022

Total elapsed time: < 1 sec

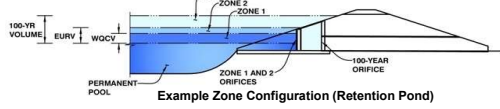
## Appendix D

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Drainage Plan**

Basin ID: **Pond 1**



## Watershed Information

Selected BMP Type =	<b>EDB</b>	
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.

Water Quality Capture Volume (WQCV) =	0.598	acre-feet
Excess Urban Runoff Volume (EURV) =	1.555	acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.962	acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	1.511	acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	2.197	acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	3.278	acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	4.893	acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	6.323	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	8.741	acre-feet
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

## Optional User Overrides

		acre-feet
		acre-feet
	0.92	inches
	1.20	inches
	1.45	inches
		inches
	2.15	inches
	2.49	inches
		inches

## 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 Surge Volume (ISV) =	200	ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2	

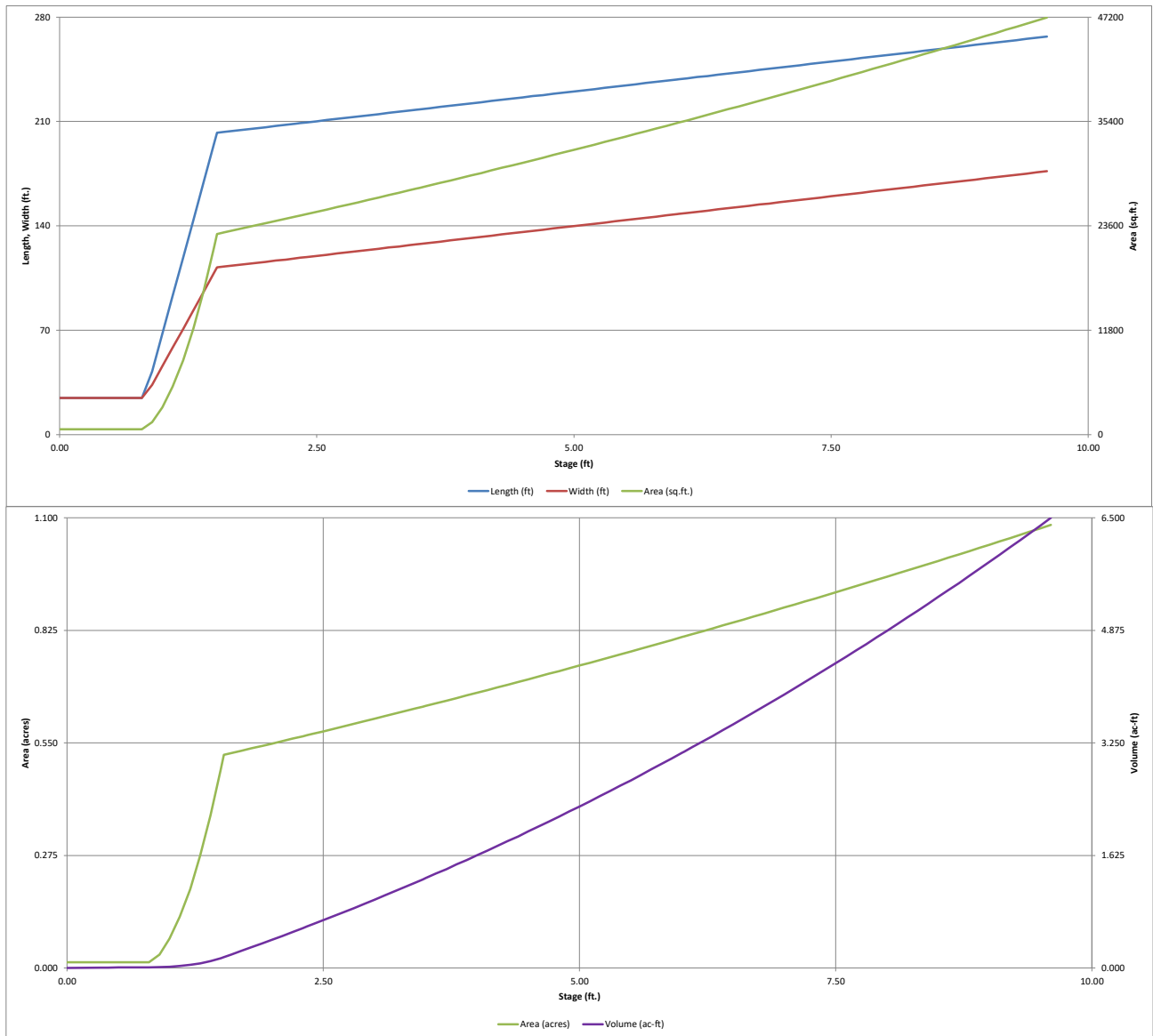
Initial Surge Area (A <sub>ISV</sub> ) =	606	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	24.6	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	24.6	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.70	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	202.4	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	112.1	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	22,695	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	6,302	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.47	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	238.2	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	147.9	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	35,221	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	128,421	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>3.104</b>	acre-feet

## Flying Horse North Drain

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft. <sup>2</sup> )	Optional Override Area (ft. <sup>2</sup> )	Area (acre)	Volume (ft. <sup>3</sup> )	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
Zone 3 (100-year)	6.00		238.2	147.9	35,221		0.809	135,333	3.107
	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

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

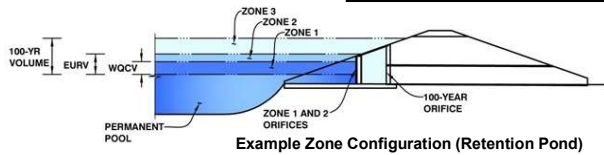


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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 =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-5/8 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  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, H <sub>o</sub> =	2.34	3.47	ft (relative to basin bottom at Stage = 0 ft)	2.34	3.47
Overflow Weir Front Edge Length =	6.00	6.00	feet	6.00	6.00
Overflow Weir Grate Slope =	0.00	0.00	H:V	9.49	3.69
Horiz. Length of Weir Sides =	6.00	6.00	feet	25.06	25.06
Overflow Grate Type =	Type C Grate	Type C Grate		12.53	12.53
Debris Clogging % =	50%	50%	%		

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Circular Orifice Diameter or Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

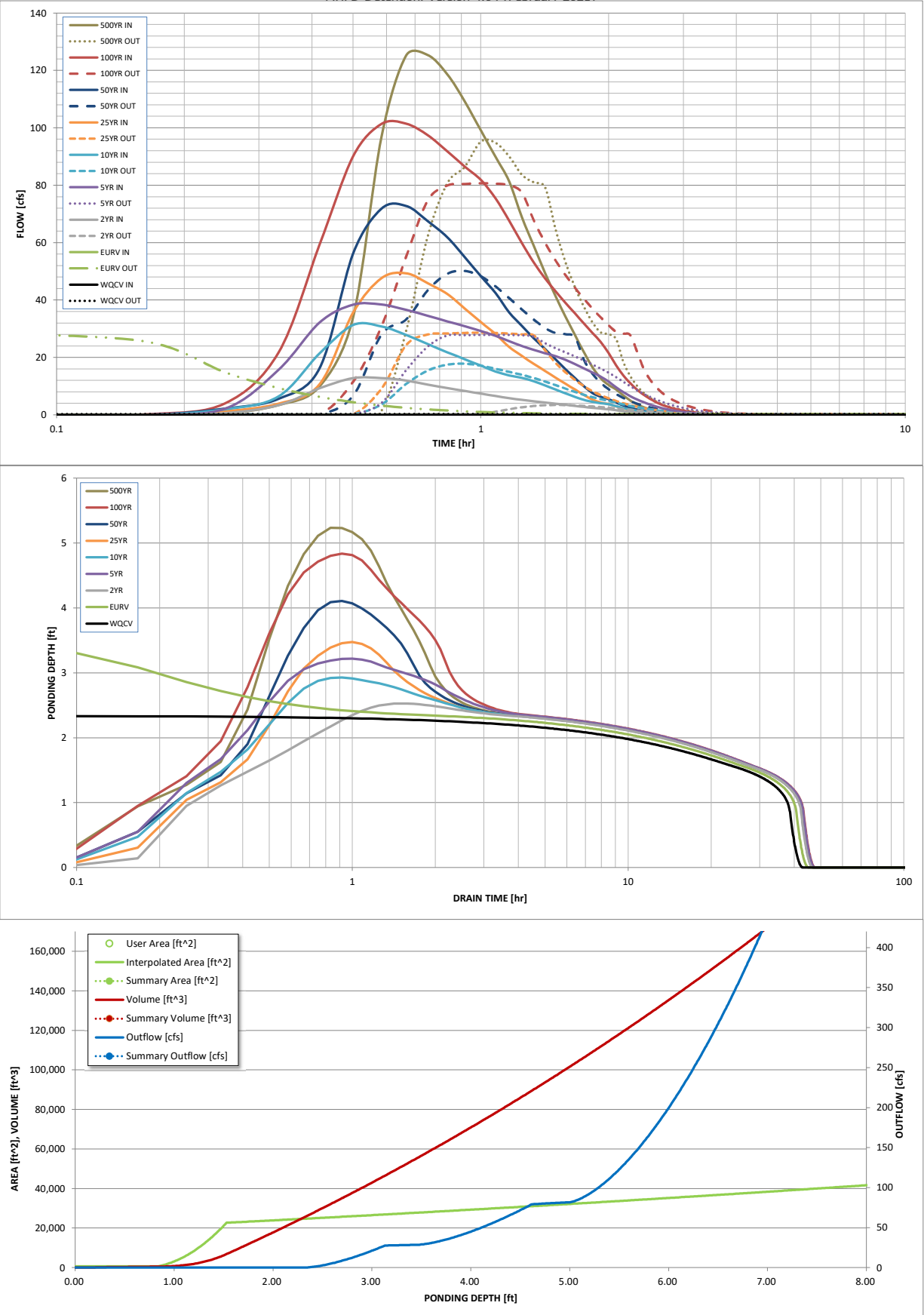
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.598	1.555	0.962	1.511	2.197	3.278	4.893	6.323	8.741
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.962	3.966	2.197	3.278	4.893	9.282	8.741
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.5	3.9	11.5	26.5	44.5	60.8	86.2
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.64	0.26	0.61	1.02	1.85	1.97
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	12.8	38.4	31.3	49.3	72.8	101.4	125.3
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	3.4	27.9	17.8	28.6	50.1	80.7	95.2
Peak Inflow Q (cfs) =	N/A	N/A	N/A	1.0	1.6	1.1	1.1	1.0	1.1
Peak Outflow Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio Peak Outflow to Predevelopment Q =	Overflow Weir 1	Overflow Weir 2	Overflow Weir 1	Outlet Plate 1	Overflow Weir 1	Overflow Weir 2	Overflow Weir 2	Outlet Plate 2	Spillway
Structure Controlling Flow =	N/A	1.17	0.13	1.1	0.7	1.1	1.2	1.3	1.3
Max Velocity through Grate 1 (fps) =	N/A	0.44	N/A	N/A	N/A	0.0	0.8	1.9	2.0
Max Velocity through Grate 2 (fps) =	38	37	41	33	37	34	30	22	22
Time to Drain 97% of Inflow Volume (hours) =	40	41	43	40	42	40	39	35	35
Time to Drain 99% of Inflow Volume (hours) =	2.34	3.90	2.53	3.22	2.93	3.48	4.11	4.84	5.24
Maximum Ponding Depth (ft) =	0.57	0.67	0.58	0.62	0.60	0.64	0.68	0.73	0.75
Area at Maximum Ponding Depth (acres) =	0.598	1.561	0.702	1.116	0.938	1.280	1.695	2.209	2.505
Maximum Volume Stored (acre-ft) =									

DETENTION BASIN OUTLET STRUCTURE DESIGN

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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: ...[SWM]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	0.05	0.00	0.00	0.06	0.23	0.51
	0:15:00	0.00	0.00	0.60	2.20	1.96	1.28	2.18	4.08	3.39
	0:20:00	0.00	0.00	3.35	15.62	6.37	3.91	5.55	21.63	9.84
	0:25:00	0.00	0.00	9.22	32.11	21.41	10.60	16.17	59.20	33.82
	0:30:00	0.00	0.00	12.81	38.38	31.25	35.56	56.08	90.00	96.85
	0:35:00	0.00	0.00	12.83	38.43	30.81	47.58	71.86	101.32	125.12
	0:40:00	0.00	0.00	11.94	36.56	27.81	49.32	72.78	101.42	125.34
	0:45:00	0.00	0.00	10.52	34.49	24.63	45.81	67.44	97.43	118.69
	0:50:00	0.00	0.00	9.31	32.59	21.78	42.11	61.92	91.82	109.19
	0:55:00	0.00	0.00	8.31	30.86	19.39	37.05	54.93	86.50	99.04
	1:00:00	0.00	0.00	7.39	29.18	17.15	32.31	48.29	81.87	89.80
	1:05:00	0.00	0.00	6.57	27.48	15.10	28.14	42.37	75.35	81.30
	1:10:00	0.00	0.00	5.78	25.66	13.74	23.67	35.68	67.64	68.77
	1:15:00	0.00	0.00	5.19	23.98	12.87	20.54	30.96	59.80	58.88
	1:20:00	0.00	0.00	4.72	22.63	11.71	17.74	26.69	53.05	49.58
	1:25:00	0.00	0.00	4.30	21.48	10.22	15.33	22.96	47.61	41.35
	1:30:00	0.00	0.00	3.90	20.44	8.81	12.98	19.31	43.05	34.25
	1:35:00	0.00	0.00	3.50	19.17	7.48	10.83	15.93	39.01	27.75
	1:40:00	0.00	0.00	3.10	17.66	6.26	8.80	12.80	35.29	21.80
	1:45:00	0.00	0.00	2.74	16.15	5.19	6.92	9.92	31.80	16.59
	1:50:00	0.00	0.00	2.47	14.73	4.51	5.28	7.60	28.49	12.76
	1:55:00	0.00	0.00	2.15	13.33	4.08	4.33	6.29	25.40	10.41
	2:00:00	0.00	0.00	1.92	11.58	3.68	3.77	5.47	21.53	8.86
	2:05:00	0.00	0.00	1.57	9.61	2.99	2.96	4.27	17.27	6.77
	2:10:00	0.00	0.00	1.26	7.92	2.37	2.26	3.25	13.72	5.00
	2:15:00	0.00	0.00	1.00	6.52	1.86	1.75	2.49	10.98	3.66
	2:20:00	0.00	0.00	0.80	5.38	1.45	1.34	1.88	8.82	2.65
	2:25:00	0.00	0.00	0.63	4.43	1.11	1.02	1.42	7.08	1.96
	2:30:00	0.00	0.00	0.49	3.64	0.84	0.78	1.08	5.67	1.47
	2:35:00	0.00	0.00	0.39	2.96	0.63	0.58	0.80	4.50	1.11
	2:40:00	0.00	0.00	0.30	2.39	0.48	0.44	0.60	3.56	0.85
	2:45:00	0.00	0.00	0.23	1.91	0.37	0.34	0.46	2.83	0.65
	2:50:00	0.00	0.00	0.17	1.53	0.27	0.25	0.34	2.28	0.48
	2:55:00	0.00	0.00	0.12	1.23	0.19	0.18	0.24	1.86	0.34
	3:00:00	0.00	0.00	0.08	0.97	0.13	0.12	0.16	1.49	0.22
	3:05:00	0.00	0.00	0.05	0.75	0.07	0.07	0.09	1.17	0.12
	3:10:00	0.00	0.00	0.03	0.57	0.04	0.04	0.05	0.90	0.06
	3:15:00	0.00	0.00	0.01	0.43	0.01	0.01	0.01	0.67	0.02
	3:20:00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.48	0.00
	3:25:00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.33	0.00
	3:30:00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.22	0.00
	3:35:00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.15	0.00
	3:40:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.08	0.00
	3:45:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.05	0.00
	3:50:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	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.

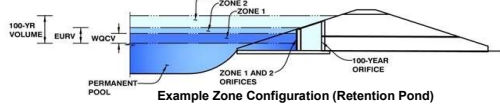
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# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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 =	<b>EDB</b>
Watershed Area =	73.38 acres
Watershed Length =	3,100 ft
Watershed Length to Centroid =	1,450 ft
Watershed Slope =	0.036 ft/ft
Watershed Imperviousness =	26.62% 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.

Water Quality Capture Volume (WQCV) =	0.859 acre-feet
Excess Urban Runoff Volume (EURV) =	1.986 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	1.176 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	1.996 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	3.099 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	4.944 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	7.641 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	10.074 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	14.103 acre-feet
Approximate 2-yr Detention Volume =	1.085 acre-feet
Approximate 5-yr Detention Volume =	1.622 acre-feet
Approximate 10-yr Detention Volume =	2.519 acre-feet
Approximate 25-yr Detention Volume =	3.034 acre-feet
Approximate 50-yr Detention Volume =	3.619 acre-feet
Approximate 100-yr Detention Volume =	4.479 acre-feet

## Optional User Overrides

	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.45	inches
	inches
2.15	inches
2.49	inches
	inches

## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.859 acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.763 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.856 acre-feet
Total Detention Basin Volume =	4.479 acre-feet
Initial Surcharge Volume (ISV) =	500 ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2

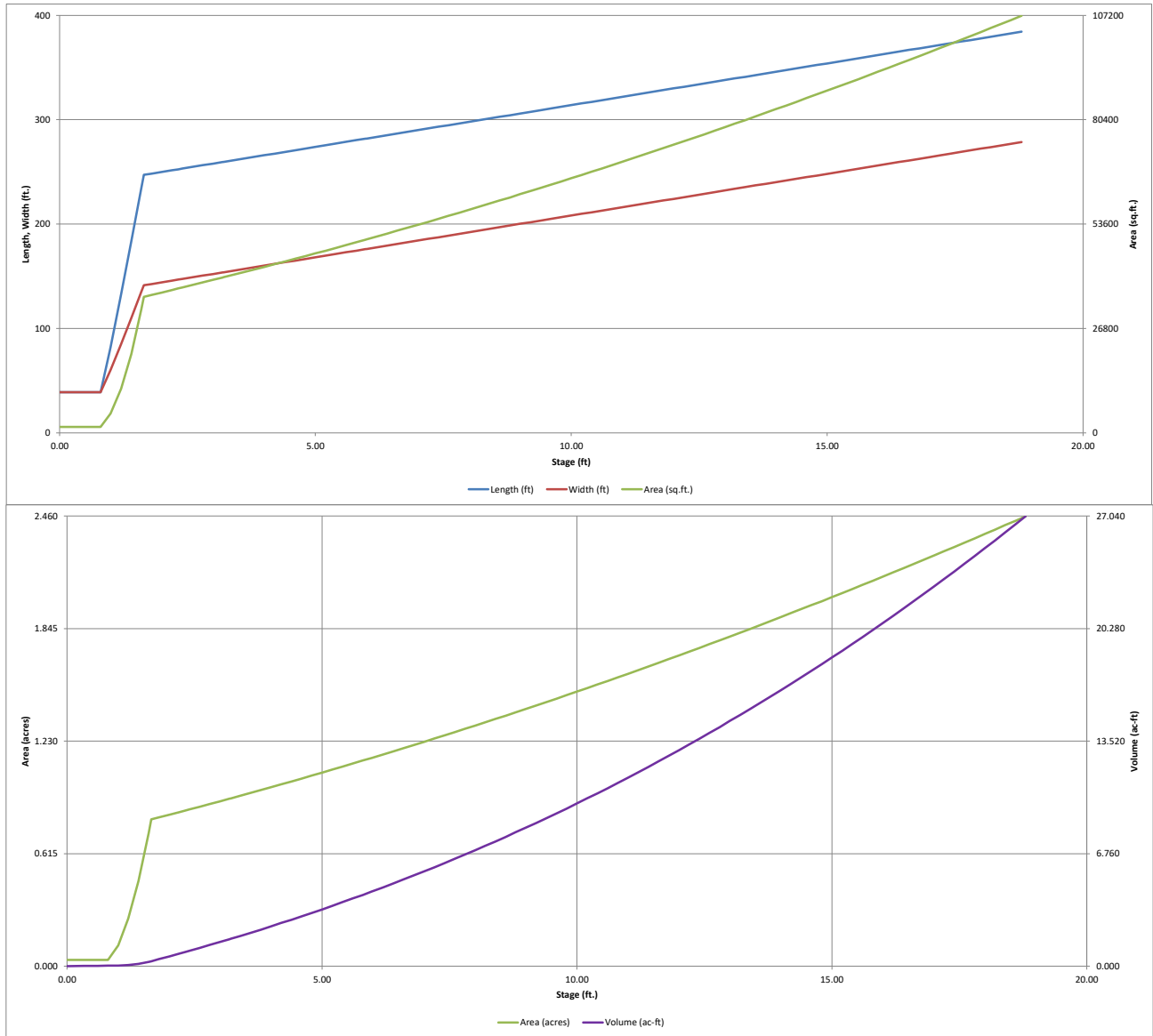
Initial Surcharge Area (A <sub>ISV</sub> ) =	1,515 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	38.9 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	38.9 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.82 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	247.2 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	141.4 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	34,961 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	11,959 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.35 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	282.0 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	176.2 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	49,696 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	183,193 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>4,509</b> acre-feet

Depth Increment = 0.20 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		38.9	38.9	1,515		0.035		
<b>ISV</b>	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
<b>Floor</b>	1.65		247.2	141.4	34,961		0.803	13,295	0.305
	1.80		248.4	142.6	35,429		0.813	18,574	0.426
	2.00		250.0	144.2	36,057		0.828	25,723	0.591
	2.20		251.6	145.8	36,690		0.842	32,997	0.758
<b>Zone 1 (WQCV)</b>	2.32		252.6	146.8	37,073		0.851	37,423	0.859
	2.40		253.2	147.4	37,329		0.857	40,399	0.927
	2.60		254.8	149.0	37,972		0.872	47,929	1.100
	2.80		256.4	150.6	38,621		0.887	55,588	1.276
	3.00		258.0	152.2	39,275		0.902	63,378	1.455
<b>Zone 2 (5-year)</b>	3.19		259.5	153.7	39,901		0.916	70,900	1.628
	3.20		259.6	153.8	39,934		0.917	71,299	1.637
	3.40		261.2	155.4	40,598		0.932	79,352	1.822
	3.60		262.8	157.0	41,267		0.947	87,538	2.010
	3.80		264.4	158.6	41,941		0.963	95,859	2.201
	4.00		266.0	160.2	42,621		0.978	104,315	2.395
	4.20		267.6	161.8	43,305		0.994	112,908	2.592
	4.40		269.2	163.4	43,995		1.010	121,637	2.792
	4.60		270.8	165.0	44,690		1.026	130,506	2.996
	4.80		272.4	166.6	45,389		1.042	139,514	3.203
	5.00		274.0	168.2	46,094		1.058	148,662	3.413
	5.20		275.6	169.8	46,805		1.074	157,952	3.626
	5.40		277.2	171.4	47,520		1.091	167,384	3.843
	5.60		278.8	173.0	48,240		1.107	176,960	4.062
	5.80		280.4	174.6	48,966		1.124	186,681	4.286
<b>Zone 3 (100-year)</b>	5.98		281.8	176.1	49,623		1.139	195,553	4.489
	6.00		282.0	176.2	49,696		1.141	196,547	4.512
	6.20		283.6	177.8	50,432		1.158	206,559	4.742
	6.40		285.2	179.4	51,173		1.175	216,720	4.975
	6.60		286.8	181.0	51,919		1.192	227,029	5.212
	6.80		288.4	182.6	52,670		1.209	237,488	5.452
	7.00		290.0	184.2	53,426		1.226	248,097	5.696
	7.20		291.6	185.8	54,187		1.244	258,858	5.943
	7.40		293.2	187.4	54,954		1.262	269,773	6.193
	7.60		294.8	189.0	55,725		1.279	280,840	6.447
	7.80		296.4	190.6	56,502		1.297	292,063	6.705
	8.00		298.0	192.2	57,284		1.315	303,442	6.966
	8.20		299.6	193.8	58,071		1.333	314,977	7.231
	8.40		301.2	195.4	58,863		1.351	326,670	7.499
	8.60		302.8	197.0	59,660		1.370	338,523	7.771
	8.80		304.4	198.6	60,462		1.388	350,535	8.047
	9.00		306.0	200.2	61,270		1.407	362,708	8.327
	9.20		307.6	201.8	62,082		1.425	375,043	8.610
	9.40		309.2	203.4	62,900		1.444	387,541	8.897
	9.60		310.8	205.0	63,723		1.463	400,203	9.187
	9.80		312.4	206.6	64,551		1.482	413,031	9.482
	10.00		314.0	208.2	65,384		1.501	426,024	9.780
	10.20		315.6	209.8	66,222		1.520	439,184	10.082
	10.40		317.2	211.4	67,065		1.540	452,513	10.388
	10.60		318.8	213.0	67,913		1.559	466,011	10.698
	10.80		320.4	214.6	68,767		1.579	479,679	11.012
	11.00		322.0	216.2	69,626		1.598	493,518	11.330
	11.20		323.6	217.8	70,489		1.618	507,529	11.651
	11.40		325.2	219.4	71,358		1.638	521,714	11.977
	11.60		326.8	221.0	72,232		1.658	536,073	12.307
	11.80		328.4	222.6	73,111		1.678	550,607	12.640
	12.00		330.0	224.2	73,995		1.699	565,318	12.978
	12.20		331.6	225.8	74,885		1.719	580,205	13.320
	12.40		333.2	227.4	75,779		1.740	595,272	13.666
	12.60		334.8	229.0	76,679		1.760	610,517	14.016
	12.80		336.4	230.6	77,583		1.781	625,944	14.370
	13.00		338.0	232.2	78,493		1.802	641,551	14.728
	13.20		339.6	233.8	79,408		1.823	657,341	15.090
	13.40		341.2	235.4	80,328		1.844	673,315	15.457
	13.60		342.8	237.0	81,253		1.865	689,473	15.828
	13.80		344.4	238.6	82,184		1.887	705,816	16.203
	14.00		346.0	240.2	83,119		1.908	722,347	16.583
	14.20		347.6	241.8	84,060		1.930	739,064	16.967
	14.40		349.2	243.4	85,005		1.951	755,971	17.355
	14.60		350.8	245.0	85,956		1.973	773,067	17.747
	14.80		352.4	246.6	86,912		1.995	790,353	18.144
	15.00		354.0	248.2	87,873		2.017	807,832	18.545
	15.20		355.6	249.8	88,839		2.039	825,503	18.951
	15.40		357.2	251.4	89,810		2.062	843,368	19.361
	15.60		358.8	253.0	90,787		2.084	861,427	19.776
	15.80		360.4	254.6	91,768		2.107	879,683	20.195
	16.00		362.0	256.2	92,755		2.129	898,135	20.618
	16.20		363.6	257.8	93,746		2.152	916,785	21.046
	16.40		365.2	259.4	94,743		2.175	935,634	21.479
	16.60		366.8	261.0	95,745		2.198	954,683	21.916
	16.80		368.4	262.6	96,752		2.221	973,932	22.358
	17.00		370.0	264.2	97,765		2.244	993,384	22.805
	17.20		371.6	265.8	98,782		2.268	1,013,038	23.256
	17.40		373.2	267.4	99,804		2.291	1,032,897	23.712
	17.60		374.8	269.0	100,832		2.315	1,052,961	24.173
	17.80		376.4	270.6	101,865		2.338	1,073,230	24.638
	18.00		378.0	272.2	102,902		2.362	1,093,707	25.108
	18.20		379.6	273.8	103,945		2.386	1,114,391	25.583
	18.40		381.2	275.4	104,993		2.410	1,135,285	26.063
	18.60		382.8	277.0	106,047		2.434	1,156,389	26.547
	18.80		384.4	278.6	107,105		2.459	1,177,704	27.036

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

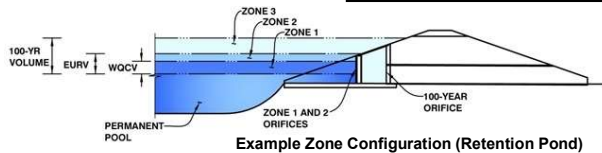


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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)	2.32	0.859	Orifice Plate
Zone 2 (5-year)	3.19	0.763	Weir&Pipe (Circular)
Zone 3 (100-year)	5.98	2.856	Weir&Pipe (Restrict)
Total (all zones)		4.479	

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

Calculated Parameters for Underdrain

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)

Underdrain Orifice Area =  ft<sup>2</sup>

Underdrain Orifice Diameter =  inches

Underdrain Orifice Centroid =  feet

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

Calculated Parameters for Plate

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)

WQ Orifice Area per Row =  ft<sup>2</sup>

Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)

Elliptical Half-Width =  feet

Orifice Plate: Orifice Vertical Spacing =  inches

Elliptical Slot Centroid =  feet

Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 2 inches)

Elliptical Slot Area =  ft<sup>2</sup>

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	0.77	1.55					
Orifice Area (sq. inches)	3.13	3.13	3.13					

	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)

Calculated Parameters for Vertical Orifice

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)

Vertical Orifice Area =  ft<sup>2</sup>

Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)

Vertical Orifice Centroid =  feet

Vertical Orifice Diameter =  inches

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

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir		Zone 2 Weir	Zone 3 Weir
Overflow Weir Front Edge Height, H <sub>o</sub> =	2.33	2.43	ft (relative to basin bottom at Stage = 0 ft)	2.33	5.63
Overflow Weir Front Edge Length =	6.00	6.00	feet	4.00	16.32
Overflow Weir Grate Slope =	0.00	5.00	H:V	3.40	2.57
Horiz. Length of Weir Sides =	4.00	16.00	feet	16.70	68.14
Overflow Grate Type =	Type C Grate	Type C Grate		8.35	34.07
Debris Clogging % =	50%	50%	%		

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 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)	4.91	26.56
Circular Orifice Diameter or Pipe Diameter =	30.00	72.00	inches	1.25	2.83
Restrictor Plate Height Above Pipe Invert =		64.00	inches	N/A	2.46
			Half-Central Angle of Restrictor Plate on Pipe =		

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage =	<input type="text" value=""/>	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth =	<input type="text" value=""/>	feet
Spillway Crest Length =	<input type="text" value=""/>	feet	Stage at Top of Freeboard =	<input type="text" value=""/>	feet
Spillway End Slopes =	<input type="text" value=""/>	H:V	Basin Area at Top of Freeboard =	<input type="text" value=""/>	acres
Freeboard above Max Water Surface =	<input type="text" value=""/>	feet	Basin Volume at Top of Freeboard =	<input type="text" value=""/>	acre-ft

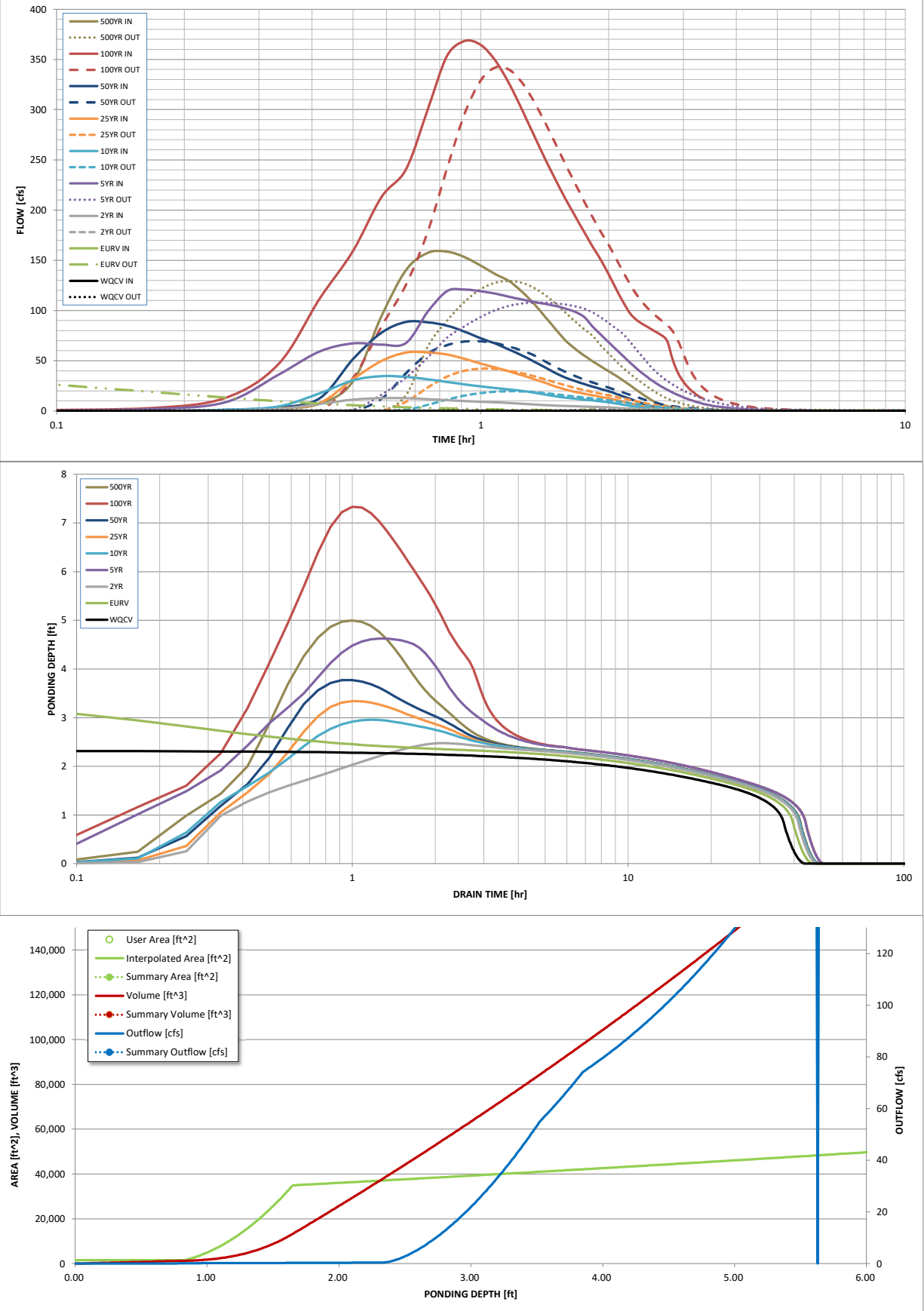
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.859	1.986	1.176	1.996	3.099	4.944	7.641	10.074	14.103
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.176	16.781	3.099	4.944	7.641	41.398	14.103
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.8	5.7	16.9	39.8	67.2	91.2	129.9
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	110.0						
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	1.50	0.23	0.54	0.92	4.80	1.77
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	12.7	120.9	34.6	58.3	88.6	368.3	158.6
Peak Inflow Q (cfs) =	N/A	N/A	2.3	107.8	19.7	42.1	69.4	342.1	129.4
Peak Outflow Q (cfs) =	N/A	N/A	N/A	1.0	1.2	1.1	1.0	1.0	1.0
Ratio Peak Outflow to Predevelopment Q =	Plate	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Outlet Plate 2	overflow Weir
Structure Controlling Flow =	N/A	2.62	0.11	3.4	1.0	2.0	3.0	4.1	3.5
Max Velocity through Grate 1 (fps) =	N/A	0.20	0.00	0.7	0.0	0.1	0.3	4.0	1.0
Max Velocity through Grate 2 (fps) =	37	38	41	20	37	34	30	4	21
Time to Drain 97% of Inflow Volume (hours) =	40	41	44	35	42	40	39	23	35
Time to Drain 99% of Inflow Volume (hours) =	2.32	3.58	2.48	4.62	2.96	3.34	3.77	7.34	5.00
Maximum Ponding Depth (ft) =	0.85	0.95	0.86	1.03	0.90	0.93	0.96	1.26	1.06
Area at Maximum Ponding Depth (acres) =	0.859	1.991	0.988	3.017	1.410	1.766	2.172	6.105	3.402
Maximum Volume Stored (acre-ft) =									

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	0.49	0.00
	0:10:00	0.00	0.00	0.00	1.95	0.00	0.00	0.03	2.98	0.28
	0:15:00	0.00	0.00	0.34	8.73	1.09	0.71	1.21	13.05	1.97
	0:20:00	0.00	0.00	1.99	36.06	4.44	2.37	3.41	46.61	7.22
	0:25:00	0.00	0.00	6.94	59.18	17.57	7.99	12.50	111.57	29.53
	0:30:00	0.00	0.00	11.22	67.25	30.47	31.69	51.67	159.41	94.54
	0:35:00	0.00	0.00	12.67	65.98	34.62	49.83	77.92	212.96	140.45
	0:40:00	0.00	0.00	12.66	67.79	33.91	58.08	88.63	240.82	157.45
	0:45:00	0.00	0.00	11.75	98.89	31.50	58.30	88.24	300.48	158.62
	0:50:00	0.00	0.00	10.76	119.35	28.86	56.18	84.86	353.75	153.10
	0:55:00	0.00	0.00	9.87	120.91	26.46	51.91	78.90	368.34	144.67
	1:00:00	0.00	0.00	9.14	119.09	24.45	47.18	72.34	364.25	136.05
	1:05:00	0.00	0.00	8.57	116.71	22.87	43.18	66.96	348.43	129.36
	1:10:00	0.00	0.00	7.91	113.72	21.45	39.29	61.13	325.90	118.76
	1:15:00	0.00	0.00	7.22	110.95	20.03	35.62	55.36	300.08	106.98
	1:20:00	0.00	0.00	6.53	108.65	18.30	31.79	49.32	274.81	94.07
	1:25:00	0.00	0.00	5.87	106.59	16.28	28.04	43.40	251.28	81.49
	1:30:00	0.00	0.00	5.34	104.57	14.54	24.34	37.65	230.17	70.24
	1:35:00	0.00	0.00	4.97	101.80	13.26	21.35	33.19	211.27	61.91
	1:40:00	0.00	0.00	4.68	98.67	12.24	19.07	29.75	194.18	55.33
	1:45:00	0.00	0.00	4.43	93.80	11.33	17.20	26.86	178.45	49.58
	1:50:00	0.00	0.00	4.20	84.19	10.47	15.55	24.28	163.93	44.40
	1:55:00	0.00	0.00	3.86	76.24	9.57	14.05	21.92	150.73	39.62
	2:00:00	0.00	0.00	3.50	68.48	8.60	12.63	19.69	136.25	35.10
	2:05:00	0.00	0.00	3.06	61.25	7.43	10.99	17.10	121.56	30.19
	2:10:00	0.00	0.00	2.60	54.44	6.24	9.32	14.48	108.16	25.36
	2:15:00	0.00	0.00	2.16	47.91	5.10	7.69	11.92	96.89	20.65
	2:20:00	0.00	0.00	1.74	42.00	4.04	6.13	9.48	90.36	16.15
	2:25:00	0.00	0.00	1.36	36.76	3.09	4.64	7.14	86.09	11.95
	2:30:00	0.00	0.00	1.05	32.05	2.36	3.28	5.02	82.31	8.53
	2:35:00	0.00	0.00	0.83	27.89	1.89	2.31	3.65	78.75	6.29
	2:40:00	0.00	0.00	0.68	24.24	1.55	1.69	2.73	75.37	4.70
	2:45:00	0.00	0.00	0.56	21.07	1.27	1.28	2.08	69.42	3.49
	2:50:00	0.00	0.00	0.47	18.31	1.04	0.97	1.58	50.81	2.56
	2:55:00	0.00	0.00	0.39	15.86	0.84	0.75	1.22	37.81	1.85
	3:00:00	0.00	0.00	0.32	13.67	0.68	0.58	0.94	29.23	1.33
	3:05:00	0.00	0.00	0.26	11.71	0.54	0.45	0.73	23.21	0.99
	3:10:00	0.00	0.00	0.22	10.00	0.43	0.36	0.57	18.70	0.79
	3:15:00	0.00	0.00	0.18	8.54	0.33	0.28	0.45	15.23	0.62
	3:20:00	0.00	0.00	0.14	7.30	0.26	0.22	0.35	12.44	0.49
	3:25:00	0.00	0.00	0.11	6.25	0.20	0.17	0.27	10.23	0.38
	3:30:00	0.00	0.00	0.08	5.38	0.15	0.13	0.20	8.50	0.28
	3:35:00	0.00	0.00	0.06	4.66	0.10	0.09	0.15	7.13	0.20
	3:40:00	0.00	0.00	0.04	4.07	0.07	0.06	0.10	6.06	0.13
	3:45:00	0.00	0.00	0.02	3.57	0.04	0.04	0.06	5.18	0.08
	3:50:00	0.00	0.00	0.01	3.14	0.02	0.02	0.03	4.44	0.04
	3:55:00	0.00	0.00	0.01	2.75	0.01	0.01	0.01	3.82	0.01
	4:00:00	0.00	0.00	0.00	2.42	0.00	0.00	0.00	3.30	0.00
	4:05:00	0.00	0.00	0.00	2.13	0.00	0.00	0.00	2.86	0.00
	4:10:00	0.00	0.00	0.00	1.87	0.00	0.00	0.00	2.48	0.00
	4:15:00	0.00	0.00	0.00	1.65	0.00	0.00	0.00	2.16	0.00
	4:20:00	0.00	0.00	0.00	1.46	0.00	0.00	0.00	1.89	0.00
	4:25:00	0.00	0.00	0.00	1.29	0.00	0.00	0.00	1.65	0.00
	4:30:00	0.00	0.00	0.00	1.15	0.00	0.00	0.00	1.45	0.00
	4:35:00	0.00	0.00	0.00	1.03	0.00	0.00	0.00	1.27	0.00
	4:40:00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	1.13	0.00
	4:45:00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	1.01	0.00
	4:50:00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.90	0.00
	4:55:00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.82	0.00
	5:00:00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.75	0.00
	5:05:00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.72	0.00
	5:10:00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.69	0.00
	5:15:00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.68	0.00
	5:20:00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.67	0.00
	5:25:00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.67	0.00
	5:30:00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.66	0.00
	5:35:00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.66	0.00
	5:40:00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.66	0.00
	5:45:00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.65	0.00
	5:50:00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.65	0.00
	5:55:00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.65	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 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.

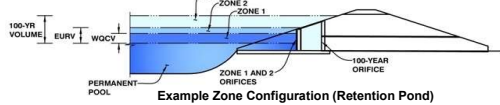
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# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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 =	<b>EDB</b>
Watershed Area =	52.52 acres
Watershed Length =	2,400 ft
Watershed Length to Centroid =	1,179 ft
Watershed Slope =	0.032 ft/ft
Watershed Imperviousness =	40.85% 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.

Water Quality Capture Volume (WQCV) =	0.797 acre-feet
Excess Urban Runoff Volume (EURV) =	2.257 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	1.456 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	2.173 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	3.039 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	4.329 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	6.276 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	7.987 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	10.913 acre-feet
Approximate 2-yr Detention Volume =	1.289 acre-feet
Approximate 5-yr Detention Volume =	1.860 acre-feet
Approximate 10-yr Detention Volume =	2.640 acre-feet
Approximate 25-yr Detention Volume =	3.004 acre-feet
Approximate 50-yr Detention Volume =	3.563 acre-feet
Approximate 100-yr Detention Volume =	4.211 acre-feet

## Optional User Overrides

	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.45	inches
	inches
2.15	inches
2.49	inches
	inches

## Define Zones and Basin Geometry

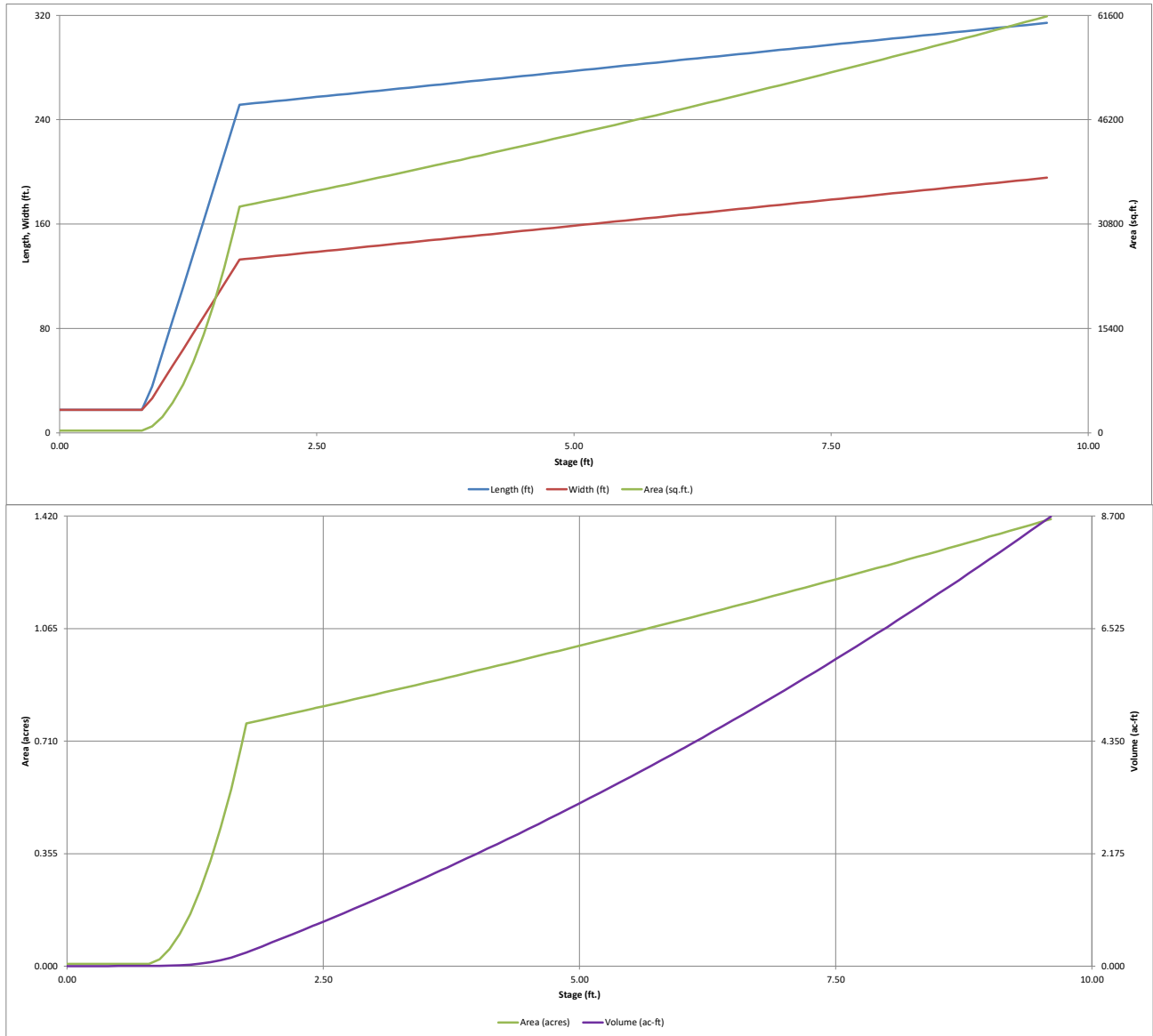
Zone 1 Volume (WQCV) =	0.797 acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.063 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.352 acre-feet
Total Detention Basin Volume =	4.211 acre-feet
Initial Surge Volume (ISV) =	104 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2

Initial Surge Area (A <sub>ISV</sub> ) =	316 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	17.8 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	17.8 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.92 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	251.4 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	132.8 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	33,383 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	11,330 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.25 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	285.4 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	166.8 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	47,602 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	171,202 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>4.196</b> acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		17.8	17.8	316		0.007		
ISV	0.33		17.8	17.8	316		0.007	104	0.002
	0.40		17.8	17.8	316		0.007	126	0.003
	0.50		17.8	17.8	316		0.007	158	0.004
	0.60		17.8	17.8	316		0.007	189	0.004
	0.70		17.8	17.8	316		0.007	221	0.005
	0.80		17.8	17.8	316		0.007	252	0.006
	0.90		35.5	26.5	942		0.022	304	0.007
	1.00		60.9	39.0	2,378		0.055	465	0.011
	1.10		86.3	51.5	4,448		0.102	801	0.018
	1.20		111.7	64.0	7,153		0.164	1,376	0.032
	1.30		137.1	76.5	10,494		0.241	2,253	0.052
	1.40		162.5	89.0	14,469		0.332	3,496	0.080
	1.50		187.9	101.5	19,079		0.438	5,168	0.119
	1.60		213.3	114.0	24,324		0.558	7,332	0.168
	1.70		238.7	126.5	30,205		0.693	10,054	0.231
Floor	1.75		251.4	132.8	33,383		0.766	11,643	0.267
	1.80		251.8	133.2	33,537		0.770	13,316	0.306
	1.90		252.6	134.0	33,845		0.777	16,685	0.383
	2.00		253.4	134.8	34,155		0.784	20,085	0.461
	2.10		254.2	135.6	34,467		0.791	23,516	0.540
	2.20		255.0	136.4	34,779		0.798	26,978	0.619
	2.30		255.8	137.2	35,093		0.806	30,472	0.700
	2.40		256.6	138.0	35,408		0.813	33,997	0.780
Zone 1 (WQCV)	2.43		256.9	138.2	35,503		0.815	35,060	0.805
	2.50		257.4	138.8	35,724		0.820	37,553	0.862
	2.60		258.2	139.6	36,042		0.827	41,142	0.944
	2.70		259.0	140.4	36,361		0.835	44,762	1.028
	2.80		259.8	141.2	36,681		0.842	48,414	1.111
	2.90		260.6	142.0	37,002		0.849	52,098	1.196
	3.00		261.4	142.8	37,325		0.857	55,814	1.281
	3.10		262.2	143.6	37,649		0.864	59,563	1.367
	3.20		263.0	144.4	37,974		0.872	63,344	1.454
	3.30		263.8	145.2	38,301		0.879	67,158	1.542
	3.40		264.6	146.0	38,629		0.887	71,004	1.630
	3.50		265.4	146.8	38,958		0.894	74,884	1.719
	3.60		266.2	147.6	39,288		0.902	78,796	1.809
Zone 2 (5-year)	3.66		266.7	148.0	39,487		0.906	81,159	1.863
	3.70		267.0	148.4	39,620		0.910	82,741	1.899
	3.80		267.8	149.2	39,953		0.917	86,720	1.991
	3.90		268.6	150.0	40,287		0.925	90,732	2.083
	4.00		269.4	150.8	40,623		0.933	94,778	2.176
	4.10		270.2	151.6	40,960		0.940	98,857	2.269
	4.20		271.0	152.4	41,298		0.948	102,969	2.364
	4.30		271.8	153.2	41,637		0.956	107,116	2.459
	4.40		272.6	154.0	41,978		0.964	111,297	2.555
	4.50		273.4	154.8	42,320		0.972	115,512	2.652
	4.60		274.2	155.6	42,663		0.979	119,761	2.749
	4.70		275.0	156.4	43,007		0.987	124,044	2.848
	4.80		275.8	157.2	43,353		0.995	128,362	2.947
	4.90		276.6	158.0	43,700		1.003	132,715	3.047
	5.00		277.4	158.8	44,048		1.011	137,102	3.147
	5.10		278.2	159.6	44,398		1.019	141,525	3.249
	5.20		279.0	160.4	44,749		1.027	145,982	3.351
	5.30		279.8	161.2	45,101		1.035	150,475	3.454
	5.40		280.6	162.0	45,454		1.043	155,002	3.558
	5.50		281.4	162.8	45,809		1.052	159,565	3.663
	5.60		282.2	163.6	46,165		1.060	164,164	3.769
	5.70		283.0	164.4	46,523		1.068	168,799	3.875
	5.80		283.8	165.2	46,881		1.076	173,469	3.982
	5.90		284.6	166.0	47,241		1.085	178,175	4.090
Zone 3 (100-year)	6.00		285.4	166.8	47,602		1.093	182,917	4.199
	6.02		285.6	166.9	47,674		1.094	183,870	4.221
	6.10		286.2	167.6	47,964		1.101	187,695	4.309
	6.20		287.0	168.4	48,258		1.109	192,510	4.419
	6.30		287.8	169.2	48,593		1.118	197,361	4.531
	6.40		288.6	170.0	49,059		1.126	202,249	4.643
	6.50		289.4	170.8	49,427		1.135	207,173	4.756
	6.60		290.2	171.6	49,796		1.143	212,134	4.870
	6.70		291.0	172.4	50,166		1.152	217,132	4.985
	6.80		291.8	173.2	50,537		1.160	222,167	5.100
	6.90		292.6	174.0	50,910		1.169	227,240	5.217
	7.00		293.4	174.8	51,284		1.177	232,349	5.334
	7.10		294.2	175.6	51,659		1.186	237,496	5.452
	7.20		295.0	176.4	52,035		1.195	242,681	5.571
	7.30		295.8	177.2	52,413		1.203	247,903	5.691
	7.40		296.6	178.0	52,792		1.212	253,164	5.812
	7.50		297.4	178.8	53,173		1.221	258,462	5.933
	7.60		298.2	179.6	53,554		1.229	263,798	6.056
	7.70		299.0	180.4	53,937		1.238	269,173	6.179
	7.80		299.8	181.2	54,321		1.247	274,586	6.304
	7.90		300.6	182.0	54,707		1.256	280,037	6.429
	8.00		301.4	182.8	55,093		1.265	285,527	6.555
	8.10		302.2	183.6	55,481		1.274	291,056	6.682
	8.20		303.0	184.4	55,871		1.283	296,623	6.810
	8.30		303.8	185.2	56,261		1.292	302,230	6.938
	8.40		304.6	186.0	56,653		1.301	307,876	7.068
	8.50		305.4	186.8	57,046		1.310	313,561	7.198
	8.60		306.2	187.6	57,441		1.319	319,285	7.330
	8.70		307.0	188.4	57,836		1.328	325,049	7.462
	8.80		307.8	189.2	58,233		1.337	330,852	7.595
	8.90		308.6	190.0	58,632		1.346	336,696	7.729
	9.00		309.4	190.8	59,031		1.355	342,579	7.865
	9.10		310.2	191.6	59,432		1.364	348,502	8.001
	9.20		311.0	192.4	59,834		1.374	354,465	8.137
	9.30		311.8	193.2	60,237		1.383	360,469	8.275
	9.40		312.6	194.0	60,642		1.392	366,513	8.414
	9.50		313.4	194.8	61,048		1.401	372,597	8.554
	9.60		314.2	195.6	61,455		1.411	378,722	8.694

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

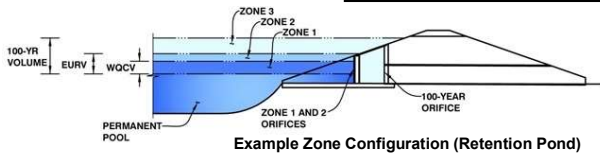


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 3**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.43	0.797	Orifice Plate
Zone 2 (5-year)	3.66	1.063	Rectangular Orifice
Zone 3 (100-year)	6.02	2.352	Weir&Pipe (Restrict)
Total (all zones)		4.211	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-13/16 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	2.57	2.57	2.57					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Height =  inches  
Vertical Orifice Width =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Rectangular Not Selected  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  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, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =  N/A  
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir Not Selected  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =  N/A  
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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 =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor Not Selected  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

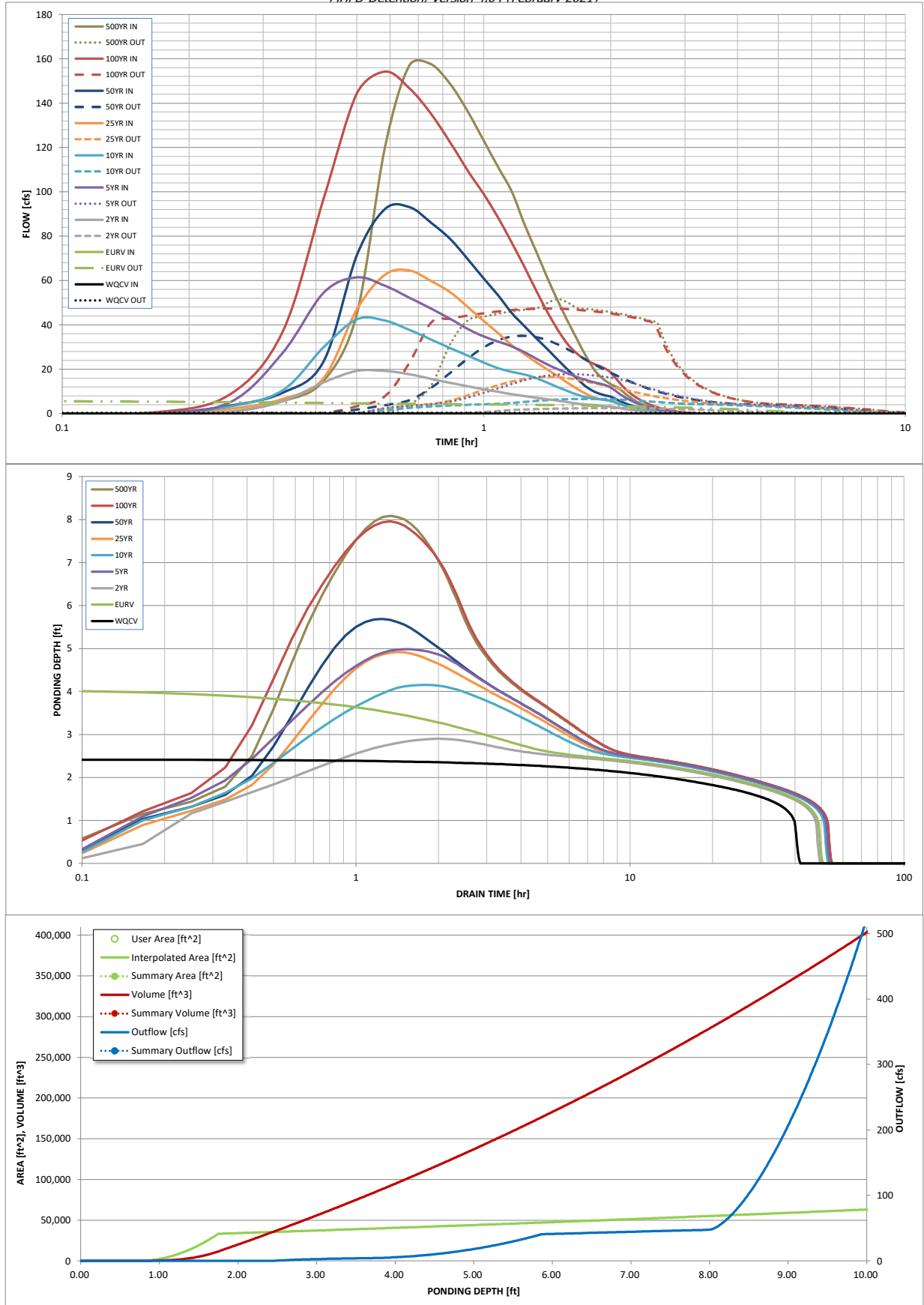
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
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) =	0.797	2.257	1.456	2.173	3.039	4.329	6.276	7.987	10.913
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.456	4.868	3.039	4.329	6.276	11.210	10.913
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.6	4.2	12.4	29.4	49.5	67.3	95.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		16.4				47.8	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.31	0.24	0.56	0.94	0.91	1.82
Peak Inflow Q (cfs) =	N/A	N/A	19.2	61.4	42.5	64.5	93.1	154.2	157.5
Peak Outflow Q (cfs) =	0.3	6.0	2.5	17.8	6.6	16.6	35.1	47.4	51.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	0.5	0.6	0.7	1.0	0.5
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	0.3	0.0	0.2	0.7	0.9	0.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	44	45	42	45	43	39	32	33
Time to Drain 99% of Inflow Volume (hours) =	40	48	47	49	49	49	48	45	45
Maximum Ponding Depth (ft) =	2.43	4.09	2.90	4.98	4.15	4.92	5.69	7.96	8.09
Area at Maximum Ponding Depth (acres) =	0.82	0.94	0.85	1.01	0.94	1.00	1.07	1.26	1.27
Maximum Volume Stored (acre-ft) =	0.805	2.260	1.196	3.127	2.317	3.057	3.854	6.492	6.656

# 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: ...[SWM]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	0.14	0.00	0.00	0.10	0.66	0.84
	0:15:00	0.00	0.00	1.02	5.11	3.26	2.12	3.60	8.65	5.62
	0:20:00	0.00	0.00	5.70	27.39	10.44	6.61	9.38	36.92	14.68
	0:25:00	0.00	0.00	14.04	54.44	29.89	15.88	23.32	96.57	44.71
	0:30:00	0.00	0.00	19.24	61.39	42.52	46.89	71.25	144.22	120.19
	0:35:00	0.00	0.00	19.24	57.65	41.94	62.66	92.23	154.23	157.03
	0:40:00	0.00	0.00	17.76	52.27	37.75	64.52	93.11	146.65	157.51
	0:45:00	0.00	0.00	15.67	47.36	33.44	59.81	86.11	135.14	148.54
	0:50:00	0.00	0.00	13.87	42.71	29.52	54.70	78.69	122.25	136.23
	0:55:00	0.00	0.00	12.37	38.19	26.13	48.12	69.68	109.53	123.08
	1:00:00	0.00	0.00	10.96	34.77	23.05	41.76	60.90	98.92	110.94
	1:05:00	0.00	0.00	9.81	32.49	20.48	36.26	53.22	88.16	100.05
	1:10:00	0.00	0.00	8.75	30.31	18.82	30.82	45.30	76.98	85.26
	1:15:00	0.00	0.00	7.90	27.65	17.64	26.84	39.40	66.02	72.94
	1:20:00	0.00	0.00	7.17	24.80	16.00	23.18	33.94	55.36	61.25
	1:25:00	0.00	0.00	6.49	22.17	13.94	19.91	29.04	45.84	50.72
	1:30:00	0.00	0.00	5.84	20.01	11.95	16.77	24.22	37.68	41.60
	1:35:00	0.00	0.00	5.19	18.21	10.12	13.86	19.74	31.26	33.29
	1:40:00	0.00	0.00	4.59	16.48	8.53	11.19	15.66	26.91	25.78
	1:45:00	0.00	0.00	4.14	15.11	7.40	8.82	12.11	24.14	19.56
	1:50:00	0.00	0.00	3.91	14.10	6.77	7.22	9.88	22.24	15.75
	1:55:00	0.00	0.00	3.51	13.22	6.30	6.28	8.52	20.89	13.32
	2:00:00	0.00	0.00	3.14	11.78	5.77	5.71	7.65	18.58	11.63
	2:05:00	0.00	0.00	2.57	9.44	4.70	4.56	6.06	14.68	9.02
	2:10:00	0.00	0.00	2.03	7.30	3.69	3.51	4.63	11.18	6.67
	2:15:00	0.00	0.00	1.60	5.64	2.87	2.71	3.53	8.55	4.90
	2:20:00	0.00	0.00	1.25	4.33	2.21	2.07	2.67	6.57	3.59
	2:25:00	0.00	0.00	0.97	3.29	1.69	1.59	2.03	5.02	2.71
	2:30:00	0.00	0.00	0.75	2.48	1.27	1.20	1.52	3.80	2.03
	2:35:00	0.00	0.00	0.58	1.85	0.95	0.90	1.14	2.88	1.53
	2:40:00	0.00	0.00	0.44	1.39	0.72	0.68	0.85	2.18	1.16
	2:45:00	0.00	0.00	0.33	1.03	0.54	0.51	0.64	1.62	0.88
	2:50:00	0.00	0.00	0.23	0.75	0.39	0.38	0.46	1.16	0.63
	2:55:00	0.00	0.00	0.16	0.53	0.26	0.26	0.32	0.81	0.42
	3:00:00	0.00	0.00	0.09	0.37	0.16	0.16	0.20	0.55	0.26
	3:05:00	0.00	0.00	0.05	0.25	0.08	0.09	0.10	0.35	0.13
	3:10:00	0.00	0.00	0.02	0.15	0.03	0.04	0.04	0.20	0.05
	3:15:00	0.00	0.00	0.01	0.09	0.01	0.01	0.01	0.12	0.00
	3:20:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.08	0.00
	3:25:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.05	0.00
	3:30:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00
	3:35:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03	0.00
	3:40:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	3:45:00	0.00	0.00	0.00	0.02	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	0.00	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

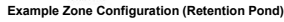
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

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.

[illegible]

*MHFD-Detention, Version 4.04 (February 2021)*

**Basin ID:** Pond 4

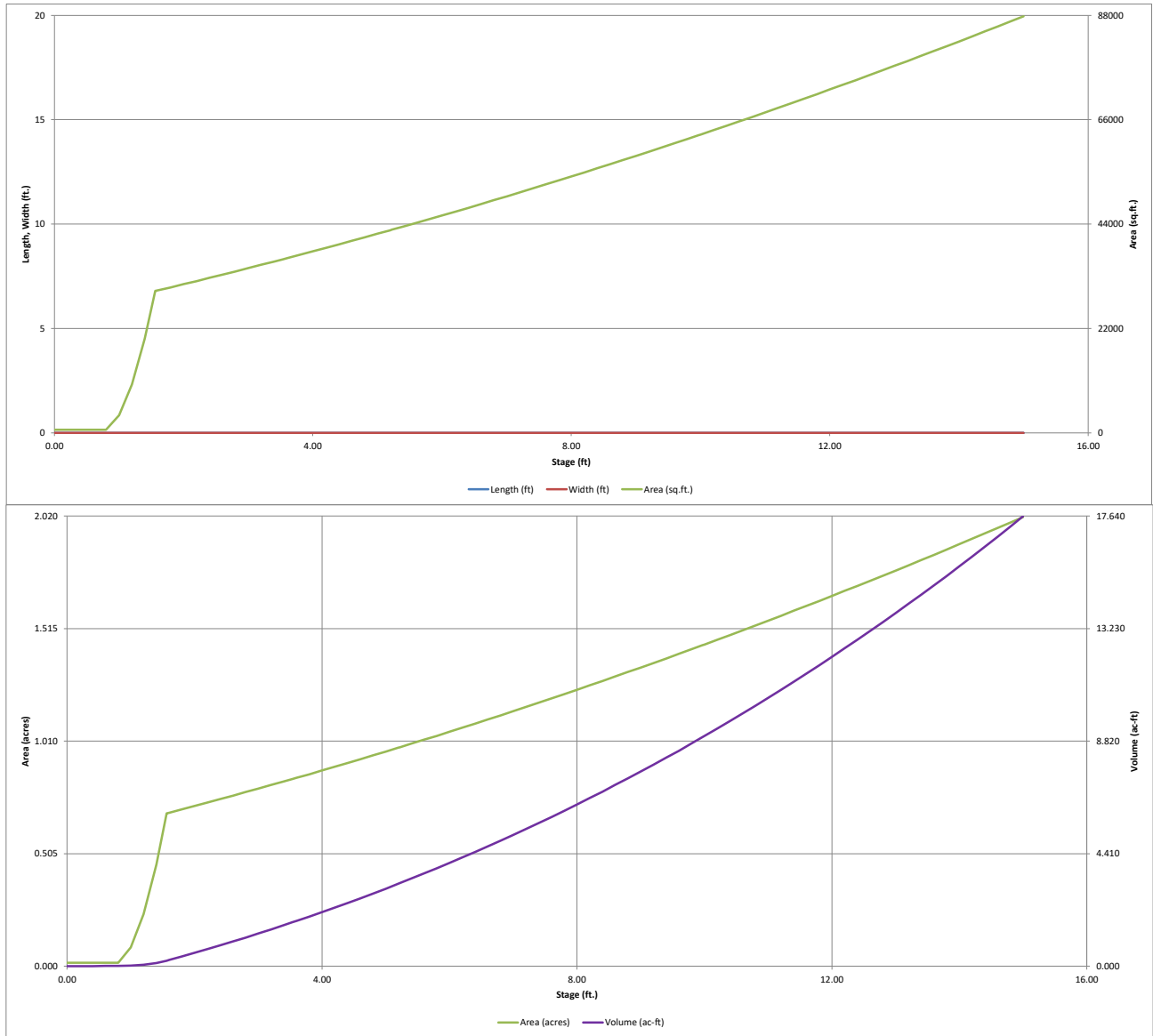


Initial Surchage Area ( $A_{ISV}$ ) =	user	ft <sup>2</sup>
Surchage Volume Length ( $L_{ISV}$ ) =	user	ft
Surchage Volume Width ( $W_{ISV}$ ) =	user	ft
Depth of Basin Floor ( $H_{FLOOR}$ ) =	user	ft
Length of Basin Floor ( $L_{FLOOR}$ ) =	user	ft
Width of Basin Floor ( $W_{FLOOR}$ ) =	user	ft
Area of Basin Floor ( $A_{FLOOR}$ ) =	user	ft <sup>2</sup>
Volume of Basin Floor ( $V_{FLOOR}$ ) =	user	ft <sup>3</sup>
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 <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ ) =	user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{TOTAL}$ ) =	user	acre-feet

Depth Increment =	0.20	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	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.

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

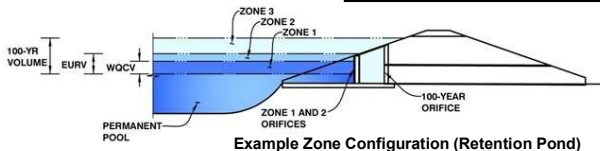


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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)	3.12	1.374	Orifice Plate
Zone 2 (5-year)	4.53	1.221	Weir&Pipe (Circular)
Zone 3 (100-year)	8.66	4.570	Weir&Pipe (Restrict)
Total (all zones)		7.166	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (use rectangular openings)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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	1.04	2.08					
Orifice Area (sq. inches)	4.68	4.68	4.68					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Circular Orifice Diameter or Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

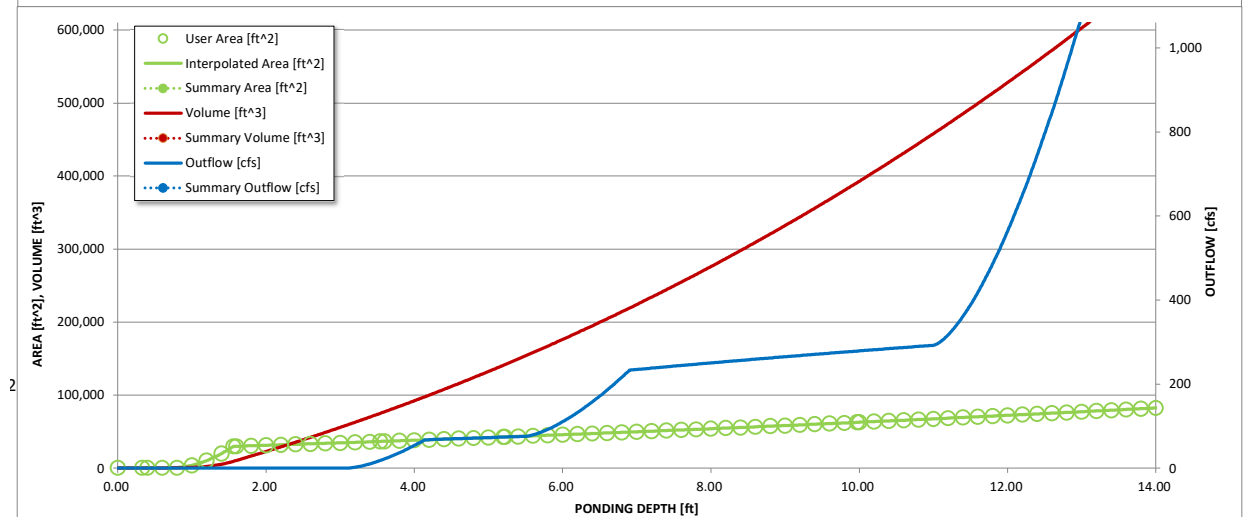
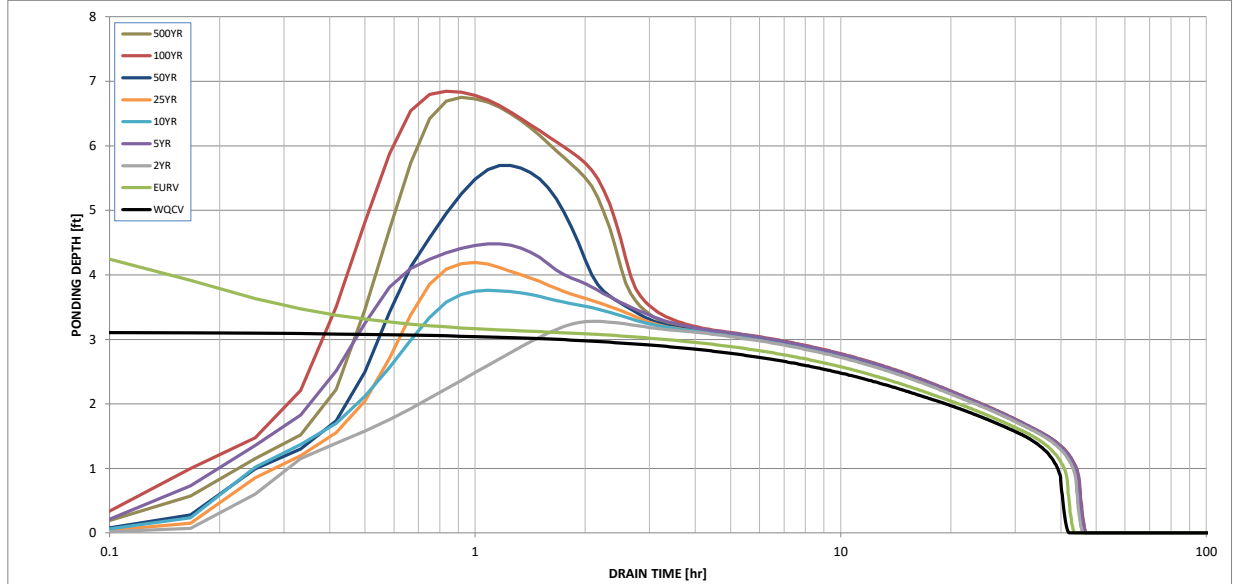
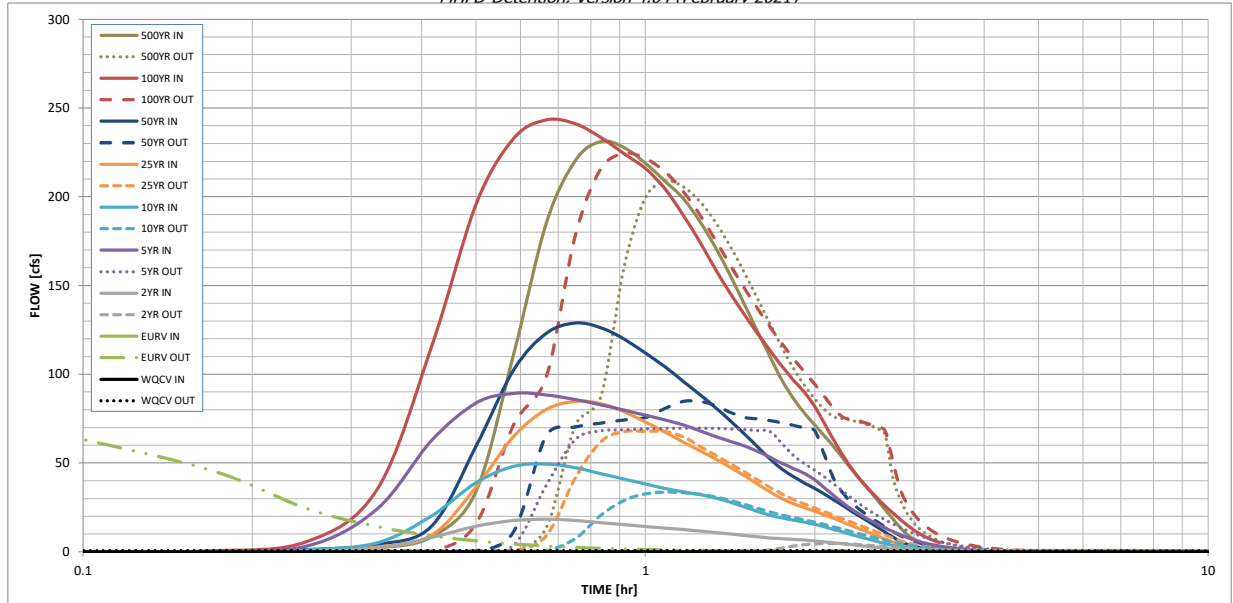
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	1.374	3.177	1.885	3.200	4.970	7.929	12.257	16.160	22.627
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.885	11.170	4.970	7.929	12.257	26.466	22.627
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.1	7.9	23.5	57.3	96.9	132.1	188.3
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.60	0.20	0.49	0.83	1.97	1.60
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	18.4	89.3	49.5	84.8	128.8	243.2	231.1
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	4.8	69.7	33.6	67.8	84.7	224.4	208.7
Peak Inflow Q (cfs) =	N/A	N/A	N/A	1.0	1.4	1.2	0.9	1.0	1.1
Peak Outflow Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Structure Controlling Flow =	Overflow Weir 1	Outlet Plate 1	Overflow Weir 1	Outlet Plate 1	Overflow Weir 1	Outlet Plate 1	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2
Max Velocity through Grate 1 (fps) =	N/A	1.09	0.06	1.0	0.5	1.0	1.1	1.2	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.1	1.1	0.9
Time to Drain 97% of Inflow Volume (hours) =	38	37	41	31	37	34	29	17	19
Time to Drain 99% of Inflow Volume (hours) =	40	40	44	39	42	40	39	33	34
Maximum Ponding Depth (ft) =	3.12	5.15	3.28	4.48	3.76	4.19	5.70	6.85	6.75
Area at Maximum Ponding Depth (acres) =	0.81	0.98	0.82	0.92	0.86	0.89	1.02	1.13	1.12
Maximum Volume Stored (acre-ft) =	1.378	3.186	1.500	2.551	1.903	2.288	3.726	4.964	4.863

# 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	0.14	0.00	0.00	0.04	0.49	0.30
	0:15:00	0.00	0.00	0.36	3.21	1.15	0.75	1.30	5.79	2.20
	0:20:00	0.00	0.00	2.22	24.17	5.11	2.78	4.08	35.12	8.40
	0:25:00	0.00	0.00	8.06	62.70	20.23	9.33	14.50	115.55	34.03
	0:30:00	0.00	0.00	14.50	83.81	39.01	36.55	59.47	195.66	111.56
	0:35:00	0.00	0.00	17.63	89.26	48.15	65.03	102.55	232.92	185.33
	0:40:00	0.00	0.00	18.38	88.39	49.46	80.21	123.07	243.22	220.19
	0:45:00	0.00	0.00	17.69	85.74	47.40	84.77	128.82	241.20	231.13
	0:50:00	0.00	0.00	16.42	82.80	44.06	83.48	126.25	233.36	227.71
	0:55:00	0.00	0.00	15.27	79.77	40.94	78.90	119.80	224.23	218.78
	1:00:00	0.00	0.00	14.25	76.90	38.16	73.05	111.86	215.93	208.79
	1:05:00	0.00	0.00	13.36	74.25	35.70	67.47	104.20	204.36	199.18
	1:10:00	0.00	0.00	12.53	71.46	33.80	61.89	96.09	189.86	186.02
	1:15:00	0.00	0.00	11.70	68.21	32.21	56.97	88.56	174.38	171.23
	1:20:00	0.00	0.00	10.88	64.95	30.33	52.25	81.15	158.98	155.50
	1:25:00	0.00	0.00	10.07	62.11	27.93	47.55	73.73	145.36	139.33
	1:30:00	0.00	0.00	9.27	59.57	25.32	42.83	66.34	133.57	124.06
	1:35:00	0.00	0.00	8.49	56.64	22.77	38.15	59.04	122.98	109.52
	1:40:00	0.00	0.00	7.82	53.11	20.60	33.67	52.11	113.22	96.35
	1:45:00	0.00	0.00	7.35	49.82	19.03	29.91	46.50	104.35	86.25
	1:50:00	0.00	0.00	7.01	46.93	17.84	27.11	42.31	96.66	78.27
	1:55:00	0.00	0.00	6.62	44.19	16.69	24.84	38.83	89.91	71.36
	2:00:00	0.00	0.00	6.17	40.57	15.48	22.86	35.74	81.76	65.14
	2:05:00	0.00	0.00	5.63	35.90	14.05	20.79	32.46	71.87	58.70
	2:10:00	0.00	0.00	5.03	31.30	12.52	18.66	29.06	62.31	52.13
	2:15:00	0.00	0.00	4.45	27.22	11.02	16.57	25.75	53.76	45.90
	2:20:00	0.00	0.00	3.91	23.71	9.60	14.57	22.59	46.49	40.08
	2:25:00	0.00	0.00	3.40	20.67	8.27	12.65	19.59	40.31	34.52
	2:30:00	0.00	0.00	2.91	17.99	7.00	10.79	16.68	34.95	29.13
	2:35:00	0.00	0.00	2.44	15.61	5.80	8.98	13.84	30.20	23.84
	2:40:00	0.00	0.00	1.99	13.46	4.65	7.22	11.08	25.93	18.69
	2:45:00	0.00	0.00	1.56	11.51	3.58	5.52	8.41	22.04	13.83
	2:50:00	0.00	0.00	1.19	9.73	2.72	3.92	5.94	18.47	9.83
	2:55:00	0.00	0.00	0.94	8.12	2.16	2.74	4.27	15.21	7.23
	3:00:00	0.00	0.00	0.78	6.72	1.78	1.99	3.18	12.29	5.39
	3:05:00	0.00	0.00	0.65	5.58	1.47	1.49	2.42	9.83	4.00
	3:10:00	0.00	0.00	0.55	4.68	1.22	1.14	1.86	7.92	2.95
	3:15:00	0.00	0.00	0.46	3.93	1.01	0.89	1.45	6.45	2.18
	3:20:00	0.00	0.00	0.39	3.30	0.82	0.71	1.14	5.27	1.59
	3:25:00	0.00	0.00	0.33	2.76	0.66	0.55	0.89	4.31	1.19
	3:30:00	0.00	0.00	0.27	2.30	0.52	0.44	0.70	3.51	0.94
	3:35:00	0.00	0.00	0.22	1.90	0.41	0.34	0.55	2.84	0.74
	3:40:00	0.00	0.00	0.18	1.56	0.32	0.27	0.43	2.30	0.59
	3:45:00	0.00	0.00	0.14	1.25	0.24	0.21	0.33	1.84	0.45
	3:50:00	0.00	0.00	0.10	1.00	0.18	0.16	0.25	1.48	0.34
	3:55:00	0.00	0.00	0.07	0.79	0.13	0.11	0.18	1.18	0.24
	4:00:00	0.00	0.00	0.05	0.61	0.09	0.08	0.12	0.92	0.16
	4:05:00	0.00	0.00	0.03	0.47	0.05	0.05	0.08	0.72	0.09
	4:10:00	0.00	0.00	0.02	0.35	0.03	0.03	0.04	0.54	0.04
	4:15:00	0.00	0.00	0.01	0.26	0.01	0.01	0.02	0.40	0.01
	4:20:00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.29	0.00
	4:25:00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.18	0.00
	4:30:00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.11	0.00
	4:35:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.07	0.00
	4:40:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.04	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.

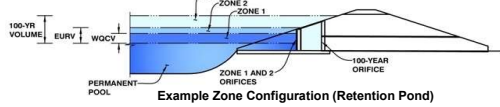
[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 5**



Example Zone Configuration (Retention Pond)

## Watershed Information

Selected BMP Type =	<b>EDB</b>
Watershed Area =	41.57 acres
Watershed Length =	967 ft
Watershed Length to Centroid =	450 ft
Watershed Slope =	0.045 ft/ft
Watershed Imperviousness =	40.57% 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

Note: L / W Ratio < 1  
L / W Ratio = 0.52

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

Water Quality Capture Volume (WQCV) =	0.628 acre-feet
Excess Urban Runoff Volume (EURV) =	1.773 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	1.090 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	1.629 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	2.282 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	3.257 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	4.729 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	6.023 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	8.232 acre-feet
Approximate 2-yr Detention Volume =	1.012 acre-feet
Approximate 5-yr Detention Volume =	1.461 acre-feet
Approximate 10-yr Detention Volume =	2.077 acre-feet
Approximate 25-yr Detention Volume =	2.364 acre-feet
Approximate 50-yr Detention Volume =	2.805 acre-feet
Approximate 100-yr Detention Volume =	3.318 acre-feet

Optional User Overrides	
	acre-feet
	acre-feet
	0.92 inches
	1.20 inches
	1.45 inches
	1.69 inches
	2.15 inches
	2.49 inches
	inches

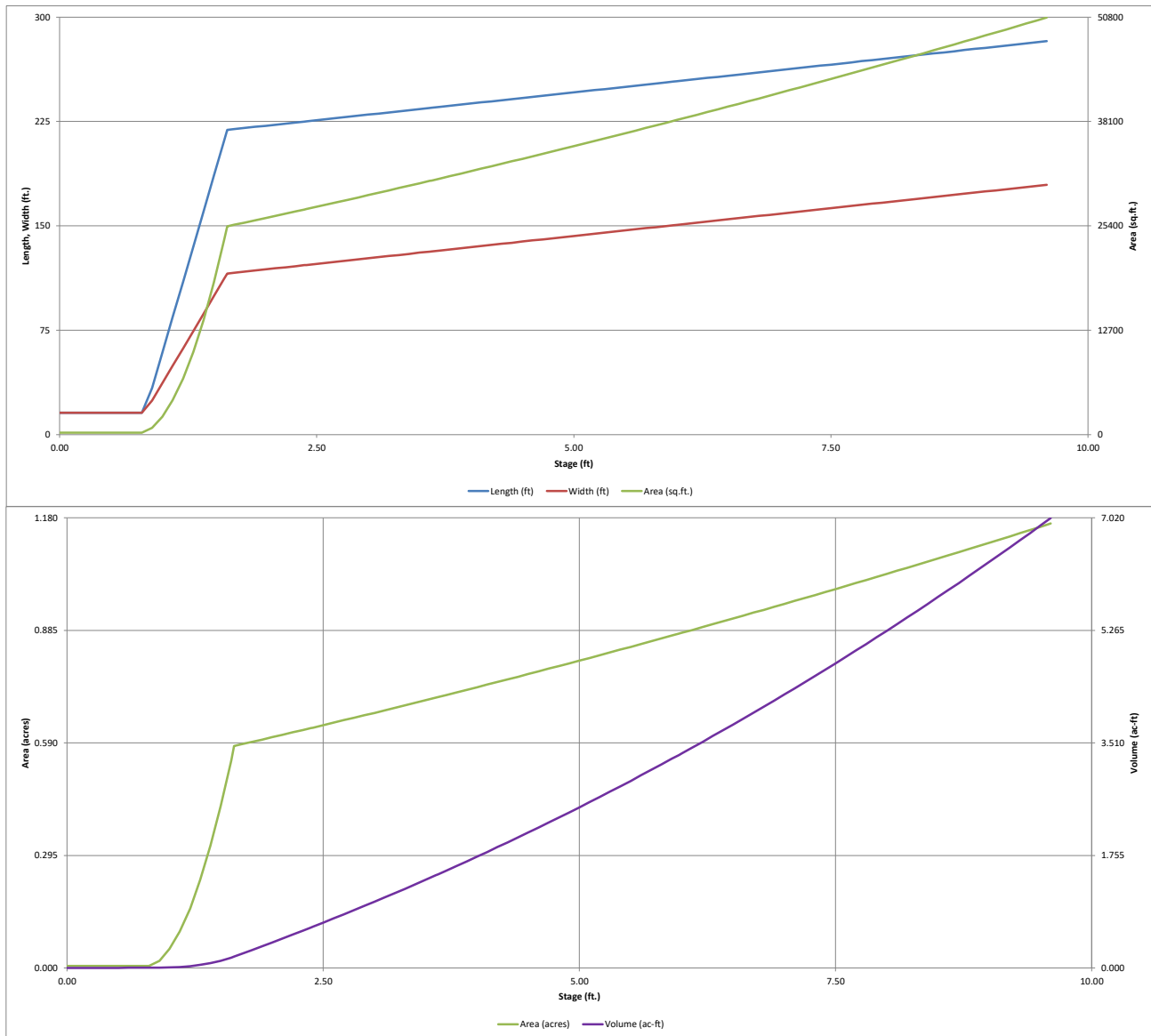
## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.628 acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.833 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.857 acre-feet
Total Detention Basin Volume =	3.318 acre-feet
Initial Surge Volume (ISV) =	82 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2
Initial Surge Area (A <sub>ISV</sub> ) =	249 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	15.8 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	15.8 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.80 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	219.0 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	115.8 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	25,351 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	7,496 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.37 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	253.9 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	150.7 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	38,276 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	138,059 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>3.346</b> acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft. <sup>2</sup> )	Optional Override Area (ft. <sup>2</sup> )	Area (acre)	Volume (ft. <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		15.8	15.8	249		0.006		
ISV	0.33		15.8	15.8	249		0.006	82	0.002
	0.40		15.8	15.8	249		0.006	100	0.002
	0.50		15.8	15.8	249		0.006	124	0.003
	0.60		15.8	15.8	249		0.006	149	0.003
	0.70		15.8	15.8	249		0.006	174	0.004
	0.80		15.8	15.8	249		0.006	199	0.005
	0.90		33.6	24.5	823		0.019	242	0.006
	1.00		59.0	37.0	2,183		0.050	387	0.009
	1.10		84.4	49.5	4,177		0.096	700	0.016
	1.20		109.8	62.0	6,807		0.156	1,244	0.029
	1.30		135.2	74.5	10,072		0.231	2,082	0.048
	1.40		160.6	87.0	13,972		0.321	3,279	0.075
	1.50		186.0	99.5	18,506		0.425	4,898	0.112
	1.60		211.4	112.0	23,676		0.544	7,002	0.161
Floor	1.63		219.0	115.8	25,351		0.582	7,737	0.178
	1.70		219.5	116.3	25,539		0.586	9,518	0.219
	1.80		220.3	117.1	25,808		0.592	12,086	0.277
	1.90		221.1	117.9	26,079		0.599	14,680	0.337
	2.00		221.9	118.7	26,351		0.605	17,301	0.397
	2.10		222.7	119.5	26,624		0.611	19,950	0.458
	2.20		223.5	120.3	26,898		0.617	22,626	0.519
	2.30		224.3	121.1	27,174		0.624	25,330	0.581
Zone 1 (WQCV)	2.38		225.0	121.8	27,395		0.629	27,512	0.632
	2.40		225.1	121.9	27,451		0.630	28,061	0.644
	2.50		225.9	122.7	27,729		0.637	30,820	0.708
	2.60		226.7	123.5	28,009		0.643	33,607	0.772
	2.70		227.5	124.3	28,290		0.649	36,422	0.836
	2.80		228.3	125.1	28,572		0.656	39,265	0.901
	2.90		229.1	125.9	28,855		0.662	42,136	0.967
	3.00		229.9	126.7	29,140		0.669	45,036	1.034
	3.10		230.7	127.5	29,426		0.676	47,964	1.101
	3.20		231.5	128.3	29,713		0.682	50,921	1.169
	3.30		232.3	129.1	30,002		0.689	53,907	1.238
	3.40		233.1	129.9	30,291		0.695	56,922	1.307
	3.50		233.9	130.7	30,583		0.702	59,965	1.377
	3.60		234.7	131.5	30,875		0.709	63,038	1.447
Zone 2 (5-year)	3.62		234.9	131.7	30,934		0.710	63,656	1.461
	3.70		235.5	132.3	31,169		0.716	66,140	1.518
	3.80		236.3	133.1	31,464		0.722	69,272	1.590
	3.90		237.1	133.9	31,760		0.729	72,433	1.663
	4.00		237.9	134.7	32,057		0.736	75,624	1.736
	4.10		238.7	135.5	32,356		0.743	78,844	1.810
	4.20		239.5	136.3	32,656		0.750	82,095	1.885
	4.30		240.3	137.1	32,957		0.757	85,376	1.960
	4.40		241.1	137.9	33,260		0.764	88,687	2.036
	4.50		241.9	138.7	33,564		0.771	92,028	2.113
	4.60		242.7	139.5	33,869		0.778	95,399	2.190
	4.70		243.5	140.3	34,176		0.785	98,802	2.268
	4.80		244.3	141.1	34,483		0.792	102,235	2.347
	4.90		245.1	141.9	34,792		0.799	105,698	2.427
	5.00		245.9	142.7	35,103		0.806	109,193	2.507
	5.10		246.7	143.5	35,414		0.813	112,719	2.588
	5.20		247.5	144.3	35,727		0.820	116,276	2.669
	5.30		248.3	145.1	36,041		0.827	119,864	2.752
	5.40		249.1	145.9	36,357		0.835	123,484	2.835
	5.50		249.9	146.7	36,673		0.842	127,136	2.919
	5.60		250.7	147.5	36,991		0.849	130,819	3.003
	5.70		251.5	148.3	37,310		0.857	134,534	3.088
	5.80		252.3	149.1	37,631		0.864	138,281	3.174
Zone 3 (100-year)	5.90		253.1	149.9	37,953		0.871	142,060	3.261
	5.97		253.7	150.5	38,179		0.876	144,725	3.322
	6.00		253.9	150.7	38,276		0.879	145,872	3.349
	6.10		254.7	151.5	38,600		0.886	149,715	3.437
	6.20		255.5	152.3	38,926		0.894	153,592	3.526
	6.30		256.3	153.1	39,253		0.901	157,501	3.616
	6.40		257.1	153.9	39,581		0.909	161,442	3.706
	6.50		257.9	154.7	39,911		0.916	165,417	3.797
	6.60		258.7	155.5	40,241		0.924	169,425	3.889
	6.70		259.5	156.3	40,573		0.931	173,465	3.982
	6.80		260.3	157.1	40,907		0.939	177,539	4.076
	6.90		261.1	157.9	41,241		0.947	181,647	4.170
	7.00		261.9	158.7	41,577		0.954	185,788	4.265
	7.10		262.7	159.5	41,914		0.962	189,962	4.361
	7.20		263.5	160.3	42,253		0.970	194,170	4.458
	7.30		264.3	161.1	42,593		0.978	198,413	4.555
	7.40		265.1	161.9	42,934		0.986	202,689	4.653
	7.50		265.9	162.7	43,276		0.993	206,999	4.752
	7.60		266.7	163.5	43,619		1.001	211,344	4.852
	7.70		267.5	164.3	43,964		1.009	215,723	4.952
7.80		268.3	165.1	44,310		1.017	220,137	5.054	
7.90		269.1	165.9	44,658		1.025	224,586	5.156	
8.00		269.9	166.7	45,007		1.033	229,069	5.259	
8.10		270.7	167.5	45,357		1.041	233,587	5.362	
8.20		271.5	168.3	45,708		1.049	238,140	5.467	
8.30		272.3	169.1	46,060		1.057	242,728	5.572	
8.40		273.1	169.9	46,414		1.066	247,352	5.678	
8.50		273.9	170.7	46,769		1.074	252,011	5.785	
8.60		274.7	171.5	47,126		1.082	256,706	5.893	
8.70		275.5	172.3	47,483		1.090	261,437	6.002	
8.80		276.3	173.1	47,842		1.098	266,203	6.111	
8.90		277.1	173.9	48,202		1.107	271,005	6.221	
9.00		277.9	174.7	48,564		1.115	275,843	6.332	
9.10		278.7	175.5	48,927		1.123	280,718	6.444	
9.20		279.5	176.3	49,291		1.132	285,629	6.557	
9.30		280.3	177.1	49,656		1.140	290,576	6.671	
9.40		281.1	177.9	50,023		1.148	295,560	6.785	
9.50		281.9	178.7	50,391		1.157	300,581	6.900	
9.60		282.7	179.5	50,760		1.165	305,638	7.016	

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

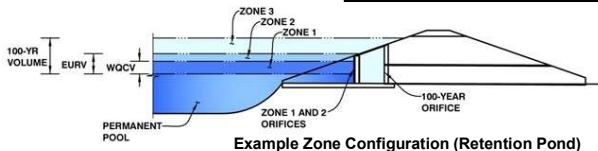


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 5**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.38	0.628	Orifice Plate
Zone 2 (5-year)	3.62	0.833	Circular Orifice
Zone 3 (100-year)	5.97	1.857	Weir&Pipe (Restrict)
Total (all zones)		3.318	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-5/8 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	2.10	2.10	2.10					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Circular Not Selected  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir Not Selected  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor Not Selected  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

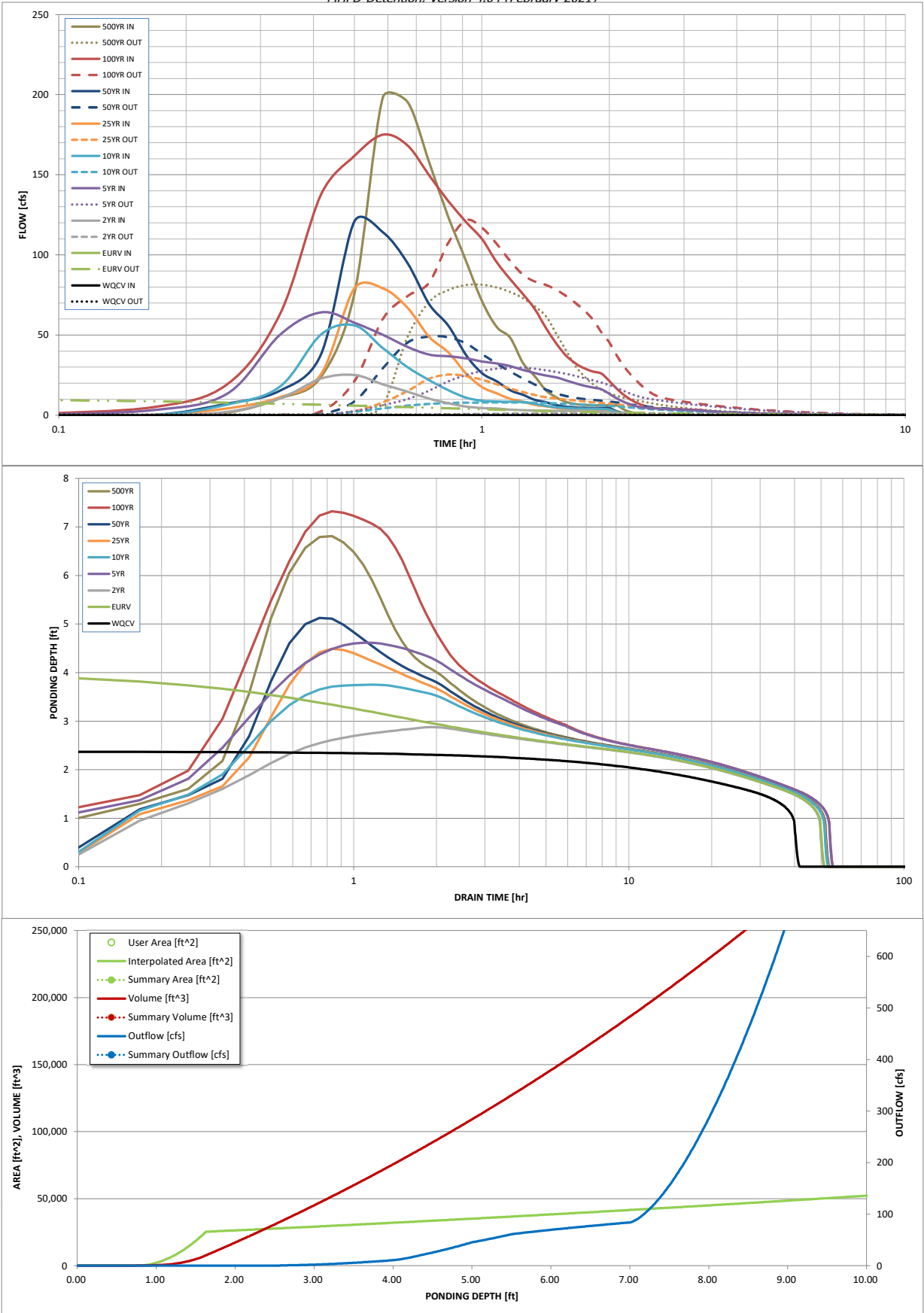
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
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) =	0.628	1.773	1.090	1.629	2.282	3.257	4.729	6.023	8.232
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.090	5.570	2.282	3.257	4.729	13.593	8.232
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.9	6.7	20.1	42.1	71.8	97.3	137.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		41.0				117.6	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.99	0.48	1.01	1.73	2.83	3.30
Peak Inflow Q (cfs) =	N/A	N/A	25.1	64.2	56.0	79.2	120.9	174.9	198.2
Peak Outflow Q (cfs) =	0.3	10.7	1.5	29.7	8.0	25.3	49.1	121.6	81.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.4	0.6	0.7	1.0	0.6
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Spillway	Overflow Weir
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	1.1	N/A	0.8	2.6	5.2	4.7
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	45	47	39	45	43	39	25	32
Time to Drain 99% of Inflow Volume (hours) =	40	48	49	48	49	49	47	42	44
Maximum Ponding Depth (ft) =	2.38	4.06	2.88	4.62	3.75	4.49	5.13	7.32	6.81
Area at Maximum Ponding Depth (acres) =	0.63	0.74	0.66	0.78	0.72	0.77	0.81	0.98	0.94
Maximum Volume Stored (acre-ft) =	0.632	1.780	0.947	2.198	1.554	2.105	2.604	4.575	4.085

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: ...[SWM]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	0.48	0.00
	0:10:00	0.00	0.00	0.00	3.16	0.00	0.00	0.21	5.03	1.69
	0:15:00	0.00	0.00	2.07	13.37	6.59	4.28	7.17	19.21	10.48
	0:20:00	0.00	0.00	10.55	50.20	17.83	11.21	15.28	63.13	23.93
	0:25:00	0.00	0.00	22.86	64.20	50.31	25.57	37.89	137.55	75.86
	0:30:00	0.00	0.00	25.07	57.68	56.02	79.16	120.93	161.74	198.16
	0:35:00	0.00	0.00	19.29	50.15	41.85	79.22	114.18	174.94	195.61
	0:40:00	0.00	0.00	14.72	42.67	30.02	67.09	95.06	168.38	157.98
	0:45:00	0.00	0.00	10.32	37.78	21.89	48.96	69.44	149.81	123.61
	0:50:00	0.00	0.00	7.44	36.75	15.55	39.26	55.85	133.53	96.48
	0:55:00	0.00	0.00	5.40	35.46	11.02	26.07	37.75	120.67	71.16
	1:00:00	0.00	0.00	4.47	33.53	9.03	17.59	26.24	110.00	55.05
	1:05:00	0.00	0.00	4.18	32.26	8.52	13.63	21.22	95.46	48.34
	1:10:00	0.00	0.00	3.48	30.57	8.34	10.19	15.59	84.87	32.64
	1:15:00	0.00	0.00	3.14	28.31	8.30	8.48	12.73	75.57	24.32
	1:20:00	0.00	0.00	2.94	26.29	7.23	6.47	9.60	66.29	15.64
	1:25:00	0.00	0.00	2.82	24.73	5.83	5.55	8.11	54.45	11.07
	1:30:00	0.00	0.00	2.75	23.59	5.02	4.53	6.28	44.64	8.23
	1:35:00	0.00	0.00	2.71	21.70	4.54	3.98	5.32	37.02	6.87
	1:40:00	0.00	0.00	2.71	19.82	4.26	3.71	4.84	32.15	6.41
	1:45:00	0.00	0.00	2.71	18.37	4.11	3.57	4.59	29.13	6.22
	1:50:00	0.00	0.00	2.71	17.26	4.06	3.51	4.49	27.23	6.22
	1:55:00	0.00	0.00	2.12	16.16	3.87	3.49	4.44	25.94	6.22
	2:00:00	0.00	0.00	1.79	13.37	3.39	3.49	4.44	21.39	6.22
	2:05:00	0.00	0.00	1.00	10.45	1.89	1.95	2.46	16.45	3.43
	2:10:00	0.00	0.00	0.55	8.21	1.04	1.08	1.37	12.61	1.89
	2:15:00	0.00	0.00	0.26	6.55	0.52	0.55	0.70	9.67	0.96
	2:20:00	0.00	0.00	0.11	5.41	0.24	0.27	0.33	7.53	0.46
	2:25:00	0.00	0.00	0.04	4.80	0.07	0.08	0.10	5.96	0.14
	2:30:00	0.00	0.00	0.00	4.40	0.00	0.00	0.00	4.89	0.00
	2:35:00	0.00	0.00	0.00	4.14	0.00	0.00	0.00	4.41	0.00
	2:40:00	0.00	0.00	0.00	3.93	0.00	0.00	0.00	4.16	0.00
	2:45:00	0.00	0.00	0.00	3.77	0.00	0.00	0.00	3.99	0.00
	2:50:00	0.00	0.00	0.00	3.65	0.00	0.00	0.00	3.87	0.00
	2:55:00	0.00	0.00	0.00	3.52	0.00	0.00	0.00	3.75	0.00
	3:00:00	0.00	0.00	0.00	3.40	0.00	0.00	0.00	3.62	0.00
	3:05:00	0.00	0.00	0.00	3.27	0.00	0.00	0.00	3.49	0.00
	3:10:00	0.00	0.00	0.00	3.14	0.00	0.00	0.00	3.36	0.00
	3:15:00	0.00	0.00	0.00	3.01	0.00	0.00	0.00	3.23	0.00
	3:20:00	0.00	0.00	0.00	2.86	0.00	0.00	0.00	3.11	0.00
	3:25:00	0.00	0.00	0.00	2.64	0.00	0.00	0.00	2.97	0.00
	3:30:00	0.00	0.00	0.00	2.44	0.00	0.00	0.00	2.80	0.00
	3:35:00	0.00	0.00	0.00	2.26	0.00	0.00	0.00	2.59	0.00
	3:40:00	0.00	0.00	0.00	2.10	0.00	0.00	0.00	2.39	0.00
	3:45:00	0.00	0.00	0.00	1.95	0.00	0.00	0.00	2.21	0.00
	3:50:00	0.00	0.00	0.00	1.81	0.00	0.00	0.00	2.06	0.00
	3:55:00	0.00	0.00	0.00	1.70	0.00	0.00	0.00	1.91	0.00
	4:00:00	0.00	0.00	0.00	1.59	0.00	0.00	0.00	1.79	0.00
	4:05:00	0.00	0.00	0.00	1.49	0.00	0.00	0.00	1.67	0.00
	4:10:00	0.00	0.00	0.00	1.40	0.00	0.00	0.00	1.57	0.00
	4:15:00	0.00	0.00	0.00	1.32	0.00	0.00	0.00	1.47	0.00
	4:20:00	0.00	0.00	0.00	1.25	0.00	0.00	0.00	1.38	0.00
	4:25:00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	1.30	0.00
	4:30:00	0.00	0.00	0.00	1.11	0.00	0.00	0.00	1.23	0.00
	4:35:00	0.00	0.00	0.00	1.05	0.00	0.00	0.00	1.16	0.00
	4:40:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.10	0.00
	4:45:00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	1.04	0.00
	4:50:00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.98	0.00
	4:55:00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.94	0.00
	5:00:00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.89	0.00
	5:05:00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.85	0.00
	5:10:00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.81	0.00
	5:15:00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.78	0.00
	5:20:00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.74	0.00
	5:25:00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.71	0.00
	5:30:00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.67	0.00
	5:35:00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.65	0.00
	5:40:00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.63	0.00
	5:45:00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.60	0.00
	5:50:00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.58	0.00
	5:55:00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.55	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.

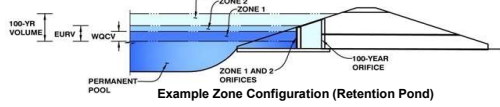
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# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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 =	<b>EDB</b>
Watershed Area =	26.83 acres
Watershed Length =	1,140 ft
Watershed Length to Centroid =	570 ft
Watershed Slope =	0.039 ft/ft
Watershed Imperviousness =	37.27% 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.

Water Quality Capture Volume (WQCV) =	0.386 acre-feet
Excess Urban Runoff Volume (EURV) =	1.044 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.645 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	0.986 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	1.405 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	2.049 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	3.014 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	3.865 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	5.310 acre-feet
Approximate 2-yr Detention Volume =	0.591 acre-feet
Approximate 5-yr Detention Volume =	0.859 acre-feet
Approximate 10-yr Detention Volume =	1.240 acre-feet
Approximate 25-yr Detention Volume =	1.426 acre-feet
Approximate 50-yr Detention Volume =	1.694 acre-feet
Approximate 100-yr Detention Volume =	2.023 acre-feet

## Optional User Overrides

	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.45	inches
	inches
2.15	inches
2.49	inches
	inches

## Define Zones and Basin Geometry

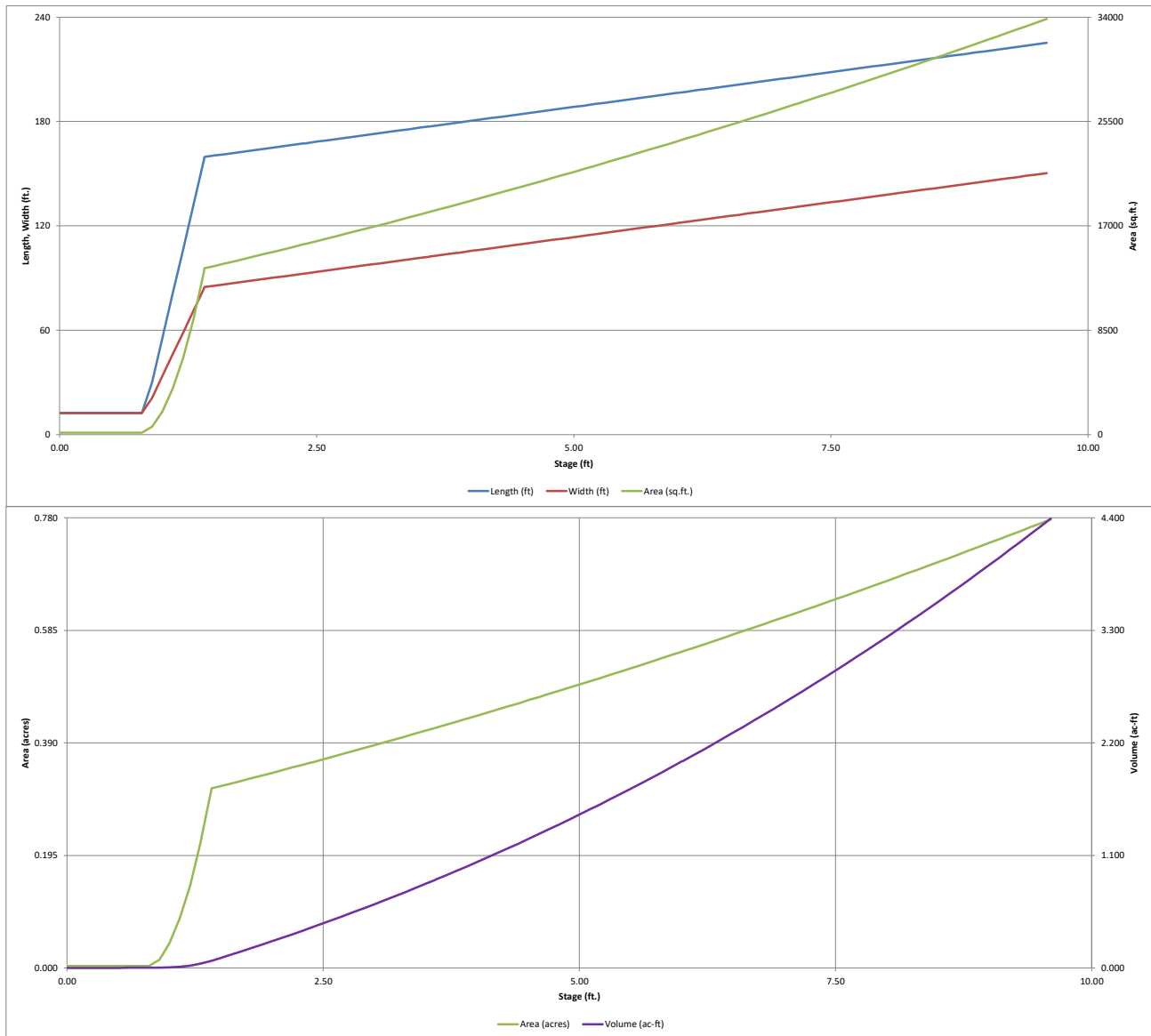
Zone 1 Volume (WQCV) =	0.386 acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.473 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.164 acre-feet
Total Detention Basin Volume =	2.023 acre-feet
Initial Surge Volume (ISV) =	50 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2

Initial Surge Area (A <sub>ISV</sub> ) =	153 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	12.4 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	12.4 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.58 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	159.7 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	84.9 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	13,550 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	2,927 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.59 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	196.4 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	121.6 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	23,878 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	84,786 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>2.017</b> acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft. <sup>2</sup> )	Optional Override Area (ft. <sup>2</sup> )	Area (acre)	Volume (ft. <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		12.4	12.4	153		0.004		
ISV	0.33		12.4	12.4	153		0.004	50	0.001
	0.40		12.4	12.4	153		0.004	61	0.001
	0.50		12.4	12.4	153		0.004	76	0.002
	0.60		12.4	12.4	153		0.004	92	0.002
	0.70		12.4	12.4	153		0.004	107	0.002
	0.80		12.4	12.4	153		0.004	122	0.003
	0.90		30.1	21.1	636		0.015	153	0.004
	1.00		55.5	33.6	1,867		0.043	272	0.006
	1.10		80.9	46.1	3,732		0.086	547	0.013
	1.20		106.3	58.6	6,232		0.143	1,040	0.024
	1.30		131.7	71.1	9,368		0.215	1,815	0.042
Floor	1.40		157.1	83.6	13,138		0.302	2,935	0.067
	1.41		159.7	84.9	13,550		0.311	3,068	0.070
	1.50		160.4	85.6	13,727		0.315	4,296	0.099
	1.60		161.2	86.4	13,924		0.320	5,678	0.130
	1.70		162.0	87.2	14,123		0.324	7,081	0.163
	1.80		162.8	88.0	14,323		0.329	8,503	0.195
	1.90		163.6	88.8	14,524		0.333	9,945	0.228
	2.00		164.4	89.6	14,727		0.338	11,408	0.262
	2.10		165.2	90.4	14,931		0.343	12,891	0.296
	2.20		166.0	91.2	15,136		0.347	14,394	0.330
	2.30		166.8	92.0	15,342		0.352	15,918	0.365
Zone 1 (WQCV)	2.36		167.3	92.5	15,466		0.355	16,842	0.387
	2.40		167.6	92.8	15,550		0.357	17,462	0.401
	2.50		168.4	93.6	15,759		0.362	19,028	0.437
	2.60		169.2	94.4	15,969		0.367	20,614	0.473
	2.70		170.0	95.2	16,180		0.371	22,221	0.510
	2.80		170.8	96.0	16,393		0.376	23,850	0.548
	2.90		171.6	96.8	16,607		0.381	25,500	0.585
	3.00		172.4	97.6	16,823		0.386	27,172	0.624
	3.10		173.2	98.4	17,039		0.391	28,865	0.663
	3.20		174.0	99.2	17,257		0.396	30,580	0.702
	3.30		174.8	100.0	17,476		0.401	32,316	0.742
	3.40		175.6	100.8	17,697		0.406	34,075	0.782
	3.50		176.4	101.6	17,918		0.411	35,856	0.823
Zone 2 (5-year)	3.59		177.1	102.3	18,119		0.416	37,477	0.860
	3.60		177.2	102.4	18,141		0.416	37,659	0.865
	3.70		178.0	103.2	18,366		0.422	39,484	0.906
	3.80		178.8	104.0	18,591		0.427	41,332	0.949
	3.90		179.6	104.8	18,818		0.432	43,202	0.992
	4.00		180.4	105.6	19,046		0.437	45,095	1.035
	4.10		181.2	106.4	19,276		0.443	47,012	1.079
	4.20		182.0	107.2	19,506		0.448	48,951	1.124
	4.30		182.8	108.0	19,738		0.453	50,913	1.169
	4.40		183.6	108.8	19,972		0.458	52,898	1.214
	4.50		184.4	109.6	20,206		0.464	54,907	1.260
	4.60		185.2	110.4	20,442		0.469	56,940	1.307
	4.70		186.0	111.2	20,679		0.475	58,996	1.354
	4.80		186.8	112.0	20,918		0.480	61,076	1.402
	4.90		187.6	112.8	21,157		0.486	63,179	1.450
	5.00		188.4	113.6	21,398		0.491	65,307	1.499
	5.10		189.2	114.4	21,640		0.497	67,459	1.549
	5.20		190.0	115.2	21,884		0.502	69,635	1.599
	5.30		190.8	116.0	22,129		0.508	71,836	1.649
	5.40		191.6	116.8	22,375		0.514	74,061	1.700
	5.50		192.4	117.6	22,622		0.519	76,311	1.752
	5.60		193.2	118.4	22,871		0.525	78,585	1.804
	5.70		194.0	119.2	23,121		0.531	80,885	1.857
	5.80		194.8	120.0	23,372		0.537	83,210	1.910
	5.90		195.6	120.8	23,624		0.542	85,559	1.964
Zone 3 (100-year)	6.00		196.4	121.6	23,878		0.548	87,934	2.019
	6.01		196.5	121.7	23,903		0.549	88,173	2.024
	6.10		197.2	122.4	24,133		0.554	90,335	2.074
	6.20		198.0	123.2	24,389		0.560	92,761	2.130
	6.30		198.8	124.0	24,647		0.566	95,213	2.186
	6.40		199.6	124.8	24,906		0.572	97,691	2.243
	6.50		200.4	125.6	25,166		0.578	100,194	2.300
	6.60		201.2	126.4	25,427		0.584	102,724	2.358
	6.70		202.0	127.2	25,690		0.590	105,280	2.417
	6.80		202.8	128.0	25,954		0.596	107,862	2.476
	6.90		203.6	128.8	26,219		0.602	110,471	2.536
	7.00		204.4	129.6	26,486		0.608	113,106	2.597
	7.10		205.2	130.4	26,754		0.614	115,768	2.658
	7.20		206.0	131.2	27,023		0.620	118,457	2.719
	7.30		206.8	132.0	27,293		0.627	121,172	2.782
	7.40		207.6	132.8	27,565		0.633	123,915	2.845
	7.50		208.4	133.6	27,838		0.639	126,685	2.908
	7.60		209.2	134.4	28,112		0.645	129,483	2.973
	7.70		210.0	135.2	28,387		0.652	132,308	3.037
	7.80		210.8	136.0	28,664		0.658	135,162	3.103
	7.90		211.6	136.8	28,942		0.664	138,041	3.169
	8.00		212.4	137.6	29,222		0.671	140,949	3.236
	8.10		213.2	138.4	29,502		0.677	143,885	3.303
	8.20		214.0	139.2	29,784		0.684	146,849	3.371
	8.30		214.8	140.0	30,067		0.690	149,842	3.440
	8.40		215.6	140.8	30,352		0.697	152,863	3.509
	8.50		216.4	141.6	30,638		0.703	155,912	3.579
	8.60		217.2	142.4	30,925		0.710	158,990	3.650
	8.70		218.0	143.2	31,213		0.717	162,097	3.721
	8.80		218.8	144.0	31,502		0.723	165,233	3.793
	8.90		219.6	144.8	31,793		0.730	168,398	3.866
	9.00		220.4	145.6	32,085		0.737	171,592	3.939
	9.10		221.2	146.4	32,379		0.743	174,815	4.013
	9.20		222.0	147.2	32,674		0.750	178,068	4.088
	9.30		222.8	148.0	32,970		0.757	181,350	4.163
	9.40		223.6	148.8	33,267		0.764	184,662	4.239
	9.50		224.4	149.6	33,565		0.771	188,003	4.316
	9.60		225.2	150.4	33,865		0.777	191,375	4.393

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

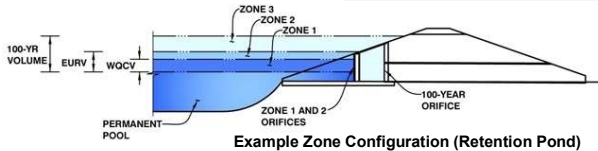


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: \_\_\_\_\_

Basin ID: \_\_\_\_\_



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.36	0.386	Orifice Plate
Zone 2 (5-year)	3.59	0.473	Circular Orifice
Zone 3 (100-year)	6.01	1.164	Weir&Pipe (Restrict)
Total (all zones)		2.023	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-5/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	1.36	1.36	1.36					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice

Zone 2 Circular   ft<sup>2</sup>  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =    
Debris Clogging % =  %

Calculated Parameters for Overflow Weir

Zone 3 Weir   feet  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =    
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Zone 3 Restrictor   ft<sup>2</sup>  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

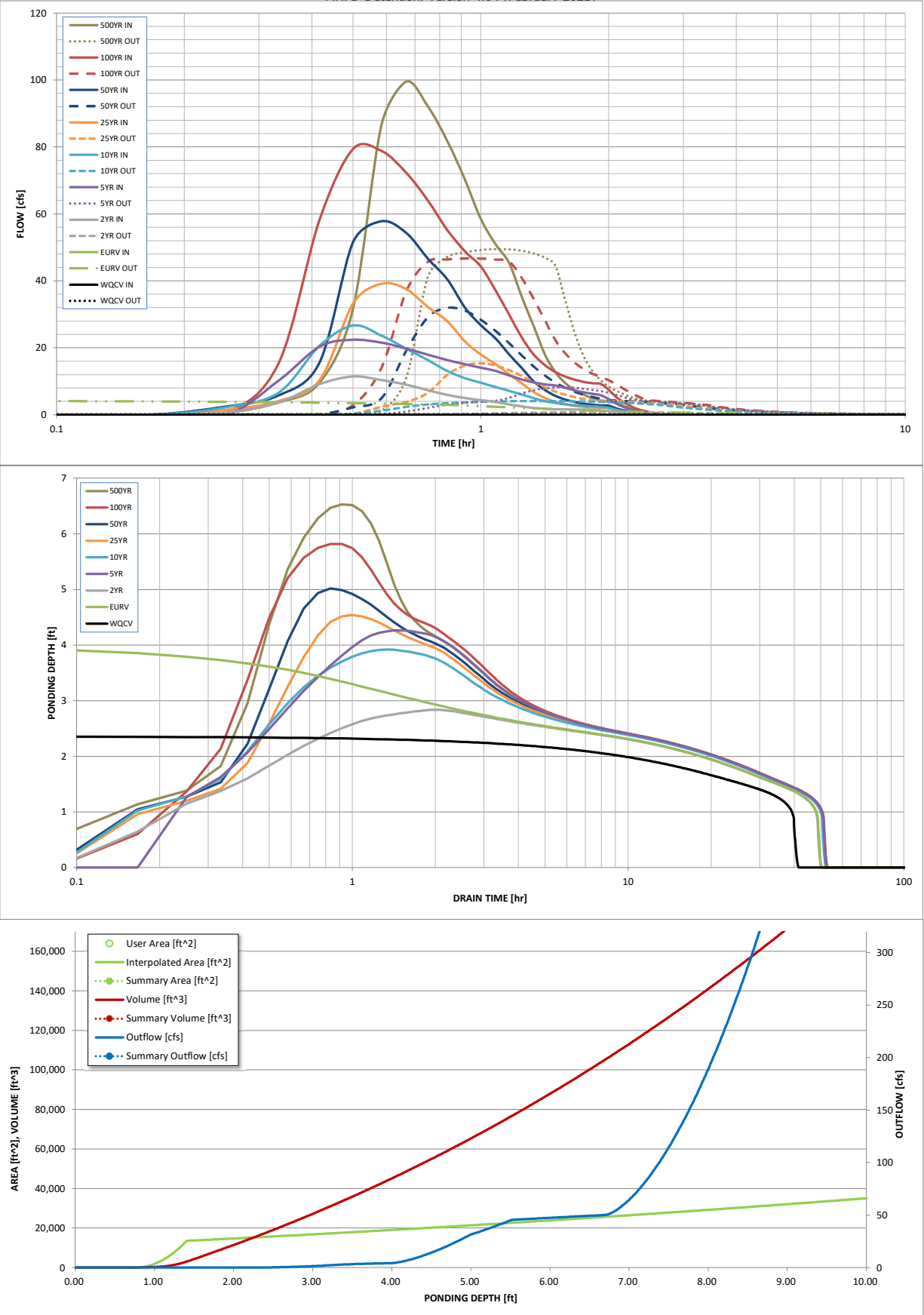
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.386	1.044	0.645	0.986	1.405	2.049	3.014	3.865	5.310
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.645	1.859	1.405	2.049	3.014	5.008	5.310
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.4	3.2	9.2	20.9	34.9	46.6	65.9
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.02	0.30	0.34	0.78	1.30	1.74	2.46
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.02	0.30	0.34	0.78	1.30	1.74	2.46
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	11.5	22.4	26.7	39.2	57.8	79.4	99.5
Peak Inflow Q (cfs) =	N/A	N/A	0.9	8.2	4.1	15.4	31.9	46.7	49.5
Peak Outflow Q (cfs) =	N/A	N/A	0.9	8.2	4.1	15.4	31.9	46.7	49.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.4	0.7	0.9	1.0	0.8
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.01	N/A	0.3	N/A	0.9	2.3	3.6	3.8
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) =	38	44	46	43	44	42	38	31	30
Time to Drain 99% of Inflow Volume (hours) =	40	48	48	49	49	48	47	44	43
Maximum Ponding Depth (ft) =	2.36	4.02	2.84	4.26	3.92	4.54	5.02	5.82	6.53
Area at Maximum Ponding Depth (acres) =	0.36	0.44	0.38	0.45	0.43	0.47	0.49	0.54	0.58
Maximum Volume Stored (acre-ft) =	0.387	1.044	0.559	1.151	0.996	1.274	1.504	1.916	2.317

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: ...[SWM]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	0.00	0.00	0.00	0.07	0.00	0.58
	0:15:00	0.00	0.00	0.70	0.00	2.24	1.46	2.46	0.65	3.72
	0:20:00	0.00	0.00	3.72	10.14	6.56	4.14	5.77	15.28	9.61
	0:25:00	0.00	0.00	9.15	20.36	20.60	10.32	15.54	58.19	31.63
	0:30:00	0.00	0.00	11.45	22.40	26.69	33.21	51.53	79.38	86.57
	0:35:00	0.00	0.00	10.37	21.53	23.65	39.18	57.81	78.80	99.50
	0:40:00	0.00	0.00	9.02	19.79	19.77	37.53	54.38	72.32	92.11
	0:45:00	0.00	0.00	7.33	17.98	16.36	32.20	46.67	64.04	81.86
	0:50:00	0.00	0.00	5.96	16.36	13.10	28.01	40.49	55.22	70.36
	0:55:00	0.00	0.00	5.02	15.11	10.97	21.96	32.07	48.86	58.45
	1:00:00	0.00	0.00	4.38	14.09	9.57	18.01	26.76	44.30	50.93
	1:05:00	0.00	0.00	3.84	13.10	8.31	15.14	22.79	37.12	45.34
	1:10:00	0.00	0.00	3.13	11.79	7.13	12.09	18.06	29.89	35.09
	1:15:00	0.00	0.00	2.51	10.54	6.07	9.40	13.89	23.01	26.42
	1:20:00	0.00	0.00	2.05	9.68	4.99	6.80	9.92	17.99	18.03
	1:25:00	0.00	0.00	1.81	9.12	4.08	5.04	7.44	14.82	12.70
	1:30:00	0.00	0.00	1.69	8.75	3.52	3.85	5.66	12.78	9.42
	1:35:00	0.00	0.00	1.63	8.03	3.13	3.14	4.56	11.41	7.38
	1:40:00	0.00	0.00	1.60	7.27	2.86	2.68	3.81	10.48	5.96
	1:45:00	0.00	0.00	1.57	6.71	2.68	2.41	3.35	9.83	5.01
	1:50:00	0.00	0.00	1.55	6.29	2.54	2.23	3.03	9.43	4.34
	1:55:00	0.00	0.00	1.34	5.87	2.38	2.11	2.83	9.23	3.93
	2:00:00	0.00	0.00	1.18	4.71	2.12	2.03	2.71	7.50	3.79
	2:05:00	0.00	0.00	0.86	3.36	1.52	1.47	1.94	5.37	2.70
	2:10:00	0.00	0.00	0.62	2.36	1.07	1.03	1.36	3.81	1.91
	2:15:00	0.00	0.00	0.44	1.63	0.75	0.73	0.95	2.66	1.34
	2:20:00	0.00	0.00	0.30	1.10	0.52	0.50	0.65	1.82	0.92
	2:25:00	0.00	0.00	0.20	0.74	0.35	0.33	0.43	1.23	0.61
	2:30:00	0.00	0.00	0.13	0.49	0.23	0.23	0.30	0.81	0.41
	2:35:00	0.00	0.00	0.08	0.30	0.14	0.14	0.18	0.50	0.25
	2:40:00	0.00	0.00	0.04	0.17	0.07	0.08	0.10	0.28	0.13
	2:45:00	0.00	0.00	0.02	0.10	0.03	0.03	0.04	0.14	0.05
	2:50:00	0.00	0.00	0.01	0.04	0.01	0.01	0.01	0.05	0.00
	2:55:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

### Summary Stage-Area-Volume-Discharge Relationships

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

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

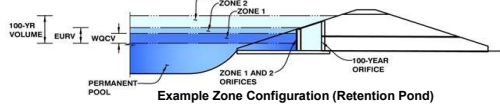
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# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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 =	<b>EDB</b>
Watershed Area =	114.73 acres
Watershed Length =	1,683 ft
Watershed Length to Centroid =	1,362 ft
Watershed Slope =	0.040 ft/ft
Watershed Imperviousness =	41.33% 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

Note: L / W Ratio < 1  
L / W Ratio = 0.57

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

Water Quality Capture Volume (WQCV) =	1.753 acre-feet
Excess Urban Runoff Volume (EURV) =	4.993 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	3.194 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	4.750 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	6.622 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	9.399 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	13.593 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	17.271 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	23.553 acre-feet
Approximate 2-yr Detention Volume =	2.855 acre-feet
Approximate 5-yr Detention Volume =	4.115 acre-feet
Approximate 10-yr Detention Volume =	5.830 acre-feet
Approximate 25-yr Detention Volume =	6.625 acre-feet
Approximate 50-yr Detention Volume =	7.857 acre-feet
Approximate 100-yr Detention Volume =	9.273 acre-feet

0.92	inches
1.20	inches
1.45	inches
1.69	inches
2.15	inches
2.49	inches

## Define Zones and Basin Geometry

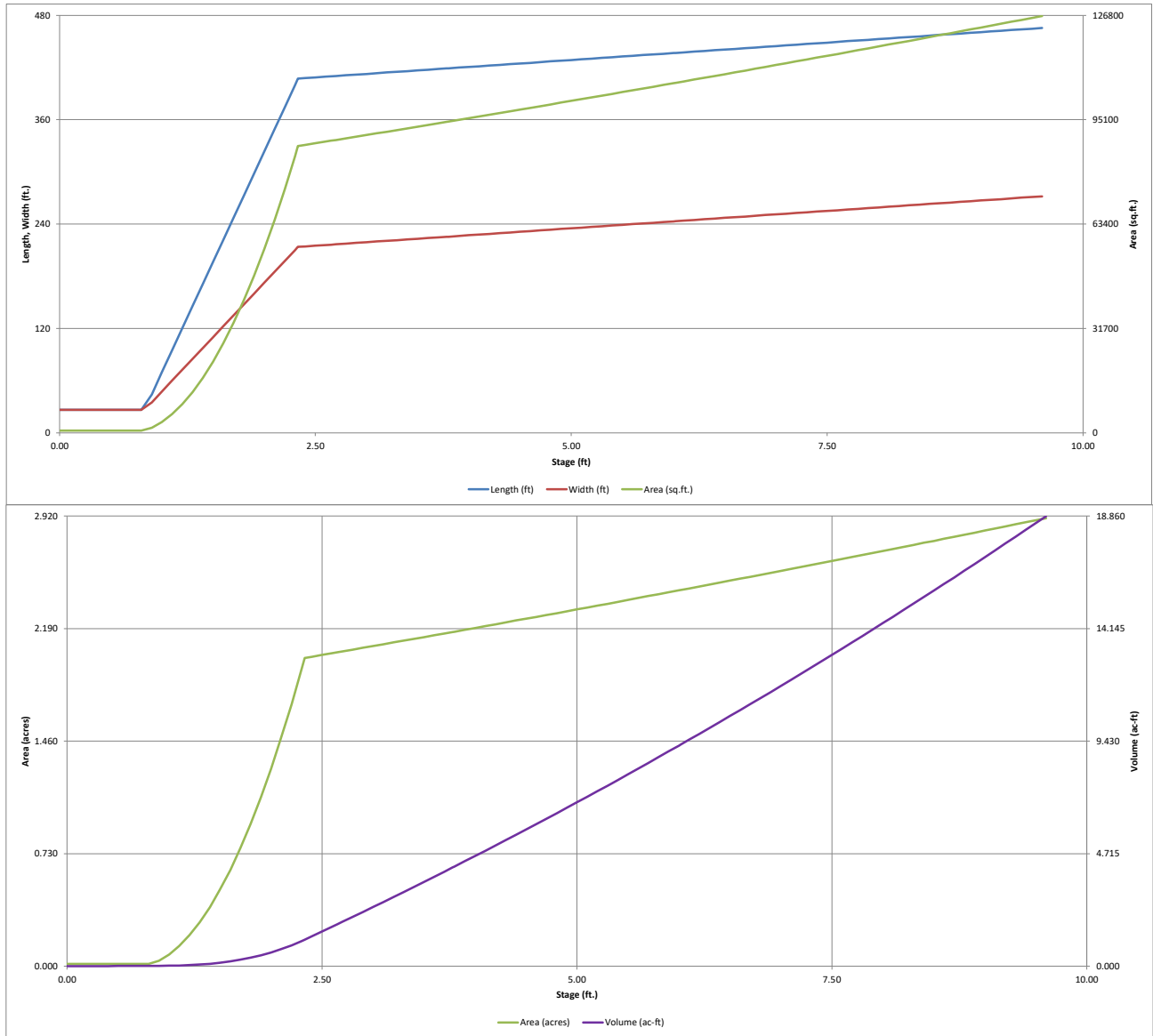
Zone 1 Volume (WQCV) =	1.753 acre-feet
Zone 2 Volume (5-year - Zone 1) =	2.362 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	5.158 acre-feet
Total Detention Basin Volume =	9.273 acre-feet
Initial Surge Volume (ISV) =	229 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2

Initial Surge Area (A <sub>ISV</sub> ) =	694 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	26.3 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	26.3 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	1.50 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	407.3 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	213.8 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	87,110 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	47,790 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	3.67 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	436.7 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	243.2 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	106,210 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	354,164 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>9.241</b> acre-feet

Depth Increment =	0.10	ft									
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft. <sup>2</sup> )	Optional Override Area (ft. <sup>2</sup> )	Area (acre)	Volume (ft. <sup>3</sup> )	Volume (ac-ft)		
Top of Micropool	0.00		26.3	26.3	694		0.016				
ISV	0.33		26.3	26.3	694		0.016	229	0.005		
	0.40		26.3	26.3	694		0.016	278	0.006		
	0.50		26.3	26.3	694		0.016	347	0.008		
	0.60		26.3	26.3	694		0.016	417	0.010		
	0.70		26.3	26.3	694		0.016	486	0.011		
	0.80		26.3	26.3	694		0.016	555	0.013		
	0.90		44.1	35.1	1,549		0.036	653	0.015		
	1.00		69.5	47.6	3,309		0.076	890	0.020		
	1.10		94.9	60.1	5,705		0.131	1,336	0.031		
	1.20		120.3	72.6	8,735		0.201	2,053	0.047		
	1.30		145.7	85.1	12,401		0.285	3,104	0.071		
	1.40		171.1	97.6	16,701		0.383	4,554	0.105		
	1.50		196.5	110.1	21,637		0.497	6,466	0.148		
	1.60		221.9	122.6	27,208		0.625	8,903	0.204		
	1.70		247.3	135.1	33,413		0.767	11,928	0.274		
	1.80		272.7	147.6	40,254		0.924	15,606	0.358		
	1.90		298.1	160.1	47,729		1.096	20,000	0.459		
	2.00		323.5	172.6	55,840		1.282	25,173	0.578		
	2.10		348.9	185.1	64,585		1.483	31,189	0.716		
	2.20		374.3	197.6	73,966		1.698	38,112	0.875		
Floor	2.30		399.7	210.1	83,981		1.928	46,004	1.056		
	2.33		407.3	213.8	87,110		2.000	48,570	1.115		
	2.40		407.9	214.4	87,458		2.008	54,680	1.255		
	2.50		408.7	215.2	87,957		2.019	63,450	1.457		
	2.60		409.5	216.0	88,456		2.031	72,271	1.659		
Zone 1 (WQCV)	2.65		409.9	216.4	88,707		2.036	76,700	1.761		
	2.70		410.3	216.8	88,957		2.042	81,142	1.863		
	2.80		411.1	217.6	89,460		2.054	90,063	2.068		
	2.90		411.9	218.4	89,963		2.065	99,034	2.274		
	3.00		412.7	219.2	90,468		2.077	108,055	2.481		
	3.10		413.5	220.0	90,974		2.088	117,128	2.689		
	3.20		414.3	220.8	91,482		2.100	126,250	2.898		
	3.30		415.1	221.6	91,991		2.112	135,424	3.109		
	3.40		415.9	222.4	92,501		2.124	144,648	3.321		
	3.50		416.7	223.2	93,012		2.135	153,924	3.534		
	3.60		417.5	224.0	93,525		2.147	163,251	3.748		
	3.70		418.3	224.8	94,038		2.159	172,629	3.963		
Zone 2 (5-year)	3.78		418.9	225.4	94,450		2.168	180,169	4.136		
	3.80		419.1	225.6	94,554		2.171	182,059	4.179		
	3.90		419.9	226.4	95,070		2.183	191,540	4.397		
	4.00		420.7	227.2	95,588		2.194	201,073	4.616		
	4.10		421.5	228.0	96,107		2.206	210,657	4.836		
	4.20		422.3	228.8	96,627		2.218	220,294	5.057		
	4.30		423.1	229.6	97,148		2.230	229,983	5.280		
	4.40		423.9	230.4	97,671		2.242	239,724	5.503		
	4.50		424.7	231.2	98,195		2.254	249,517	5.728		
	4.60		425.5	232.0	98,721		2.266	259,363	5.954		
	4.70		426.3	232.8	99,247		2.278	269,261	6.181		
	4.80		427.1	233.6	99,775		2.291	279,212	6.410		
	4.90		427.9	234.4	100,304		2.303	289,216	6.639		
	5.00		428.7	235.2	100,835		2.315	299,273	6.870		
	5.10		429.5	236.0	101,367		2.327	309,383	7.102		
	5.20		430.3	236.8	101,900		2.339	319,547	7.336		
	5.30		431.1	237.6	102,434		2.352	329,763	7.570		
	5.40		431.9	238.4	102,970		2.364	340,033	7.806		
	5.50		432.7	239.2	103,507		2.376	350,357	8.043		
	5.60		433.5	240.0	104,045		2.389	360,735	8.281		
	5.70		434.3	240.8	104,584		2.401	371,166	8.521		
	5.80		435.1	241.6	105,125		2.413	381,652	8.762		
	5.90		435.9	242.4	105,667		2.426	392,191	9.003		
Zone 3 (100-year)	6.00		436.7	243.2	106,210		2.438	402,785	9.247		
	6.02		436.9	243.4	106,319		2.441	404,910	9.295		
	6.10		437.5	244.0	106,755		2.451	413,433	9.491		
	6.20		438.3	244.8	107,301		2.463	424,136	9.737		
	6.30		439.1	245.6	107,848		2.476	434,894	9.984		
	6.40		439.9	246.4	108,396		2.488	445,706	10.232		
	6.50		440.7	247.2	108,946		2.501	456,573	10.481		
	6.60		441.5	248.0	109,497		2.514	467,495	10.732		
	6.70		442.3	248.8	110,049		2.526	478,472	10.984		
	6.80		443.1	249.6	110,603		2.539	489,505	11.237		
	6.90		443.9	250.4	111,157		2.552	500,593	11.492		
	7.00		444.7	251.2	111,714		2.565	511,736	11.748		
	7.10		445.5	252.0	112,271		2.577	522,936	12.005		
	7.20		446.3	252.8	112,830		2.590	534,191	12.263		
	7.30		447.1	253.6	113,389		2.603	545,502	12.523		
	7.40		447.9	254.4	113,951		2.616	556,869	12.784		
	7.50		448.7	255.2	114,513		2.629	568,292	13.046		
	7.60		449.5	256.0	115,077		2.642	579,771	13.310		
	7.70		450.3	256.8	115,642		2.655	591,307	13.575		
	7.80		451.1	257.6	116,208		2.668	602,900	13.841		
	7.90		451.9	258.4	116,776		2.681	614,549	14.108		
	8.00		452.7	259.2	117,345		2.694	626,255	14.377		
	8.10		453.5	260.0	117,915		2.707	638,018	14.647		
	8.20		454.3	260.8	118,486		2.720	649,838	14.918		
	8.30		455.1	261.6	119,059		2.733	661,715	15.191		
	8.40		455.9	262.4	119,633		2.746	673,650	15.465		
	8.50		456.7	263.2	120,209		2.760	685,642	15.740		
	8.60		457.5	264.0	120,785		2.773	697,692	16.017		
	8.70		458.3	264.8	121,363		2.786	709,799	16.295		
	8.80		459.1	265.6	121,942		2.799	721,964	16.574		
	8.90		459.9	266.4	122,522		2.813	734,187	16.855		
	9.00		460.7	267.2	123,104		2.826	746,469	17.137		
	9.10		461.5	268.0	123,687		2.839	758,808	17.420		
	9.20		462.3	268.8	124,271		2.853	771,206	17.704		
	9.30		463.1	269.6	124,857		2.866	783,663	17.990		
	9.40		463.9	270.4	125,444		2.880	796,178	18.278		
	9.50		464.7	271.2	126,032		2.893	808,751	18.566		
	9.60		465.5	272.0	126,621		2.907	821,384	18.856		

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

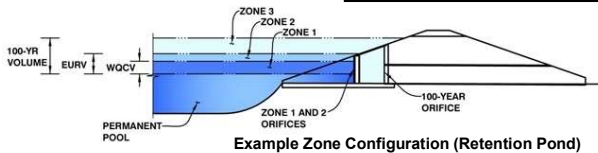


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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)	2.65	1.753	Orifice Plate
Zone 2 (5-year)	3.78	2.362	Weir&Pipe (Circular)
Zone 3 (100-year)	6.02	5.158	Weir&Pipe (Restrict)
Total (all zones)		9.273	

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<sup>2</sup>

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 = 3.701E-02 ft<sup>2</sup>

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 = 5.33 sq. inches (use rectangular openings)

Elliptical Slot Area = N/A ft<sup>2</sup>

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)	5.33	5.33	5.33					

	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)

Calculated Parameters for Vertical Orifice

Invert of Vertical Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)

Vertical Orifice Area = N/A ft<sup>2</sup>

Depth at top of Zone using Vertical Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)

Vertical Orifice Centroid = N/A feet

Vertical Orifice Diameter = N/A inches

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

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir		Zone 2 Weir	Zone 3 Weir
Overflow Weir Front Edge Height, H <sub>o</sub> =	2.65	3.78	ft (relative to basin bottom at Stage = 0 ft)	2.65	6.78
Overflow Weir Front Edge Length =	6.00	6.00	feet	6.00	12.37
Overflow Weir Grate Slope =	0.00	4.00	H:V	3.54	2.05
Horiz. Length of Weir Sides =	6.00	12.00	feet	25.06	51.65
Overflow Grate Type =	Type C Grate	Type C Grate		12.53	25.83
Debris Clogging % =	50%	50%	%		

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 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)	7.07	25.18
Circular Orifice Diameter or Pipe Diameter =	36.00	72.00	inches	1.50	2.70
Restrictor Plate Height Above Pipe Invert =		60.00	inches	N/A	2.30
			Half-Central Angle of Restrictor Plate on Pipe =		

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

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 =	2.93	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	19.38	acre-ft

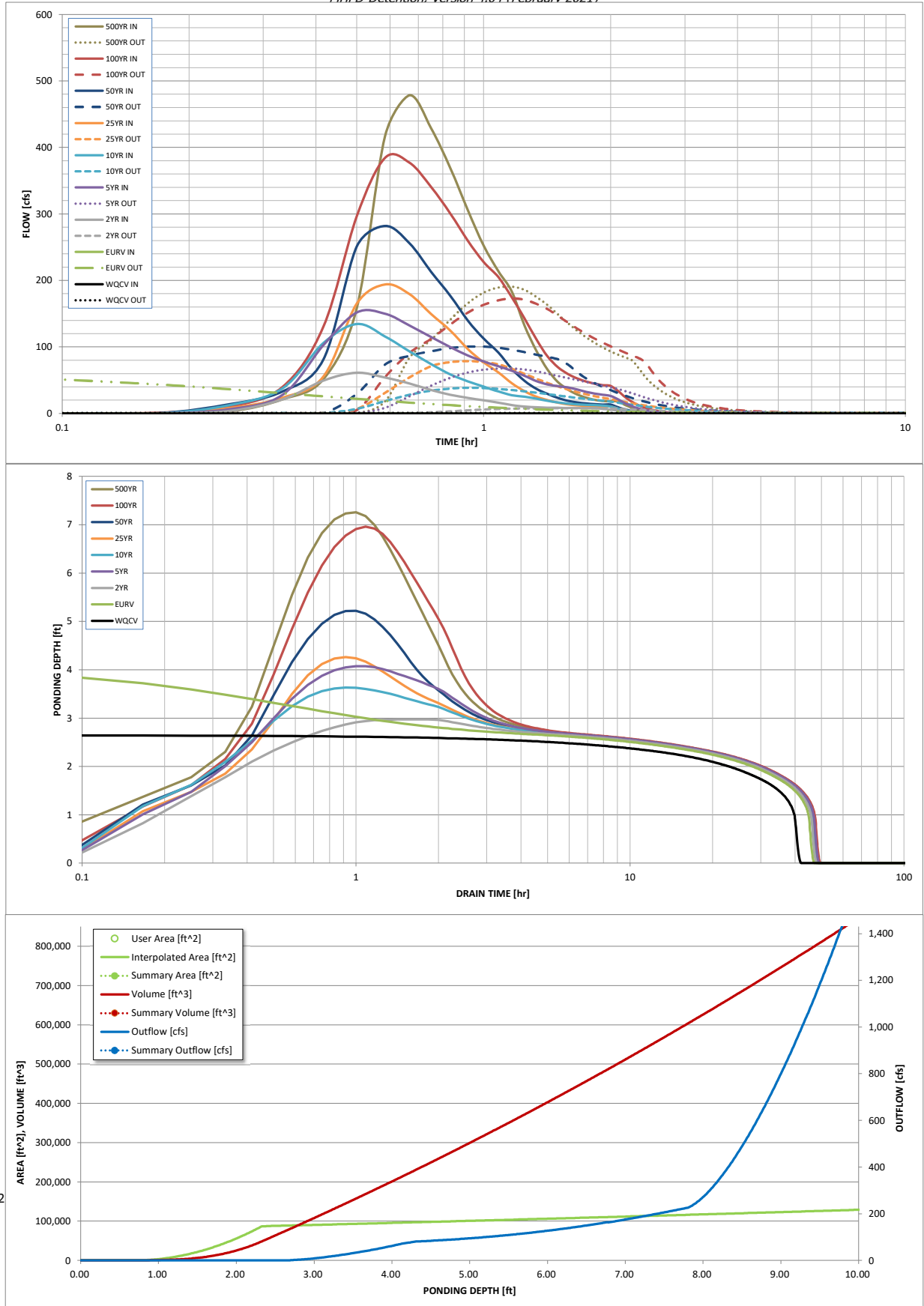
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	1.753	4.993	3.194	4.750	6.622	9.399	13.593	17.271	23.553
CUHP Runoff Volume (acre-ft) =	N/A	N/A	3.194	10.587	6.622	9.399	13.593	24.502	23.553
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.9	14.6	42.4	94.7	159.5	213.5	301.7
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	66.7						
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.02	0.58	0.37	0.83	1.39	1.68	2.63
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	61.1	151.8	134.6	193.9	282.0	384.1	478.3
Peak Inflow Q (cfs) =	N/A	N/A	7.9	67.6	38.6	78.6	100.5	172.9	190.7
Peak Outflow Q (cfs) =	N/A	N/A	N/A	1.0	0.9	0.8	0.6	0.9	0.6
Ratio Peak Outflow to Predevelopment Q =	Overflow Weir 1	Overflow Weir 2	Overflow Weir 1	Overflow Weir 2	Overflow Weir 1	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2
Structure Controlling Flow =	N/A	2.87	0.28	2.6	1.5	3.0	3.3	3.8	3.9
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	0.0	N/A	0.0	0.3	1.5	1.8
Max Velocity through Grate 2 (fps) =	38	40	43	37	40	37	34	27	27
Time to Drain 97% of Inflow Volume (hours) =	40	44	45	43	44	43	42	39	39
Time to Drain 99% of Inflow Volume (hours) =	2.65	4.18	2.97	4.07	3.63	4.26	5.22	6.96	7.26
Maximum Ponding Depth (ft) =	2.04	2.22	2.07	2.20	2.15	2.23	2.34	2.56	2.60
Area at Maximum Ponding Depth (acres) =	1.761	5.013	2.418	4.770	3.812	5.191	7.359	11.620	12.393
Maximum Volume Stored (acre-ft) =									

# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Depotion, 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	0.00	0.00	0.00	0.41	1.11	3.27
	0:15:00	0.00	0.00	3.98	6.42	12.72	8.26	13.96	10.44	21.11
	0:20:00	0.00	0.00	21.38	28.00	37.71	23.79	33.10	39.96	51.57
	0:25:00	0.00	0.00	49.53	102.61	105.83	55.32	81.25	130.31	157.90
	0:30:00	0.00	0.00	61.14	151.84	134.58	165.16	250.88	296.42	416.57
	0:35:00	0.00	0.00	53.94	150.00	115.86	193.94	282.00	384.14	478.32
	0:40:00	0.00	0.00	45.05	132.16	93.30	179.43	255.90	376.97	429.03
	0:45:00	0.00	0.00	35.35	114.89	74.13	149.53	213.20	340.54	369.08
	0:50:00	0.00	0.00	28.18	99.86	58.72	124.60	177.08	300.77	305.95
	0:55:00	0.00	0.00	23.48	87.26	48.39	97.10	139.89	259.77	252.01
	1:00:00	0.00	0.00	19.68	78.06	40.18	76.80	112.41	227.52	213.89
	1:05:00	0.00	0.00	16.30	70.84	32.99	61.73	91.55	205.01	183.00
	1:10:00	0.00	0.00	12.60	64.23	27.54	45.50	66.89	174.58	131.89
	1:15:00	0.00	0.00	10.40	56.55	25.16	33.41	49.02	142.78	94.53
	1:20:00	0.00	0.00	9.38	48.79	22.45	25.11	37.01	111.61	66.21
	1:25:00	0.00	0.00	8.78	43.74	19.00	20.00	29.43	86.16	47.38
	1:30:00	0.00	0.00	8.48	40.91	16.57	16.26	23.34	69.59	36.08
	1:35:00	0.00	0.00	8.27	39.12	14.93	13.78	19.19	59.37	28.57
	1:40:00	0.00	0.00	8.12	35.97	13.81	12.37	16.71	52.62	23.69
	1:45:00	0.00	0.00	8.02	32.59	13.06	11.40	15.00	48.01	20.50
	1:50:00	0.00	0.00	7.96	30.07	12.52	10.80	14.00	44.83	18.87
	1:55:00	0.00	0.00	6.84	28.24	11.79	10.49	13.47	42.61	18.30
	2:00:00	0.00	0.00	5.89	26.33	10.56	10.31	13.16	41.27	18.09
	2:05:00	0.00	0.00	4.13	21.15	7.35	7.26	9.21	33.72	12.71
	2:10:00	0.00	0.00	2.73	15.29	4.87	4.79	6.05	24.42	8.38
	2:15:00	0.00	0.00	1.79	10.81	3.20	3.17	4.00	17.41	5.52
	2:20:00	0.00	0.00	1.13	7.57	2.01	2.00	2.51	12.38	3.45
	2:25:00	0.00	0.00	0.67	5.17	1.24	1.26	1.57	8.61	2.15
	2:30:00	0.00	0.00	0.36	3.49	0.69	0.73	0.91	5.92	1.23
	2:35:00	0.00	0.00	0.15	2.33	0.31	0.35	0.42	3.99	0.56
	2:40:00	0.00	0.00	0.05	1.47	0.09	0.10	0.12	2.52	0.15
	2:45:00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	1.41	0.00
	2:50:00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.67	0.00
	2:55:00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.26	0.00
	3:00:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	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.

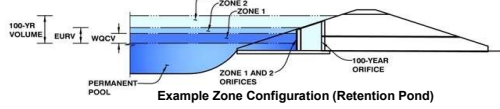
[illegible]

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 8**



## Watershed Information

Selected BMP Type =	<b>EDB</b>
Watershed Area =	15.89 acres
Watershed Length =	1,507 ft
Watershed Length to Centroid =	741 ft
Watershed Slope =	0.040 ft/ft
Watershed Imperviousness =	35.49% 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.

Water Quality Capture Volume (WQCV) =	0.222 acre-feet
Excess Urban Runoff Volume (EURV) =	0.587 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.365 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	0.568 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	0.819 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	1.212 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	1.797 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	2.314 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	3.192 acre-feet
Approximate 2-yr Detention Volume =	0.330 acre-feet
Approximate 5-yr Detention Volume =	0.482 acre-feet
Approximate 10-yr Detention Volume =	0.703 acre-feet
Approximate 25-yr Detention Volume =	0.813 acre-feet
Approximate 50-yr Detention Volume =	0.966 acre-feet
Approximate 100-yr Detention Volume =	1.160 acre-feet

## Optional User Overrides

	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.45	inches
	inches
2.15	inches
2.49	inches
	inches

## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.222 acre-feet
Select Zone 2 Storage Volume (Optional) =	acre-feet
Select Zone 3 Storage Volume (Optional) =	acre-feet
Total Detention Basin Volume =	0.222 acre-feet
Initial Surcharge Volume (ISV) =	29 ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (L <sub>LW</sub> ) =	2

Total detention volume is less than 100-year volume.

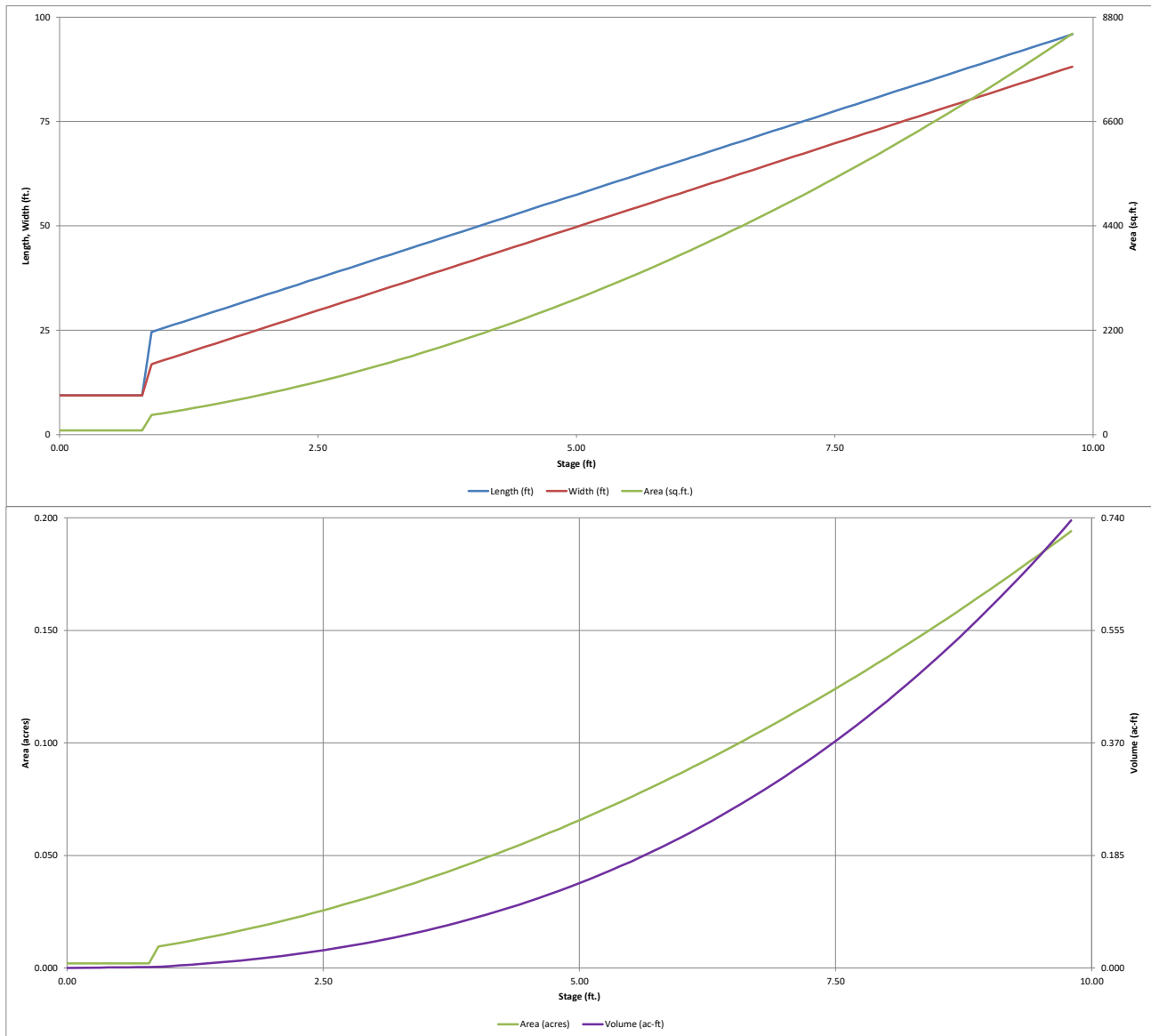
Initial Surcharge Area (A <sub>ISV</sub> ) =	88 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	9.4 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	9.4 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.06 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	24.6 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	16.9 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	415 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	14 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	5.11 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	65.5 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	57.8 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	3,783 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	9,286 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>0.215</b> acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		9.4	9.4	88		0.002		
<b>ISV</b>	0.33		9.4	9.4	88		0.002	29	0.001
	0.40		9.4	9.4	88		0.002	35	0.001
	0.50		9.4	9.4	88		0.002	44	0.001
	0.60		9.4	9.4	88		0.002	53	0.001
	0.70		9.4	9.4	88		0.002	62	0.001
	0.80		9.4	9.4	88		0.002	70	0.002
<b>Floor</b>	0.89		24.6	16.9	415		0.010	87	0.002
	0.90		24.7	17.0	419		0.010	91	0.002
	1.00		25.5	17.8	453		0.010	135	0.003
	1.10		26.3	18.6	488		0.011	182	0.004
	1.20		27.1	19.4	524		0.012	232	0.005
	1.30		27.9	20.2	562		0.013	287	0.007
	1.40		28.7	21.0	601		0.014	345	0.008
	1.50		29.5	21.8	642		0.015	407	0.009
	1.60		30.3	22.6	683		0.016	473	0.011
	1.70		31.1	23.4	726		0.017	544	0.012
	1.80		31.9	24.2	770		0.018	618	0.014
	1.90		32.7	25.0	816		0.019	698	0.016
	2.00		33.5	25.8	863		0.020	782	0.018
	2.10		34.3	26.6	911		0.021	870	0.020
	2.20		35.1	27.4	960		0.022	964	0.022
	2.30		35.9	28.2	1,011		0.023	1,062	0.024
	2.40		36.7	29.0	1,063		0.024	1,166	0.027
	2.50		37.5	29.8	1,116		0.026	1,275	0.029
	2.60		38.3	30.6	1,170		0.027	1,389	0.032
	2.70		39.1	31.4	1,226		0.028	1,509	0.035
	2.80		39.9	32.2	1,283		0.029	1,634	0.038
	2.90		40.7	33.0	1,341		0.031	1,766	0.041
	3.00		41.5	33.8	1,401		0.032	1,903	0.044
	3.10		42.3	34.6	1,462		0.034	2,046	0.047
	3.20		43.1	35.4	1,524		0.035	2,195	0.050
	3.30		43.9	36.2	1,587		0.036	2,351	0.054
	3.40		44.7	37.0	1,652		0.038	2,512	0.058
	3.50		45.5	37.8	1,718		0.039	2,681	0.062
	3.60		46.3	38.6	1,785		0.041	2,856	0.066
	3.70		47.1	39.4	1,853		0.043	3,038	0.070
	3.80		47.9	40.2	1,923		0.044	3,227	0.074
	3.90		48.7	41.0	1,994		0.046	3,423	0.079
	4.00		49.5	41.8	2,067		0.047	3,626	0.083
	4.10		50.3	42.6	2,140		0.049	3,836	0.088
	4.20		51.1	43.4	2,215		0.051	4,054	0.093
	4.30		51.9	44.2	2,291		0.053	4,279	0.098
	4.40		52.7	45.0	2,369		0.054	4,512	0.104
	4.50		53.5	45.8	2,448		0.056	4,753	0.109
	4.60		54.3	46.6	2,528		0.058	5,002	0.115
	4.70		55.1	47.4	2,609		0.060	5,258	0.121
	4.80		55.9	48.2	2,692		0.062	5,523	0.127
	4.90		56.7	49.0	2,776		0.064	5,797	0.133
	5.00		57.5	49.8	2,861		0.066	6,079	0.140
	5.10		58.3	50.6	2,947		0.068	6,369	0.146
	5.20		59.1	51.4	3,035		0.070	6,668	0.153
	5.30		59.9	52.2	3,124		0.072	6,976	0.160
	5.40		60.7	53.0	3,214		0.074	7,293	0.167
	5.50		61.5	53.8	3,306		0.076	7,619	0.175
	5.60		62.3	54.6	3,399		0.078	7,954	0.183
	5.70		63.1	55.4	3,493		0.080	8,299	0.191
	5.80		63.9	56.2	3,588		0.082	8,653	0.199
	5.90		64.7	57.0	3,685		0.085	9,016	0.207
	6.00		65.5	57.8	3,783		0.087	9,390	0.216
<b>Zone 1 (WQCV)</b>	6.08		66.1	58.4	3,862		0.089	9,695	0.223
	6.10		66.3	58.6	3,882		0.089	9,773	0.224
	6.20		67.1	59.4	3,982		0.091	10,166	0.233
	6.30		67.9	60.2	4,084		0.094	10,569	0.243
	6.40		68.7	61.0	4,187		0.096	10,983	0.252
	6.50		69.5	61.8	4,292		0.099	11,407	0.262
	6.60		70.3	62.6	4,397		0.101	11,841	0.272
	6.70		71.1	63.4	4,504		0.103	12,286	0.282
	6.80		71.9	64.2	4,612		0.106	12,742	0.293
	6.90		72.7	65.0	4,722		0.108	13,209	0.303
	7.00		73.5	65.8	4,833		0.111	13,687	0.314
	7.10		74.3	66.6	4,945		0.114	14,176	0.325
	7.20		75.1	67.4	5,058		0.116	14,676	0.337
	7.30		75.9	68.2	5,173		0.119	15,187	0.349
	7.40		76.7	69.0	5,289		0.121	15,710	0.361
	7.50		77.5	69.8	5,406		0.124	16,245	0.373
	7.60		78.3	70.6	5,524		0.127	16,791	0.385
	7.70		79.1	71.4	5,644		0.130	17,350	0.398
	7.80		79.9	72.2	5,765		0.132	17,920	0.411
	7.90		80.7	73.0	5,887		0.135	18,503	0.425
	8.00		81.5	73.8	6,011		0.138	19,098	0.438
	8.10		82.3	74.6	6,136		0.141	19,705	0.452
	8.20		83.1	75.4	6,262		0.144	20,325	0.467
	8.30		83.9	76.2	6,389		0.147	20,957	0.481
	8.40		84.7	77.0	6,518		0.150	21,603	0.496
	8.50		85.5	77.8	6,648		0.153	22,261	0.511
	8.60		86.3	78.6	6,779		0.156	22,932	0.526
	8.70		87.1	79.4	6,911		0.159	23,617	0.542
	8.80		87.9	80.2	7,045		0.162	24,315	0.558
	8.90		88.7	81.0	7,180		0.165	25,026	0.575
	9.00		89.5	81.8	7,317		0.168	25,751	0.591
	9.10		90.3	82.6	7,454		0.171	26,489	0.608
	9.20		91.1	83.4	7,593		0.174	27,242	0.625
	9.30		91.9	84.2	7,733		0.178	28,008	0.643
	9.40		92.7	85.0	7,875		0.181	28,788	0.661
	9.50		93.5	85.8	8,018		0.184	29,583	0.679
	9.60		94.3	86.6	8,162		0.187	30,392	0.698
	9.70		95.1	87.4	8,307		0.191	31,215	0.717
	9.80		95.9	88.2	8,454		0.194	32,053	0.736

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

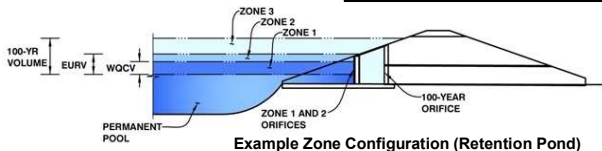


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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)	6.08	0.222	Orifice Plate
Zone 2			Not Utilized
Zone 3			Not Utilized
Total (all zones)		0.222	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 5/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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	2.40	3.20	4.00	4.80	5.60
Orifice Area (sq. inches)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir

Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Circular Orifice Diameter =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

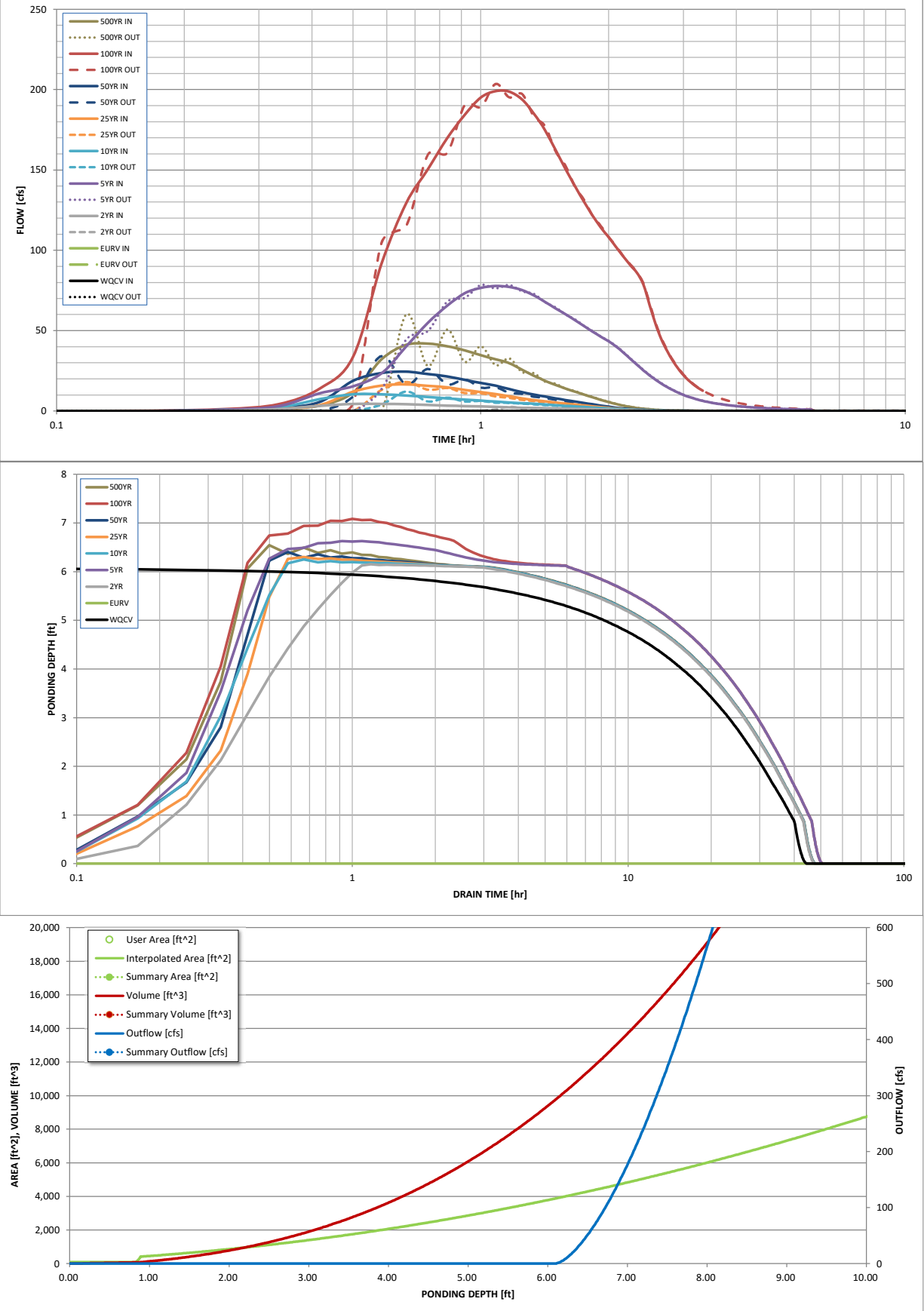
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.222	0.587	0.365	0.568	0.819	1.212	1.797	2.314	3.192
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.365	10.181	0.819	1.212	1.797	25.936	3.192
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	1.2	3.6	8.5	14.3	19.5	27.7
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	4.91	0.23	0.53	0.90	14.20	1.75
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	4.4	77.8	10.4	16.6	24.4	199.1	41.9
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	2.6	78.4	12.1	18.0	34.1	203.5	60.0
Peak Inflow Q (cfs) =	N/A	N/A	1.0	3.4	2.1	2.4	0.9	2.2	
Peak Outflow Q (cfs) =	0.1	89.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Structure Controlling Flow =	Plate	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	36	0	37	1	32	28	24	1	17
Time to Drain 99% of Inflow Volume (hours) =	40	0	42	19	39	37	34	3	30
Maximum Ponding Depth (ft) =	6.08	8.98	6.15	6.63	6.25	6.30	6.41	7.09	6.54
Area at Maximum Ponding Depth (acres) =	0.09	0.17	0.09	0.10	0.09	0.09	0.10	0.11	0.10
Maximum Volume Stored (acre-ft) =	0.223	0.588	0.229	0.274	0.238	0.243	0.252	0.323	0.266

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	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.20	0.18
	0:15:00	0.00	0.00	0.22	0.79	0.70	0.46	0.78	1.20	1.20
	0:20:00	0.00	0.00	1.20	2.95	2.20	1.38	1.95	4.22	3.38
	0:25:00	0.00	0.00	3.19	10.98	7.30	3.65	5.55	13.88	11.41
	0:30:00	0.00	0.00	4.36	15.39	10.44	12.00	18.79	33.58	32.19
	0:35:00	0.00	0.00	4.41	23.39	10.40	15.75	23.64	91.65	41.10
	0:40:00	0.00	0.00	4.18	40.08	9.58	16.59	24.44	129.24	41.92
	0:45:00	0.00	0.00	3.75	54.84	8.67	15.62	22.95	150.28	40.31
	0:50:00	0.00	0.00	3.38	65.52	7.79	14.68	21.53	169.77	37.72
	0:55:00	0.00	0.00	3.08	73.23	7.08	13.07	19.32	184.27	34.70
	1:00:00	0.00	0.00	2.82	76.59	6.44	11.69	17.42	195.05	32.15
	1:05:00	0.00	0.00	2.56	77.76	5.84	10.48	15.72	199.05	29.80
	1:10:00	0.00	0.00	2.27	77.19	5.27	9.12	13.63	198.73	25.71
	1:15:00	0.00	0.00	2.02	75.21	4.87	7.86	11.70	193.93	22.00
	1:20:00	0.00	0.00	1.85	71.91	4.48	6.83	10.20	185.11	18.81
	1:25:00	0.00	0.00	1.72	67.86	4.03	6.02	8.99	174.76	16.21
	1:30:00	0.00	0.00	1.60	63.85	3.61	5.28	7.85	162.44	13.99
	1:35:00	0.00	0.00	1.49	60.16	3.22	4.62	6.82	150.65	12.02
	1:40:00	0.00	0.00	1.37	56.55	2.85	4.02	5.89	139.88	10.22
	1:45:00	0.00	0.00	1.26	52.91	2.50	3.45	5.00	130.22	8.52
	1:50:00	0.00	0.00	1.15	49.43	2.17	2.90	4.16	121.72	6.95
	1:55:00	0.00	0.00	0.98	46.27	1.85	2.39	3.37	114.36	5.53
	2:00:00	0.00	0.00	0.83	43.41	1.56	1.92	2.67	108.22	4.33
	2:05:00	0.00	0.00	0.66	40.18	1.26	1.43	2.01	102.04	3.28
	2:10:00	0.00	0.00	0.54	36.38	1.02	1.09	1.53	96.18	2.49
	2:15:00	0.00	0.00	0.44	32.52	0.83	0.84	1.19	90.78	1.88
	2:20:00	0.00	0.00	0.36	28.78	0.67	0.65	0.91	86.01	1.41
	2:25:00	0.00	0.00	0.29	25.30	0.54	0.51	0.71	78.67	1.05
	2:30:00	0.00	0.00	0.24	22.14	0.43	0.40	0.55	65.81	0.77
	2:35:00	0.00	0.00	0.19	19.43	0.33	0.31	0.42	53.87	0.56
	2:40:00	0.00	0.00	0.15	16.98	0.26	0.24	0.32	44.53	0.43
	2:45:00	0.00	0.00	0.12	14.85	0.20	0.18	0.24	37.19	0.33
	2:50:00	0.00	0.00	0.10	13.01	0.15	0.14	0.19	31.26	0.26
	2:55:00	0.00	0.00	0.08	11.41	0.12	0.11	0.15	26.42	0.20
	3:00:00	0.00	0.00	0.06	10.05	0.09	0.08	0.11	22.47	0.15
	3:05:00	0.00	0.00	0.04	8.88	0.07	0.06	0.08	19.29	0.11
	3:10:00	0.00	0.00	0.03	7.89	0.04	0.04	0.05	16.59	0.07
	3:15:00	0.00	0.00	0.02	7.04	0.03	0.03	0.03	14.45	0.04
	3:20:00	0.00	0.00	0.01	6.31	0.01	0.01	0.02	12.60	0.02
	3:25:00	0.00	0.00	0.00	5.69	0.01	0.01	0.01	11.05	0.01
	3:30:00	0.00	0.00	0.00	5.16	0.00	0.00	0.00	9.76	0.00
	3:35:00	0.00	0.00	0.00	4.70	0.00	0.00	0.00	8.67	0.00
	3:40:00	0.00	0.00	0.00	4.29	0.00	0.00	0.00	7.75	0.00
	3:45:00	0.00	0.00	0.00	3.93	0.00	0.00	0.00	6.94	0.00
	3:50:00	0.00	0.00	0.00	3.61	0.00	0.00	0.00	6.25	0.00
	3:55:00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	5.65	0.00
	4:00:00	0.00	0.00	0.00	3.07	0.00	0.00	0.00	5.13	0.00
	4:05:00	0.00	0.00	0.00	2.85	0.00	0.00	0.00	4.67	0.00
	4:10:00	0.00	0.00	0.00	2.64	0.00	0.00	0.00	4.26	0.00
	4:15:00	0.00	0.00	0.00	2.46	0.00	0.00	0.00	3.91	0.00
	4:20:00	0.00	0.00	0.00	2.30	0.00	0.00	0.00	3.59	0.00
	4:25:00	0.00	0.00	0.00	2.15	0.00	0.00	0.00	3.31	0.00
	4:30:00	0.00	0.00	0.00	2.01	0.00	0.00	0.00	3.06	0.00
	4:35:00	0.00	0.00	0.00	1.89	0.00	0.00	0.00	2.83	0.00
	4:40:00	0.00	0.00	0.00	1.78	0.00	0.00	0.00	2.63	0.00
	4:45:00	0.00	0.00	0.00	1.68	0.00	0.00	0.00	2.45	0.00
	4:50:00	0.00	0.00	0.00	1.58	0.00	0.00	0.00	2.29	0.00
	4:55:00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	2.14	0.00
	5:00:00	0.00	0.00	0.00	1.42	0.00	0.00	0.00	2.01	0.00
	5:05:00	0.00	0.00	0.00	1.35	0.00	0.00	0.00	1.88	0.00
	5:10:00	0.00	0.00	0.00	1.28	0.00	0.00	0.00	1.77	0.00
	5:15:00	0.00	0.00	0.00	1.22	0.00	0.00	0.00	1.67	0.00
	5:20:00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	1.58	0.00
	5:25:00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	1.50	0.00
	5:30:00	0.00	0.00	0.00	1.07	0.00	0.00	0.00	1.42	0.00
	5:35:00	0.00	0.00	0.00	1.02	0.00	0.00	0.00	1.35	0.00
	5:40:00	0.00	0.00	0.00	0.98	0.00	0.00	0.00	1.28	0.00
	5:45:00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	1.22	0.00
	5:50:00	0.00	0.00	0.00	0.91	0.00	0.00	0.00	1.16	0.00
	5:55:00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	1.11	0.00
	6:00:00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	1.06	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.

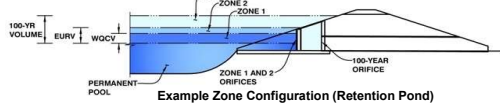
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

# 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 =	<b>EDB</b>
Watershed Area =	77.83 acres
Watershed Length =	2,354 ft
Watershed Length to Centroid =	1,434 ft
Watershed Slope =	0.039 ft/ft
Watershed Imperviousness =	37.27% 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) =	1.119 acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	3.029 acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	1.912 acre-feet	0.92 inches
5-yr Runoff Volume (P1 = 1.2 in.) =	2.931 acre-feet	1.20 inches
10-yr Runoff Volume (P1 = 1.45 in.) =	4.183 acre-feet	1.45 inches
25-yr Runoff Volume (P1 = 1.69 in.) =	6.108 acre-feet	inches
50-yr Runoff Volume (P1 = 2.15 in.) =	8.990 acre-feet	2.15 inches
100-yr Runoff Volume (P1 = 2.49 in.) =	11.532 acre-feet	2.49 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	15.854 acre-feet	inches
Approximate 2-yr Detention Volume =	1.714 acre-feet	
Approximate 5-yr Detention Volume =	2.491 acre-feet	
Approximate 10-yr Detention Volume =	3.598 acre-feet	
Approximate 25-yr Detention Volume =	4.137 acre-feet	
Approximate 50-yr Detention Volume =	4.914 acre-feet	
Approximate 100-yr Detention Volume =	5.868 acre-feet	

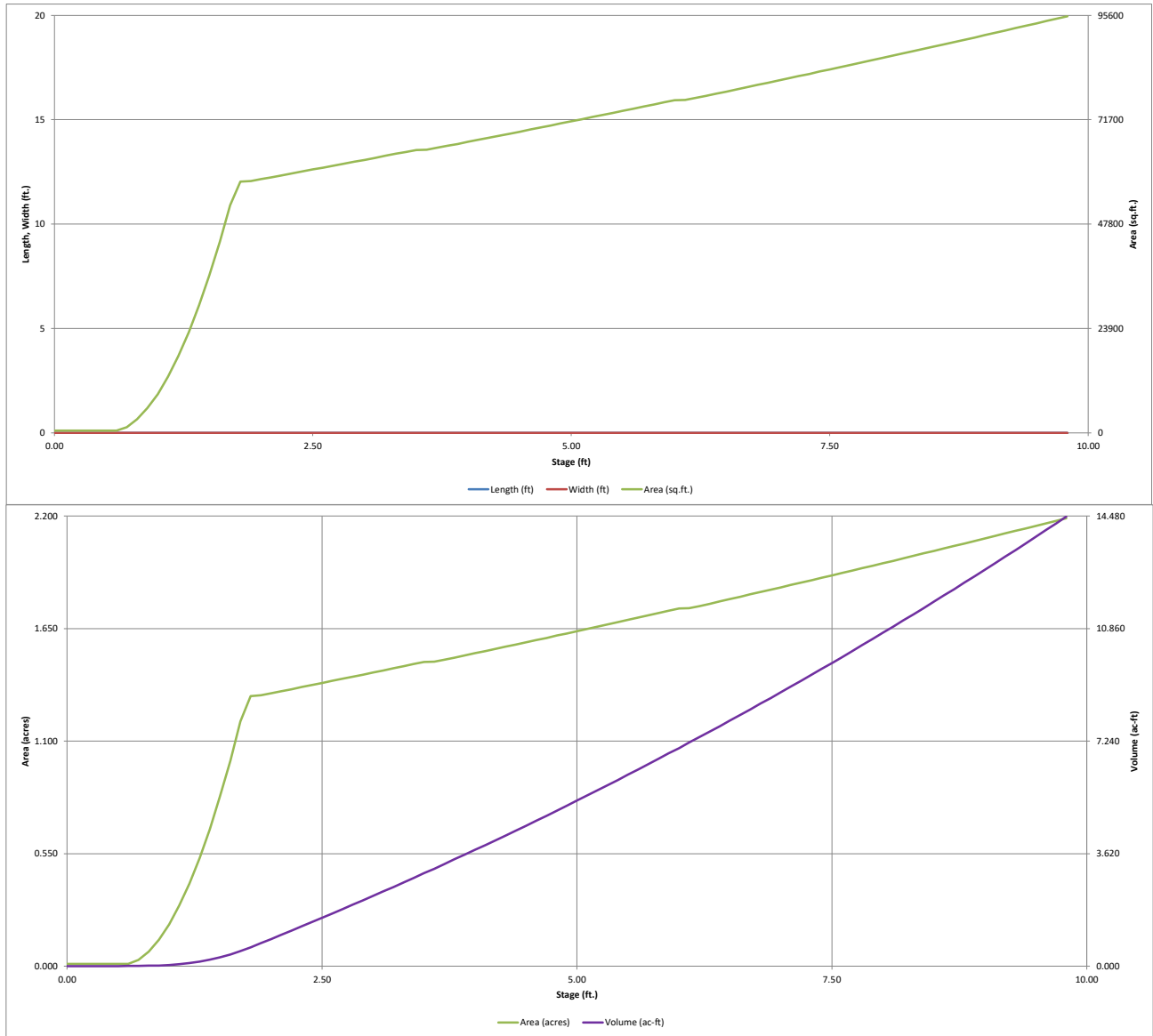
## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.119 acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.373 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.377 acre-feet
Total Detention Basin Volume =	5.868 acre-feet
Initial Surge Volume (ISV) =	user ft <sup>3</sup>
Initial Surge Depth (ISD) =	user ft
Total Available Detention Depth (H <sub>total</sub> ) =	user ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	user ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	user ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	user H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	user
Initial Surge Area (A <sub>ISV</sub> ) =	user ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	user ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	user ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	user ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	user ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	user ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	user ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	user ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	user ft
Length of Main Basin (L <sub>MAIN</sub> ) =	user ft
Width of Main Basin (W <sub>MAIN</sub> ) =	user ft
Area of Main Basin (A <sub>MAIN</sub> ) =	user ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	user ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	user acre-feet

Depth Increment =	0.10	ft								
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	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

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

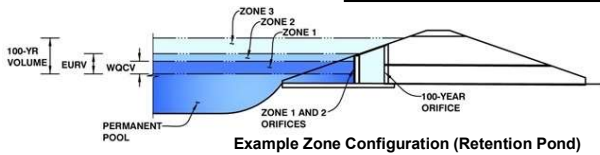


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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)	2.19	1.119	Orifice Plate
Zone 2 (5-year)	3.17	1.373	Weir&Pipe (Restrict)
Zone 3 (100-year)	5.33	3.377	Weir&Pipe (Restrict)
Total (all zones)		5.868	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (use rectangular openings)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	4.08	4.08	4.08					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

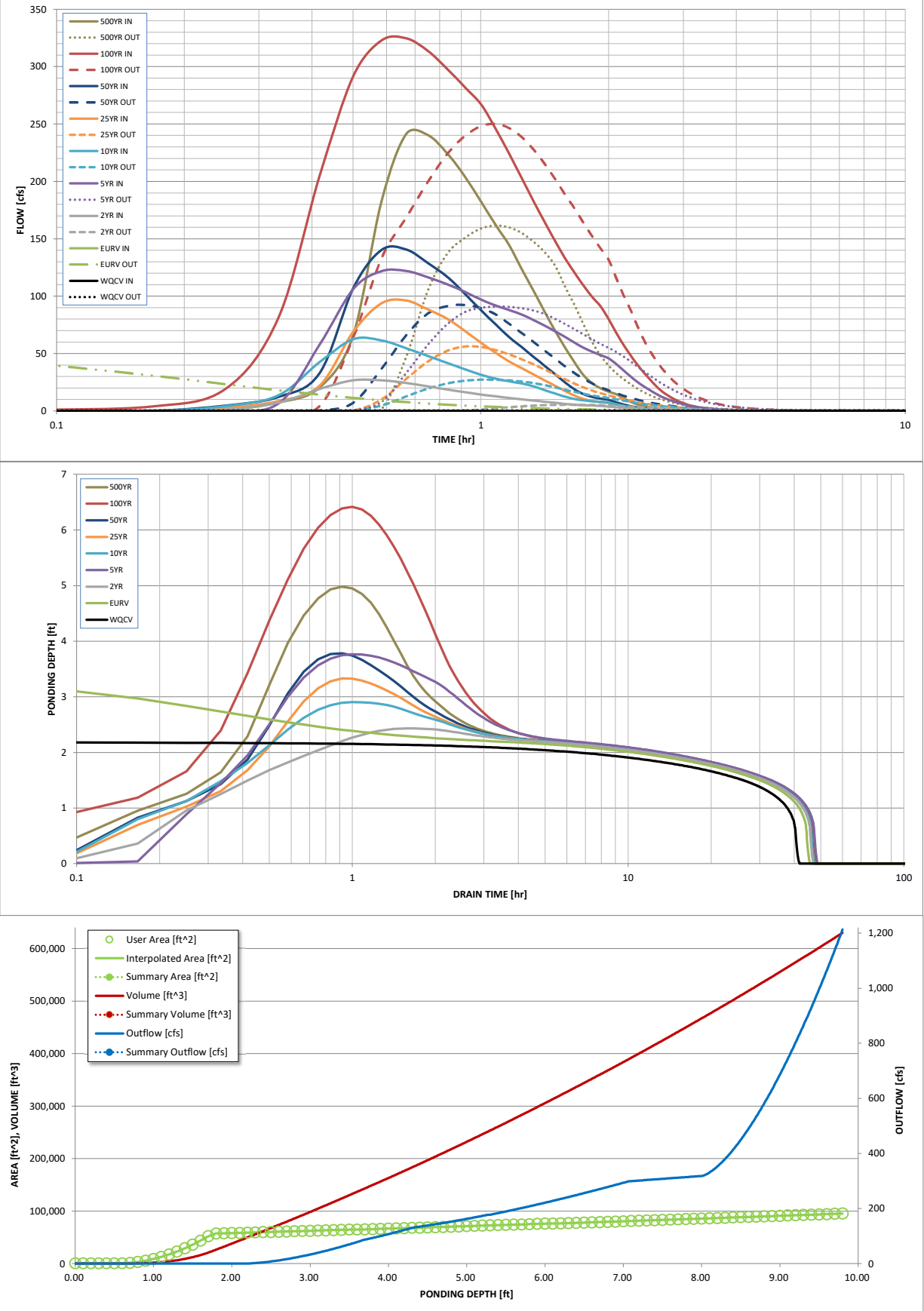
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	1.119	3.029	1.912	2.931	4.183	6.108	8.990	11.532	15.854
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.912	13.177	4.183	6.108	8.990	31.586	15.854
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.0	7.0	20.7	48.7	81.7	111.1	157.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	1.22	0.27	0.63	1.05	3.63	2.02
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	26.8	122.0	62.4	96.2	140.7	324.6	241.2
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	5.4	91.0	27.2	56.1	92.3	250.1	161.5
Peak Inflow Q (cfs) =	N/A	N/A	1.0	1.3	1.2	1.1	0.9	1.0	
Peak Outflow Q (cfs) =	N/A	N/A	0.18	2.9	0.9	1.9	3.0	4.7	4.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	0.01	0.3	0.1	0.2	0.3	2.5	1.1
Structure Controlling Flow =	Overflow Weir 1	Overflow Weir 2	Overflow Weir 2	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	2.39	0.18	2.9	0.9	1.9	3.0	4.7	4.2
Max Velocity through Grate 2 (fps) =	N/A	0.23	0.01	0.3	0.1	0.2	0.3	2.5	1.1
Time to Drain 97% of Inflow Volume (hours) =	38	39	42	29	39	36	33	11	25
Time to Drain 99% of Inflow Volume (hours) =	40	43	45	40	43	42	41	32	38
Maximum Ponding Depth (ft) =	2.19	3.53	2.43	3.76	2.90	3.33	3.78	6.42	4.98
Area at Maximum Ponding Depth (acres) =	1.35	1.49	1.38	1.50	1.43	1.47	1.51	1.78	1.64
Maximum Volume Stored (acre-ft) =	1.131	3.035	1.458	3.379	2.117	2.724	3.409	7.742	5.293

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: ...[SWM]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	0.66	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	3.86	1.09
	0:15:00	0.00	0.00	1.31	0.17	4.21	2.74	4.68	19.09	7.34
	0:20:00	0.00	0.00	7.35	6.44	13.60	8.63	12.28	81.23	20.31
	0:25:00	0.00	0.00	19.22	57.63	42.55	21.86	32.73	204.39	65.49
	0:30:00	0.00	0.00	26.78	105.91	62.43	68.70	106.51	291.30	182.57
	0:35:00	0.00	0.00	26.70	121.84	61.48	93.75	140.21	322.75	241.21
	0:40:00	0.00	0.00	24.48	121.99	54.67	96.23	140.69	324.60	240.42
	0:45:00	0.00	0.00	21.42	116.41	47.95	88.46	128.82	313.70	224.40
	0:50:00	0.00	0.00	18.69	110.41	41.78	80.30	116.84	297.86	204.33
	0:55:00	0.00	0.00	16.40	103.83	36.41	69.83	102.29	282.11	182.52
	1:00:00	0.00	0.00	14.35	97.11	31.58	59.54	87.84	267.35	162.01
	1:05:00	0.00	0.00	12.79	91.79	28.07	50.75	75.44	245.89	144.43
	1:10:00	0.00	0.00	11.36	87.95	25.80	43.14	64.38	224.04	123.22
	1:15:00	0.00	0.00	10.14	83.92	23.94	37.23	55.42	202.50	104.33
	1:20:00	0.00	0.00	9.07	79.13	21.40	31.69	46.99	182.39	85.94
	1:25:00	0.00	0.00	8.07	74.12	18.16	26.58	39.20	164.16	69.27
	1:30:00	0.00	0.00	7.09	69.16	15.05	21.73	31.70	147.43	54.76
	1:35:00	0.00	0.00	6.15	64.34	12.33	17.19	24.66	132.53	41.62
	1:40:00	0.00	0.00	5.39	59.23	10.31	13.17	18.54	119.83	30.69
	1:45:00	0.00	0.00	4.98	54.88	9.15	10.32	14.55	108.67	23.96
	1:50:00	0.00	0.00	4.81	51.47	8.48	8.65	12.17	98.97	19.70
	1:55:00	0.00	0.00	4.34	48.66	7.91	7.64	10.65	91.10	16.79
	2:00:00	0.00	0.00	3.88	45.84	7.21	6.98	9.61	80.07	14.70
	2:05:00	0.00	0.00	3.15	41.02	5.82	5.58	7.62	68.40	11.27
	2:10:00	0.00	0.00	2.45	35.43	4.47	4.23	5.71	57.91	8.13
	2:15:00	0.00	0.00	1.91	30.23	3.42	3.21	4.28	48.81	5.88
	2:20:00	0.00	0.00	1.47	25.64	2.58	2.42	3.20	40.92	4.37
	2:25:00	0.00	0.00	1.13	21.67	1.93	1.82	2.40	33.92	3.26
	2:30:00	0.00	0.00	0.86	18.21	1.43	1.35	1.77	27.65	2.43
	2:35:00	0.00	0.00	0.65	15.17	1.06	1.00	1.29	22.06	1.80
	2:40:00	0.00	0.00	0.48	12.49	0.79	0.75	0.97	17.35	1.35
	2:45:00	0.00	0.00	0.35	10.29	0.57	0.55	0.70	13.79	0.97
	2:50:00	0.00	0.00	0.23	8.53	0.39	0.38	0.48	10.99	0.66
	2:55:00	0.00	0.00	0.14	7.09	0.24	0.24	0.30	8.71	0.40
	3:00:00	0.00	0.00	0.08	5.89	0.13	0.13	0.16	6.84	0.21
	3:05:00	0.00	0.00	0.03	4.87	0.06	0.06	0.07	5.33	0.08
	3:10:00	0.00	0.00	0.01	4.03	0.01	0.01	0.01	4.14	0.01
	3:15:00	0.00	0.00	0.00	3.36	0.00	0.00	0.00	3.20	0.00
	3:20:00	0.00	0.00	0.00	2.83	0.00	0.00	0.00	2.49	0.00
	3:25:00	0.00	0.00	0.00	2.39	0.00	0.00	0.00	1.96	0.00
	3:30:00	0.00	0.00	0.00	2.02	0.00	0.00	0.00	1.57	0.00
	3:35:00	0.00	0.00	0.00	1.71	0.00	0.00	0.00	1.23	0.00
	3:40:00	0.00	0.00	0.00	1.44	0.00	0.00	0.00	0.93	0.00
	3:45:00	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.68	0.00
	3:50:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.46	0.00
	3:55:00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.29	0.00
	4:00:00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.15	0.00
	4:05:00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.06	0.00
	4:10:00	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.01	0.00
	4:15:00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.02	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.

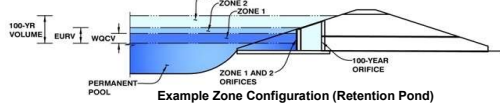
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

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

Basin ID: **Pond 10**



## Watershed Information

Selected BMP Type =	<b>EDB</b>	
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 =	16.25%	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.

Water Quality Capture Volume (WQCV) =	0.182	acre-feet
Excess Urban Runoff Volume (EURV) =	0.349	acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.190	acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	0.383	acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	0.685	acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	1.249	acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	2.035	acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	2.769	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	3.958	acre-feet
Approximate 2-yr Detention Volume =	0.181	acre-feet
Approximate 5-yr Detention Volume =	0.282	acre-feet
Approximate 10-yr Detention Volume =	0.504	acre-feet
Approximate 25-yr Detention Volume =	0.660	acre-feet
Approximate 50-yr Detention Volume =	0.787	acre-feet
Approximate 100-yr Detention Volume =	1.018	acre-feet

## Optional User Overrides

		acre-feet
		acre-feet
	0.92	inches
	1.20	inches
	1.45	inches
		inches
	2.15	inches
	2.49	inches
		inches

## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.182	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.100	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.736	acre-feet
Total Detention Basin Volume =	1.018	acre-feet
Initial Surge Volume (ISV) =	24	ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2	

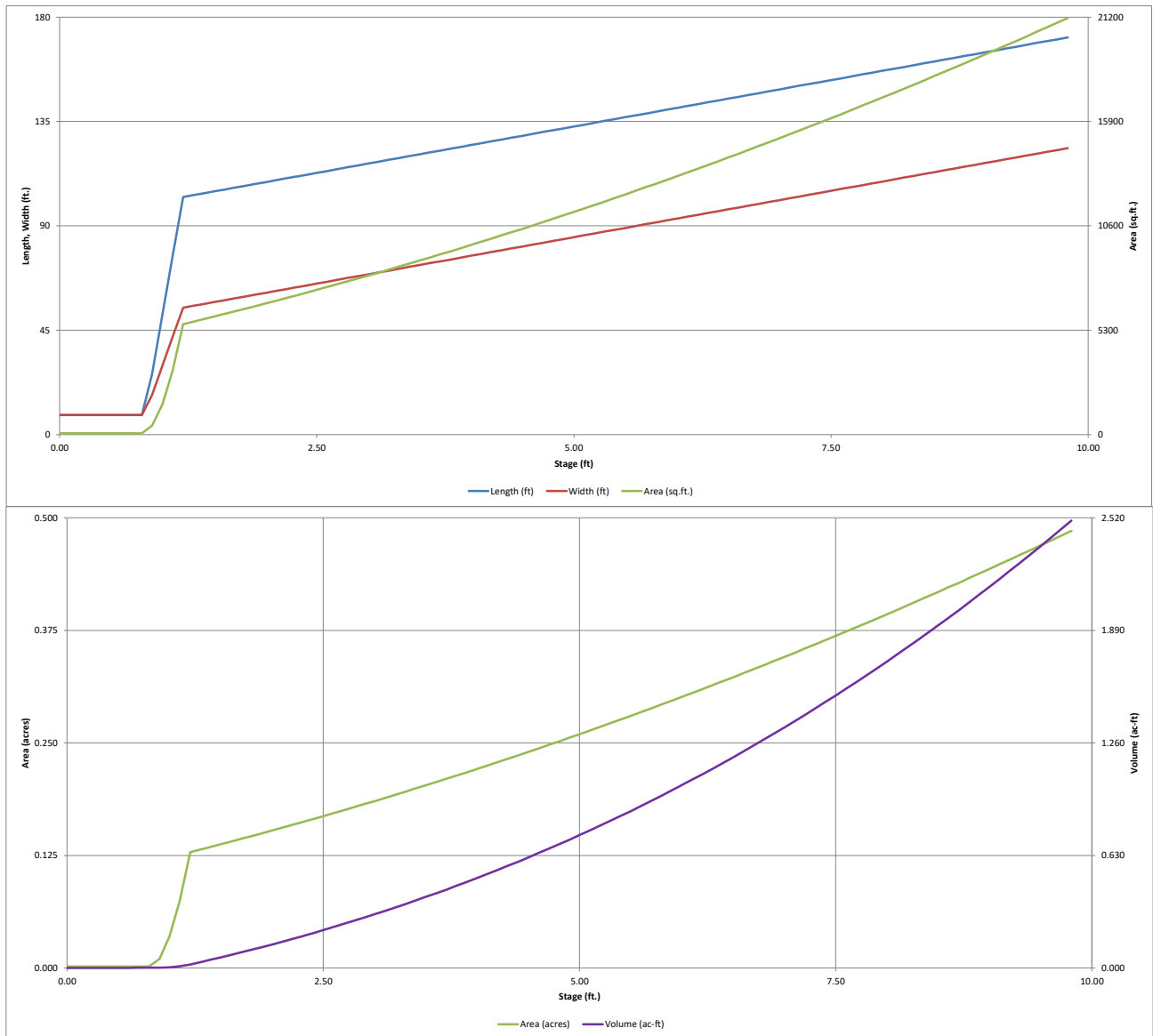
Initial Surge Area (A <sub>ISV</sub> ) =	72	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	8.5	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	8.5	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.37	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	102.5	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	54.7	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	5,608	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	779	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.80	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	140.9	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	93.1	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	13,118	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	43,685	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>1.022</b>	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		8.5	8.5	72		0.002		
<b>ISV</b>	0.33		8.5	8.5	72		0.002	24	0.001
	0.40		8.5	8.5	72		0.002	29	0.001
	0.50		8.5	8.5	72		0.002	36	0.001
	0.60		8.5	8.5	72		0.002	43	0.001
	0.70		8.5	8.5	72		0.002	50	0.001
	0.80		8.5	8.5	72		0.002	58	0.001
	0.90		26.3	17.2	452		0.010	76	0.002
	1.00		51.7	29.7	1,536		0.035	170	0.004
	1.10		77.1	42.2	3,254		0.075	405	0.009
<b>Floor</b>	1.20		102.5	54.7	5,608		0.129	842	0.019
	1.30		103.3	55.5	5,734		0.132	1,409	0.032
	1.40		104.1	56.3	5,862		0.135	1,989	0.046
	1.50		104.9	57.1	5,991		0.138	2,582	0.059
	1.60		105.7	57.9	6,121		0.141	3,187	0.073
	1.70		106.5	58.7	6,252		0.144	3,806	0.087
	1.80		107.3	59.5	6,385		0.147	4,438	0.102
	1.90		108.1	60.3	6,519		0.150	5,083	0.117
	2.00		108.9	61.1	6,655		0.153	5,742	0.132
	2.10		109.7	61.9	6,791		0.156	6,414	0.147
	2.20		110.5	62.7	6,929		0.159	7,100	0.163
	2.30		111.3	63.5	7,068		0.162	7,800	0.179
<b>Zone 1 (WQCV)</b>	2.32		111.4	63.7	7,096		0.163	7,942	0.182
	2.40		112.1	64.3	7,209		0.165	8,514	0.195
	2.50		112.9	65.1	7,351		0.169	9,242	0.212
	2.60		113.7	65.9	7,494		0.172	9,984	0.229
	2.70		114.5	66.7	7,638		0.175	10,741	0.247
	2.80		115.3	67.5	7,784		0.179	11,512	0.264
<b>Zone 2 (5-year)</b>	2.90		116.1	68.3	7,930		0.182	12,297	0.282
	3.00		116.9	69.1	8,079		0.185	13,098	0.301
	3.10		117.7	69.9	8,228		0.189	13,913	0.319
	3.20		118.5	70.7	8,379		0.192	14,743	0.338
	3.30		119.3	71.5	8,531		0.196	15,589	0.358
	3.40		120.1	72.3	8,684		0.199	16,450	0.378
	3.50		120.9	73.1	8,838		0.203	17,326	0.398
	3.60		121.7	73.9	8,994		0.206	18,217	0.418
	3.70		122.5	74.7	9,151		0.210	19,125	0.439
	3.80		123.3	75.5	9,310		0.214	20,048	0.460
	3.90		124.1	76.3	9,470		0.217	20,987	0.482
	4.00		124.9	77.1	9,630		0.221	21,942	0.504
	4.10		125.7	77.9	9,793		0.225	22,913	0.526
	4.20		126.5	78.7	9,956		0.229	23,900	0.549
	4.30		127.3	79.5	10,121		0.232	24,904	0.572
	4.40		128.1	80.3	10,287		0.236	25,924	0.595
	4.50		128.9	81.1	10,454		0.240	26,961	0.619
	4.60		129.7	81.9	10,623		0.244	28,015	0.643
	4.70		130.5	82.7	10,793		0.248	29,086	0.668
	4.80		131.3	83.5	10,964		0.252	30,174	0.693
	4.90		132.1	84.3	11,137		0.256	31,279	0.718
	5.00		132.9	85.1	11,310		0.260	32,401	0.744
	5.10		133.7	85.9	11,485		0.264	33,541	0.770
	5.20		134.5	86.7	11,662		0.268	34,698	0.797
	5.30		135.3	87.5	11,839		0.272	35,873	0.824
	5.40		136.1	88.3	12,018		0.276	37,066	0.851
	5.50		136.9	89.1	12,198		0.280	38,277	0.879
	5.60		137.7	89.9	12,380		0.284	39,506	0.907
	5.70		138.5	90.7	12,562		0.288	40,753	0.936
	5.80		139.3	91.5	12,746		0.293	42,019	0.965
	5.90		140.1	92.3	12,932		0.297	43,302	0.994
<b>Zone 3 (100-year)</b>	5.98		140.7	93.0	13,081		0.300	44,343	1.018
	6.00		140.9	93.1	13,118		0.301	44,605	1.024
	6.10		141.7	93.9	13,306		0.305	45,926	1.054
	6.20		142.5	94.7	13,495		0.310	47,266	1.085
	6.30		143.3	95.5	13,686		0.314	48,625	1.116
	6.40		144.1	96.3	13,877		0.319	50,003	1.148
	6.50		144.9	97.1	14,070		0.323	51,401	1.180
	6.60		145.7	97.9	14,264		0.327	52,818	1.213
	6.70		146.5	98.7	14,460		0.332	54,254	1.245
	6.80		147.3	99.5	14,657		0.336	55,710	1.279
	6.90		148.1	100.3	14,855		0.341	57,185	1.313
	7.00		148.9	101.1	15,054		0.346	58,681	1.347
	7.10		149.7	101.9	15,255		0.350	60,196	1.382
	7.20		150.5	102.7	15,457		0.355	61,732	1.417
	7.30		151.3	103.5	15,660		0.360	63,287	1.453
	7.40		152.1	104.3	15,864		0.364	64,864	1.489
	7.50		152.9	105.1	16,070		0.369	66,460	1.526
	7.60		153.7	105.9	16,277		0.374	68,078	1.563
	7.70		154.5	106.7	16,486		0.378	69,716	1.600
	7.80		155.3	107.5	16,695		0.383	71,375	1.639
	7.90		156.1	108.3	16,906		0.388	73,055	1.677
	8.00		156.9	109.1	17,118		0.393	74,756	1.716
	8.10		157.7	109.9	17,332		0.398	76,479	1.756
	8.20		158.5	110.7	17,546		0.403	78,222	1.796
	8.30		159.3	111.5	17,762		0.408	79,988	1.836
	8.40		160.1	112.3	17,980		0.413	81,775	1.877
	8.50		160.9	113.1	18,198		0.418	83,584	1.919
	8.60		161.7	113.9	18,418		0.423	85,415	1.961
	8.70		162.5	114.7	18,639		0.428	87,267	2.003
	8.80		163.3	115.5	18,861		0.433	89,142	2.046
	8.90		164.1	116.3	19,085		0.438	91,040	2.090
	9.00		164.9	117.1	19,310		0.443	92,960	2.134
	9.10		165.7	117.9	19,536		0.448	94,902	2.179
	9.20		166.5	118.7	19,764		0.454	96,867	2.224
	9.30		167.3	119.5	19,993		0.459	98,855	2.269
	9.40		168.1	120.3	20,223		0.464	100,865	2.316
	9.50		168.9	121.1	20,454		0.470	102,899	2.362
	9.60		169.7	121.9	20,687		0.475	104,956	2.409
	9.70		170.5	122.7	20,921		0.480	107,037	2.457
	9.80		171.3	123.5	21,156		0.486	109,140	2.506

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

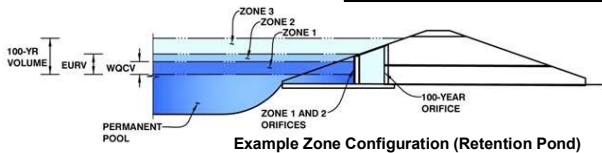


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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)	2.32	0.182	Orifice Plate
Zone 2 (5-year)	2.90	0.100	Circular Orifice
Zone 3 (100-year)	5.98	0.736	Weir&Pipe (Restrict)
Total (all zones)		1.018	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 7/8 inch)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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	0.74	1.47					
Orifice Area (sq. inches)	0.64	0.64	0.64					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Circular   
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir   
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor   
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

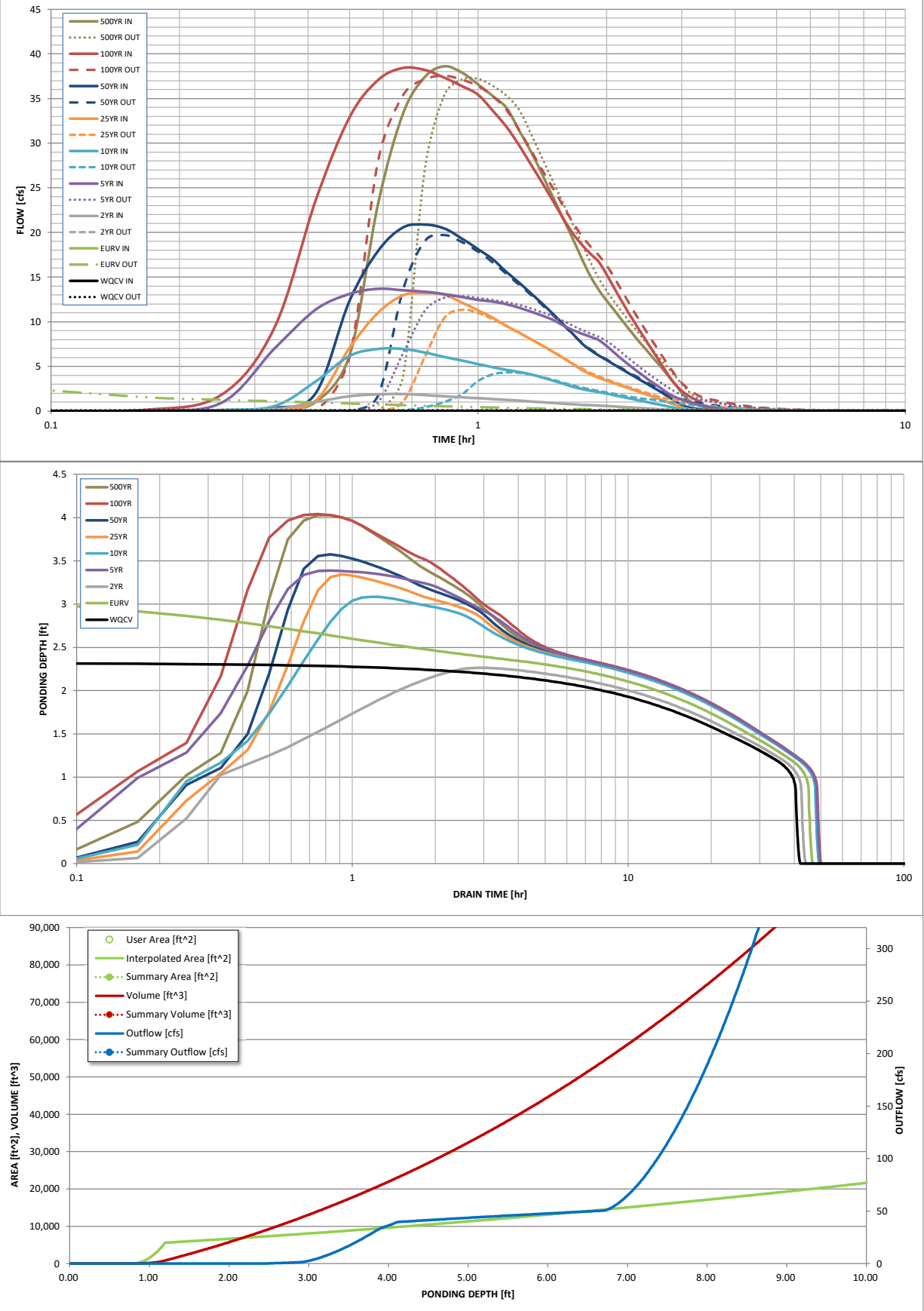
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.182	0.349	0.190	0.383	0.685	1.249	2.035	2.769	3.958
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.190	1.914	0.685	1.249	2.035	4.610	3.958
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	1.5	4.5	10.7	18.0	24.6	35.0
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.60	0.20	0.49	0.82	1.79	1.60
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	13.7	7.0	13.2	20.9	38.4	38.6
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.1	12.9	4.3	11.3	19.7	37.5	37.2
Peak Inflow Q (cfs) =	N/A	N/A	N/A	1.0	1.0	1.1	1.1	1.0	1.1
Peak Outflow Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Plate	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	0.50	N/A	0.8	0.2	0.7	1.3	2.6	2.6
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	42	41	31	41	36	30	15	18
Time to Drain 99% of Inflow Volume (hours) =	40	44	42	42	46	44	42	34	36
Maximum Ponding Depth (ft) =	2.32	3.26	2.26	3.39	3.09	3.34	3.57	4.04	4.03
Area at Maximum Ponding Depth (acres) =	0.16	0.19	0.16	0.20	0.19	0.20	0.21	0.22	0.22
Maximum Volume Stored (acre-ft) =	0.182	0.350	0.173	0.374	0.316	0.366	0.412	0.513	0.510

# 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	0.03	0.00
	0:10:00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.15	0.03
	0:15:00	0.00	0.00	0.04	0.89	0.11	0.07	0.13	1.78	0.20
	0:20:00	0.00	0.00	0.20	6.97	0.56	0.24	0.33	9.31	1.01
	0:25:00	0.00	0.00	1.01	11.35	3.31	1.17	1.99	23.57	6.27
	0:30:00	0.00	0.00	1.67	13.11	6.18	7.08	12.36	32.91	23.22
	0:35:00	0.00	0.00	1.87	13.69	6.95	11.02	17.93	37.06	33.28
	0:40:00	0.00	0.00	1.91	13.53	6.94	12.96	20.55	38.41	37.39
	0:45:00	0.00	0.00	1.79	13.37	6.55	13.24	20.88	38.19	38.61
	0:50:00	0.00	0.00	1.66	13.10	6.06	13.02	20.45	37.34	37.90
	0:55:00	0.00	0.00	1.55	12.76	5.65	12.16	19.31	36.39	36.58
	1:00:00	0.00	0.00	1.44	12.45	5.26	11.27	18.13	35.43	35.25
	1:05:00	0.00	0.00	1.35	12.25	4.89	10.43	16.99	33.61	33.92
	1:10:00	0.00	0.00	1.25	11.96	4.61	9.51	15.55	31.80	31.34
	1:15:00	0.00	0.00	1.16	11.55	4.37	8.75	14.34	29.68	28.96
	1:20:00	0.00	0.00	1.08	11.11	4.09	8.02	13.14	27.53	26.38
	1:25:00	0.00	0.00	0.99	10.66	3.75	7.32	11.99	25.47	23.88
	1:30:00	0.00	0.00	0.91	10.20	3.40	6.62	10.84	23.46	21.53
	1:35:00	0.00	0.00	0.83	9.57	3.05	5.93	9.72	21.55	19.26
	1:40:00	0.00	0.00	0.75	9.07	2.72	5.25	8.63	19.88	17.07
	1:45:00	0.00	0.00	0.69	8.67	2.46	4.61	7.59	18.62	15.08
	1:50:00	0.00	0.00	0.65	8.32	2.28	4.11	6.82	17.61	13.57
	1:55:00	0.00	0.00	0.61	7.95	2.11	3.72	6.22	16.71	12.36
	2:00:00	0.00	0.00	0.56	7.28	1.95	3.41	5.71	15.29	11.31
	2:05:00	0.00	0.00	0.52	6.55	1.78	3.11	5.20	13.79	10.25
	2:10:00	0.00	0.00	0.47	5.86	1.60	2.83	4.71	12.36	9.25
	2:15:00	0.00	0.00	0.42	5.22	1.44	2.56	4.25	11.02	8.31
	2:20:00	0.00	0.00	0.37	4.63	1.28	2.30	3.81	9.81	7.44
	2:25:00	0.00	0.00	0.33	4.08	1.13	2.05	3.39	8.65	6.62
	2:30:00	0.00	0.00	0.29	3.56	0.98	1.80	2.99	7.56	5.83
	2:35:00	0.00	0.00	0.25	3.08	0.84	1.56	2.59	6.50	5.06
	2:40:00	0.00	0.00	0.21	2.62	0.70	1.32	2.19	5.48	4.30
	2:45:00	0.00	0.00	0.17	2.18	0.57	1.09	1.80	4.49	3.54
	2:50:00	0.00	0.00	0.14	1.79	0.44	0.85	1.42	3.58	2.78
	2:55:00	0.00	0.00	0.10	1.50	0.31	0.62	1.04	2.82	2.05
	3:00:00	0.00	0.00	0.07	1.27	0.22	0.40	0.68	2.26	1.40
	3:05:00	0.00	0.00	0.06	1.08	0.17	0.26	0.47	1.84	0.99
	3:10:00	0.00	0.00	0.05	0.92	0.14	0.17	0.33	1.50	0.72
	3:15:00	0.00	0.00	0.04	0.78	0.12	0.12	0.24	1.23	0.52
	3:20:00	0.00	0.00	0.03	0.65	0.10	0.09	0.18	1.01	0.37
	3:25:00	0.00	0.00	0.03	0.54	0.08	0.07	0.13	0.82	0.26
	3:30:00	0.00	0.00	0.02	0.44	0.06	0.05	0.10	0.67	0.17
	3:35:00	0.00	0.00	0.02	0.36	0.05	0.04	0.07	0.55	0.12
	3:40:00	0.00	0.00	0.02	0.28	0.04	0.03	0.06	0.44	0.09
	3:45:00	0.00	0.00	0.01	0.22	0.03	0.02	0.04	0.35	0.07
	3:50:00	0.00	0.00	0.01	0.17	0.02	0.02	0.03	0.27	0.06
	3:55:00	0.00	0.00	0.01	0.12	0.02	0.01	0.03	0.20	0.04
	4:00:00	0.00	0.00	0.01	0.08	0.01	0.01	0.02	0.14	0.03
	4:05:00	0.00	0.00	0.00	0.05	0.01	0.01	0.01	0.09	0.02
	4:10:00	0.00	0.00	0.00	0.03	0.01	0.00	0.01	0.06	0.02
	4:15:00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.03	0.01
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	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.

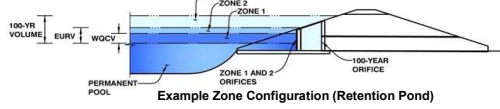
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

# 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 =	<b>EDB</b>	
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 =	25.08%	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.

Water Quality Capture Volume (WQCV) =	0.898	acre-feet
Excess Urban Runoff Volume (EURV) =	2.023	acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	1.185	acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	2.049	acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	3.233	acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	5.240	acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	8.161	acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	10.807	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	15.177	acre-feet
Approximate 2-yr Detention Volume =	1.098	acre-feet
Approximate 5-yr Detention Volume =	1.651	acre-feet
Approximate 10-yr Detention Volume =	2.601	acre-feet
Approximate 25-yr Detention Volume =	3.162	acre-feet
Approximate 50-yr Detention Volume =	3.774	acre-feet
Approximate 100-yr Detention Volume =	4.698	acre-feet

## Optional User Overrides

		acre-feet
		acre-feet
	0.92	inches
	1.20	inches
	1.45	inches
		inches
	2.15	inches
	2.49	inches
		inches

## Define Zones and Basin Geometry

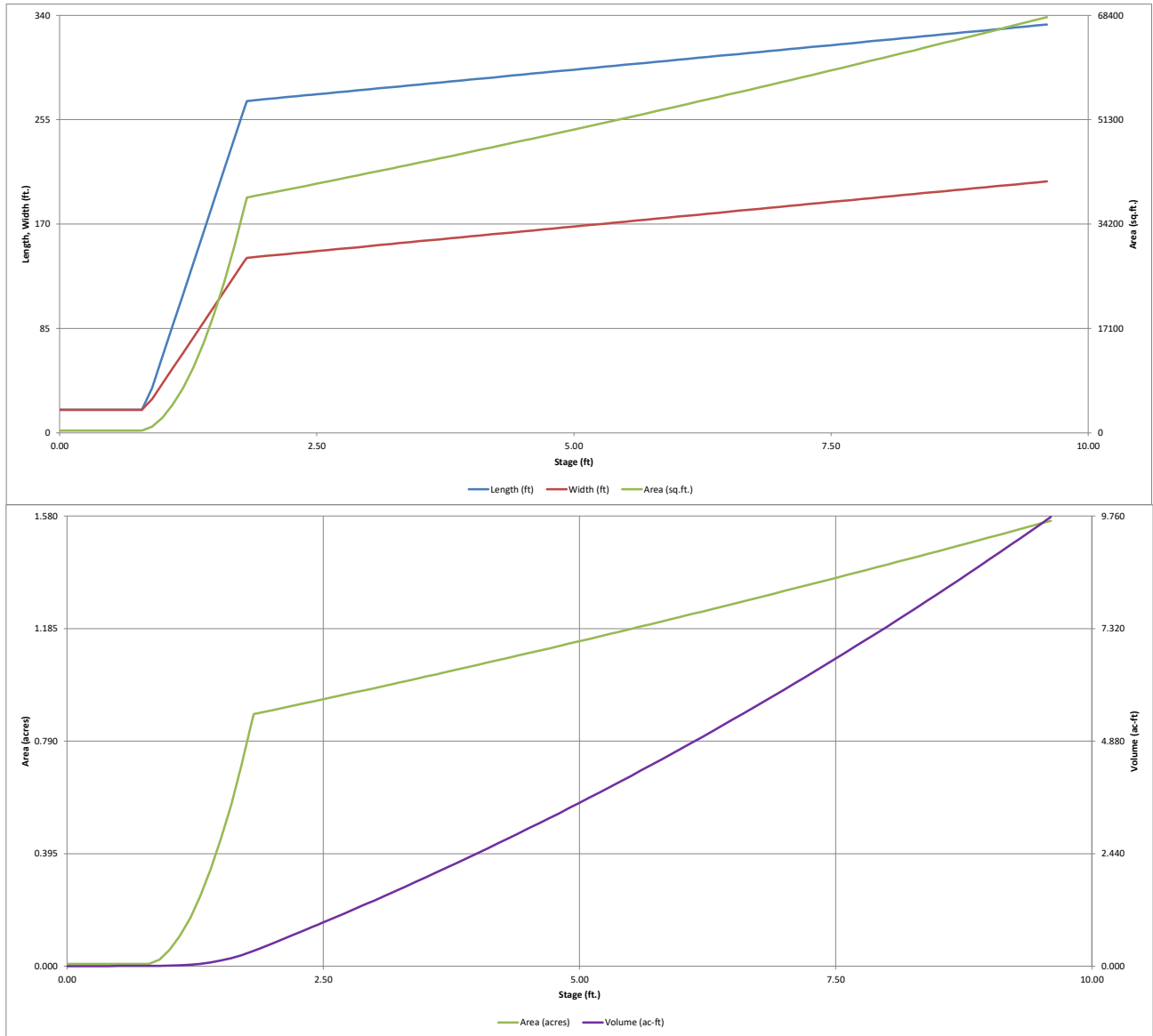
Zone 1 Volume (WQCV) =	0.898	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.753	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.047	acre-feet
Total Detention Basin Volume =	4.698	acre-feet
Initial Surcharge Volume (ISV) =	117	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2	

Initial Surcharge Area (A <sub>ISV</sub> ) =	356	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	18.9	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	18.9	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.99	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	270.3	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	142.6	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	38,549	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	14,060	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.18	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	303.8	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	176.0	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	53,475	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	191,480	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>4,725</b>	acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft. <sup>2</sup> )	Optional Override Area (ft. <sup>2</sup> )	Area (acre)	Volume (ft. <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		18.9	18.9	356		0.008		
ISV	0.33		18.9	18.9	356		0.008	117	0.003
	0.40		18.9	18.9	356		0.008	142	0.003
	0.50		18.9	18.9	356		0.008	178	0.004
	0.60		18.9	18.9	356		0.008	213	0.005
	0.70		18.9	18.9	356		0.008	249	0.006
	0.80		18.9	18.9	356		0.008	284	0.007
	0.90		36.6	27.6	1,011		0.023	341	0.008
	1.00		62.0	40.1	2,488		0.057	511	0.012
	1.10		87.4	52.6	4,600		0.106	860	0.020
	1.20		112.8	65.1	7,346		0.169	1,452	0.033
	1.30		138.2	77.6	10,728		0.246	2,350	0.054
	1.40		163.6	90.1	14,744		0.338	3,619	0.083
	1.50		189.0	102.6	19,396		0.445	5,320	0.122
	1.60		214.4	115.1	24,683		0.567	7,519	0.173
	1.70		239.8	127.6	30,604		0.703	10,278	0.236
	1.80		265.2	140.1	37,161		0.853	13,661	0.314
Floor	1.82		270.3	142.6	38,549		0.885	14,418	0.331
	1.90		271.0	143.2	38,813		0.891	17,513	0.402
	2.00		271.8	144.0	39,145		0.899	21,410	0.492
	2.10		272.6	144.8	39,478		0.906	25,342	0.582
	2.20		273.4	145.6	39,813		0.914	29,306	0.673
	2.30		274.2	146.4	40,149		0.922	33,304	0.765
	2.40		275.0	147.2	40,486		0.929	37,336	0.857
Zone 1 (WQCV)	2.45		275.4	147.6	40,655		0.933	39,365	0.904
	2.50		275.8	148.0	40,824		0.937	41,402	0.950
	2.60		276.6	148.8	41,164		0.945	45,501	1.045
	2.70		277.4	149.6	41,505		0.953	49,634	1.139
	2.80		278.2	150.4	41,847		0.961	53,802	1.235
	2.90		279.0	151.2	42,191		0.969	58,004	1.332
	3.00		279.8	152.0	42,536		0.976	62,240	1.429
	3.10		280.6	152.8	42,882		0.984	66,511	1.527
	3.20		281.4	153.6	43,229		0.992	70,817	1.626
Zone 2 (5-year)	3.23		281.6	153.9	43,334		0.995	72,115	1.656
	3.30		282.2	154.4	43,578		1.000	75,157	1.725
	3.40		283.0	155.2	43,928		1.008	79,532	1.826
	3.50		283.8	156.0	44,279		1.017	83,942	1.927
	3.60		284.6	156.8	44,631		1.025	88,388	2.029
	3.70		285.4	157.6	44,985		1.033	92,869	2.132
	3.80		286.2	158.4	45,340		1.041	97,385	2.236
	3.90		287.0	159.2	45,696		1.049	101,937	2.340
	4.00		287.8	160.0	46,054		1.057	106,524	2.445
	4.10		288.6	160.8	46,413		1.065	111,148	2.552
	4.20		289.4	161.6	46,773		1.074	115,807	2.659
	4.30		290.2	162.4	47,135		1.082	120,502	2.766
	4.40		291.0	163.2	47,497		1.090	125,234	2.875
	4.50		291.8	164.0	47,861		1.099	130,002	2.984
	4.60		292.6	164.8	48,227		1.107	134,806	3.095
	4.70		293.4	165.6	48,593		1.116	139,647	3.206
	4.80		294.2	166.4	48,961		1.124	144,525	3.318
	4.90		295.0	167.2	49,330		1.132	149,439	3.431
	5.00		295.8	168.0	49,700		1.141	154,391	3.544
	5.10		296.6	168.8	50,072		1.149	159,380	3.659
	5.20		297.4	169.6	50,445		1.158	164,405	3.774
	5.30		298.2	170.4	50,819		1.167	169,469	3.890
	5.40		299.0	171.2	51,195		1.175	174,569	4.008
	5.50		299.8	172.0	51,572		1.184	179,708	4.126
	5.60		300.6	172.8	51,950		1.193	184,884	4.244
	5.70		301.4	173.6	52,329		1.201	190,098	4.364
	5.80		302.2	174.4	52,710		1.210	195,350	4.485
	5.90		303.0	175.2	53,092		1.219	200,640	4.606
Zone 3 (100-year)	5.98		303.6	175.9	53,398		1.226	204,899	4.704
	6.00		303.8	176.0	53,475		1.228	205,968	4.728
	6.10		304.6	176.8	53,859		1.236	211,335	4.852
	6.20		305.4	177.6	54,245		1.245	216,740	4.976
	6.30		306.2	178.4	54,632		1.254	222,184	5.101
	6.40		307.0	179.2	55,020		1.263	227,666	5.226
	6.50		307.8	180.0	55,410		1.272	233,188	5.353
	6.60		308.6	180.8	55,801		1.281	238,748	5.481
	6.70		309.4	181.6	56,193		1.290	244,348	5.609
	6.80		310.2	182.4	56,587		1.299	249,987	5.739
	6.90		311.0	183.2	56,981		1.308	255,665	5.869
	7.00		311.8	184.0	57,377		1.317	261,383	6.001
	7.10		312.6	184.8	57,775		1.326	267,141	6.133
	7.20		313.4	185.6	58,173		1.335	272,938	6.266
	7.30		314.2	186.4	58,573		1.345	278,775	6.400
	7.40		315.0	187.2	58,974		1.354	284,653	6.535
	7.50		315.8	188.0	59,376		1.363	290,570	6.671
	7.60		316.6	188.8	59,780		1.372	296,528	6.807
	7.70		317.4	189.6	60,185		1.382	302,526	6.945
	7.80		318.2	190.4	60,591		1.391	308,565	7.084
	7.90		319.0	191.2	60,999		1.400	314,645	7.223
	8.00		319.8	192.0	61,408		1.410	320,765	7.364
	8.10		320.6	192.8	61,818		1.419	326,926	7.505
	8.20		321.4	193.6	62,229		1.429	333,129	7.648
	8.30		322.2	194.4	62,642		1.438	339,372	7.791
	8.40		323.0	195.2	63,056		1.448	345,657	7.935
	8.50		323.8	196.0	63,471		1.457	351,983	8.080
	8.60		324.6	196.8	63,887		1.467	358,351	8.227
	8.70		325.4	197.6	64,305		1.476	364,761	8.374
	8.80		326.2	198.4	64,724		1.486	371,212	8.522
	8.90		327.0	199.2	65,144		1.496	377,706	8.671
	9.00		327.8	200.0	65,566		1.505	384,241	8.821
	9.10		328.6	200.8	65,989		1.515	390,819	8.972
	9.20		329.4	201.6	66,413		1.525	397,439	9.124
	9.30		330.2	202.4	66,839		1.534	404,102	9.277
	9.40		331.0	203.2	67,265		1.544	410,807	9.431
	9.50		331.8	204.0	67,693		1.554	417,555	9.586
	9.60		332.6	204.8	68,123		1.564	424,346	9.742

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

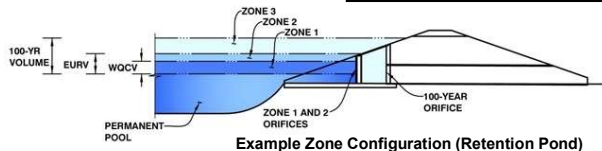


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **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)	2.45	0.898	Orifice Plate
Zone 2 (5-year)	3.23	0.753	Weir&Pipe (Circular)
Zone 3 (100-year)	5.98	3.047	Weir&Pipe (Restrict)
Total (all zones)		4.698	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-7/8 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	2.85	2.85	2.85					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Circular Orifice Diameter or Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

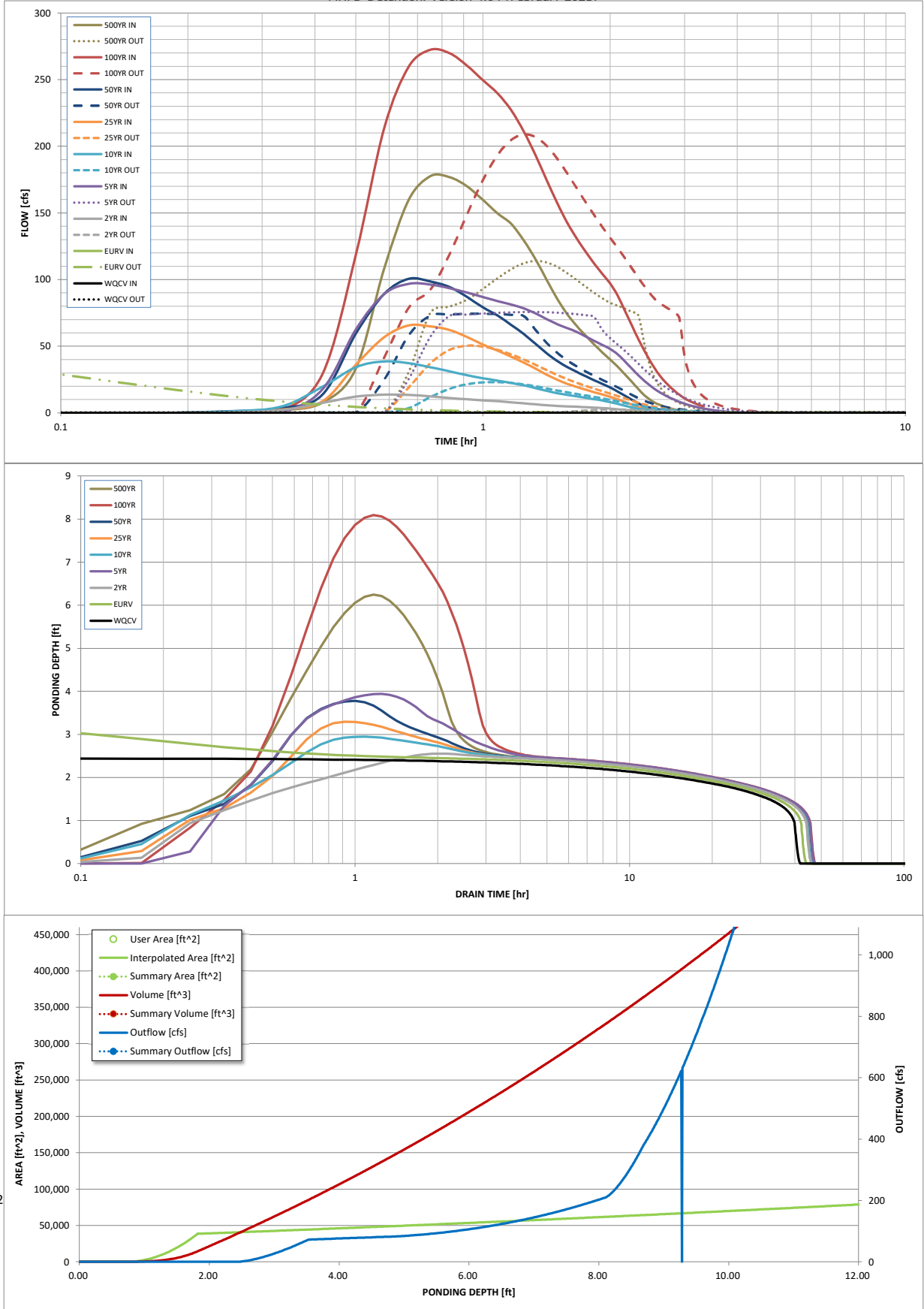
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
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) =	0.898	2.023	1.185	2.049	3.233	5.240	8.161	10.807	15.177
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.185	11.781	3.233	5.240	8.161	28.368	15.177
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.9	6.6	19.7	46.3	78.1	106.0	150.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		74.9				222.3	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.94	0.25	0.58	0.98	2.79	1.89
Peak Inflow Q (cfs) =	N/A	N/A	13.7	96.8	38.6	65.6	100.6	272.3	177.5
Peak Outflow Q (cfs) =	0.4	59.4	2.6	75.7	23.1	50.4	74.4	208.8	114.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.2	1.1	1.0	0.9	0.8
Structure Controlling Flow =	Overflow Weir 1	Outlet Plate 1	Overflow Weir 1	Outlet Plate 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Overflow Weir 2	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	1.04	0.03	1.1	0.3	0.7	1.1	1.5	1.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8	0.2
Time to Drain 97% of Inflow Volume (hours) =	39	39	42	26	38	35	30	7	21
Time to Drain 99% of Inflow Volume (hours) =	40	41	44	38	43	41	39	29	35
Maximum Ponding Depth (ft) =	2.45	3.60	2.55	3.94	2.95	3.29	3.78	8.09	6.25
Area at Maximum Ponding Depth (acres) =	0.93	1.02	0.94	1.05	0.97	1.00	1.04	1.42	1.25
Maximum Volume Stored (acre-ft) =	0.904	2.029	0.997	2.382	1.370	1.715	2.204	7.491	5.026

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Depotion. 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: ...[SWM]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	0.00	0.00	0.00	0.04	0.00	0.29
	0:15:00	0.00	0.00	0.36	0.00	1.14	0.74	1.27	0.03	2.03
	0:20:00	0.00	0.00	2.07	0.72	4.78	2.46	3.54	2.05	7.75
	0:25:00	0.00	0.00	7.55	17.57	19.64	8.69	13.71	29.01	33.12
	0:30:00	0.00	0.00	12.21	62.58	34.27	36.11	59.41	118.45	108.16
	0:35:00	0.00	0.00	13.67	89.12	38.65	56.71	89.19	213.31	159.75
	0:40:00	0.00	0.00	13.48	96.79	37.29	65.62	100.58	259.56	177.50
	0:45:00	0.00	0.00	12.39	96.33	34.29	64.92	98.60	272.32	176.82
	0:50:00	0.00	0.00	11.24	93.54	31.17	62.24	94.45	269.79	169.98
	0:55:00	0.00	0.00	10.20	90.31	28.28	56.92	86.98	260.52	159.68
	1:00:00	0.00	0.00	9.42	86.84	26.01	51.25	79.14	249.45	149.52
	1:05:00	0.00	0.00	8.79	83.89	24.20	46.67	72.97	239.57	141.81
	1:10:00	0.00	0.00	8.01	81.29	22.44	42.12	66.04	227.04	129.14
	1:15:00	0.00	0.00	7.19	78.31	20.67	37.70	59.03	210.92	115.05
	1:20:00	0.00	0.00	6.40	74.53	18.62	33.08	51.68	192.98	99.74
	1:25:00	0.00	0.00	5.72	70.37	16.50	28.69	44.74	174.38	85.48
	1:30:00	0.00	0.00	5.25	66.57	14.85	24.84	38.89	157.26	74.04
	1:35:00	0.00	0.00	4.90	63.62	13.55	21.89	34.43	142.68	65.26
	1:40:00	0.00	0.00	4.60	60.75	12.41	19.51	30.75	130.82	57.96
	1:45:00	0.00	0.00	4.31	57.39	11.35	17.44	27.49	120.88	51.44
	1:50:00	0.00	0.00	4.03	54.11	10.35	15.56	24.54	112.18	45.50
	1:55:00	0.00	0.00	3.65	51.03	9.28	13.81	21.76	104.34	39.94
	2:00:00	0.00	0.00	3.24	48.01	8.14	12.11	19.10	97.06	34.70
	2:05:00	0.00	0.00	2.74	44.03	6.79	10.19	16.06	88.10	29.06
	2:10:00	0.00	0.00	2.24	38.68	5.44	8.24	12.97	76.84	23.41
	2:15:00	0.00	0.00	1.76	33.32	4.18	6.36	9.98	65.75	17.98
	2:20:00	0.00	0.00	1.33	28.34	3.14	4.60	7.22	55.50	13.06
	2:25:00	0.00	0.00	1.04	23.85	2.44	3.16	5.08	46.18	9.38
	2:30:00	0.00	0.00	0.85	19.96	1.99	2.26	3.74	37.88	6.93
	2:35:00	0.00	0.00	0.69	16.76	1.63	1.68	2.82	30.88	5.16
	2:40:00	0.00	0.00	0.57	14.15	1.33	1.27	2.14	25.26	3.80
	2:45:00	0.00	0.00	0.47	11.94	1.07	0.96	1.63	20.69	2.76
	2:50:00	0.00	0.00	0.38	10.01	0.86	0.74	1.24	16.87	1.97
	2:55:00	0.00	0.00	0.31	8.35	0.68	0.57	0.94	13.68	1.40
	3:00:00	0.00	0.00	0.26	6.96	0.53	0.44	0.73	11.06	1.06
	3:05:00	0.00	0.00	0.21	5.80	0.42	0.34	0.58	8.98	0.83
	3:10:00	0.00	0.00	0.17	4.83	0.32	0.27	0.45	7.35	0.66
	3:15:00	0.00	0.00	0.13	4.00	0.25	0.21	0.35	6.03	0.52
	3:20:00	0.00	0.00	0.10	3.30	0.19	0.16	0.27	4.95	0.40
	3:25:00	0.00	0.00	0.07	2.69	0.14	0.12	0.20	4.04	0.29
	3:30:00	0.00	0.00	0.05	2.18	0.09	0.08	0.14	3.26	0.20
	3:35:00	0.00	0.00	0.03	1.73	0.06	0.05	0.09	2.60	0.13
	3:40:00	0.00	0.00	0.02	1.37	0.03	0.03	0.05	2.05	0.07
	3:45:00	0.00	0.00	0.01	1.07	0.01	0.01	0.02	1.59	0.03
	3:50:00	0.00	0.00	0.00	0.83	0.00	0.00	0.01	1.23	0.01
	3:55:00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.93	0.00
	4:00:00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.69	0.00
	4:05:00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.51	0.00
	4:10:00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.37	0.00
	4:15:00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.28	0.00
	4:20:00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.21	0.00
	4:25:00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.17	0.00
	4:30:00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.12	0.00
	4:35:00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.09	0.00
	4:40:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.07	0.00
	4:45:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.00
	4:50:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.04	0.00
	4:55:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03	0.00
	5:00:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	5:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	5:10:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	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	0.01	0.00	0.00	0.00	0.01	0.00
	5:25:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:30:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:35:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:40:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:45:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	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.

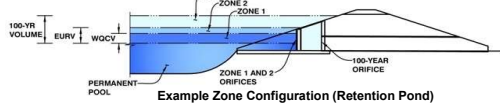
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 12**



Example Zone Configuration (Retention Pond)

## Watershed Information

Selected BMP Type =	<b>EDB</b>
Watershed Area =	26.83 acres
Watershed Length =	1,140 ft
Watershed Length to Centroid =	570 ft
Watershed Slope =	0.039 ft/ft
Watershed Imperviousness =	37.27% 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.

Water Quality Capture Volume (WQCV) =	0.386 acre-feet		
Excess Urban Runoff Volume (EURV) =	1.044 acre-feet		
2-yr Runoff Volume (P1 = 0.92 in.) =	0.645 acre-feet	0.92	inches
5-yr Runoff Volume (P1 = 1.2 in.) =	0.986 acre-feet	1.20	inches
10-yr Runoff Volume (P1 = 1.45 in.) =	1.405 acre-feet	1.45	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	2.049 acre-feet		
50-yr Runoff Volume (P1 = 2.15 in.) =	3.014 acre-feet	2.15	inches
100-yr Runoff Volume (P1 = 2.49 in.) =	3.865 acre-feet	2.49	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.310 acre-feet		
Approximate 2-yr Detention Volume =	0.591 acre-feet		
Approximate 5-yr Detention Volume =	0.859 acre-feet		
Approximate 10-yr Detention Volume =	1.240 acre-feet		
Approximate 25-yr Detention Volume =	1.426 acre-feet		
Approximate 50-yr Detention Volume =	1.694 acre-feet		
Approximate 100-yr Detention Volume =	2.023 acre-feet		

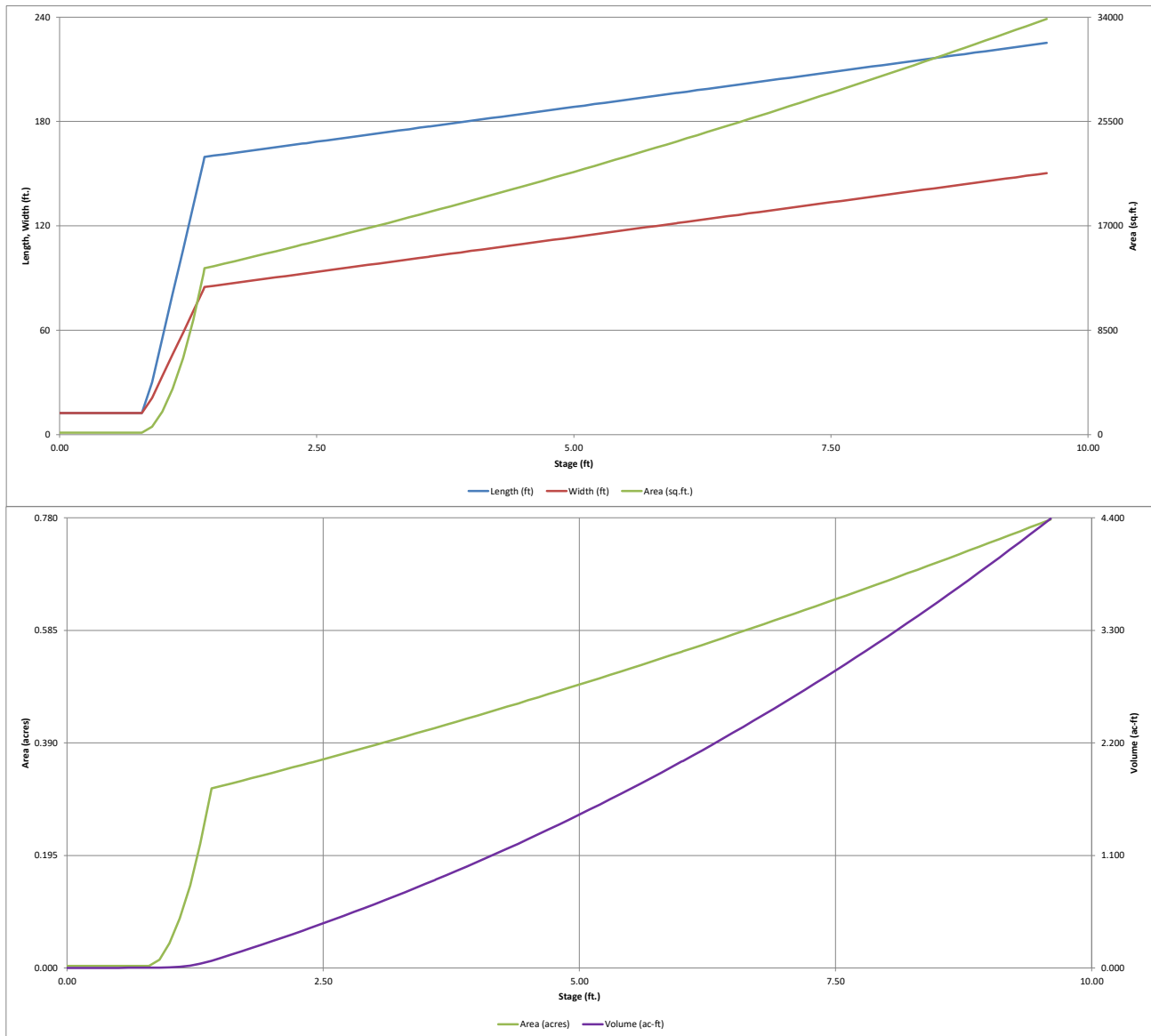
## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.386 acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.473 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.164 acre-feet
Total Detention Basin Volume =	2.023 acre-feet
Initial Surge Volume (ISV) =	50 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2
Initial Surge Area (A <sub>ISV</sub> ) =	153 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	12.4 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	12.4 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.58 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	159.7 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	84.9 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	13,550 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	2,927 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.59 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	196.4 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	121.6 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	23,878 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	84,786 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>2.017</b> acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft. <sup>2</sup> )	Optional Override Area (ft. <sup>2</sup> )	Area (acre)	Volume (ft. <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		12.4	12.4	153		0.004		
ISV	0.33		12.4	12.4	153		0.004	50	0.001
	0.40		12.4	12.4	153		0.004	61	0.001
	0.50		12.4	12.4	153		0.004	76	0.002
	0.60		12.4	12.4	153		0.004	92	0.002
	0.70		12.4	12.4	153		0.004	107	0.002
	0.80		12.4	12.4	153		0.004	122	0.003
	0.90		30.1	21.1	636		0.015	153	0.004
	1.00		55.5	33.6	1,867		0.043	272	0.006
	1.10		80.9	46.1	3,732		0.086	547	0.013
	1.20		106.3	58.6	6,232		0.143	1,040	0.024
	1.30		131.7	71.1	9,368		0.215	1,815	0.042
Floor	1.40		157.1	83.6	13,138		0.302	2,935	0.067
	1.41		159.7	84.9	13,550		0.311	3,068	0.070
	1.50		160.4	85.6	13,727		0.315	4,296	0.099
	1.60		161.2	86.4	13,924		0.320	5,678	0.130
	1.70		162.0	87.2	14,123		0.324	7,081	0.163
	1.80		162.8	88.0	14,323		0.329	8,503	0.195
	1.90		163.6	88.8	14,524		0.333	9,945	0.228
	2.00		164.4	89.6	14,727		0.338	11,408	0.262
	2.10		165.2	90.4	14,931		0.343	12,891	0.296
	2.20		166.0	91.2	15,136		0.347	14,394	0.330
	2.30		166.8	92.0	15,342		0.352	15,918	0.365
Zone 1 (WQCV)	2.36		167.3	92.5	15,466		0.355	16,842	0.387
	2.40		167.6	92.8	15,550		0.357	17,462	0.401
	2.50		168.4	93.6	15,759		0.362	19,028	0.437
	2.60		169.2	94.4	15,969		0.367	20,614	0.473
	2.70		170.0	95.2	16,180		0.371	22,221	0.510
	2.80		170.8	96.0	16,393		0.376	23,850	0.548
	2.90		171.6	96.8	16,607		0.381	25,500	0.585
	3.00		172.4	97.6	16,823		0.386	27,172	0.624
	3.10		173.2	98.4	17,039		0.391	28,865	0.663
	3.20		174.0	99.2	17,257		0.396	30,580	0.702
	3.30		174.8	100.0	17,476		0.401	32,316	0.742
	3.40		175.6	100.8	17,697		0.406	34,075	0.782
	3.50		176.4	101.6	17,918		0.411	35,856	0.823
Zone 2 (5-year)	3.59		177.1	102.3	18,119		0.416	37,477	0.860
	3.60		177.2	102.4	18,141		0.416	37,659	0.865
	3.70		178.0	103.2	18,366		0.422	39,484	0.906
	3.80		178.8	104.0	18,591		0.427	41,332	0.949
	3.90		179.6	104.8	18,818		0.432	43,202	0.992
	4.00		180.4	105.6	19,046		0.437	45,095	1.035
	4.10		181.2	106.4	19,276		0.443	47,012	1.079
	4.20		182.0	107.2	19,506		0.448	48,951	1.124
	4.30		182.8	108.0	19,738		0.453	50,913	1.169
	4.40		183.6	108.8	19,972		0.458	52,898	1.214
	4.50		184.4	109.6	20,206		0.464	54,907	1.260
	4.60		185.2	110.4	20,442		0.469	56,940	1.307
	4.70		186.0	111.2	20,679		0.475	58,996	1.354
	4.80		186.8	112.0	20,918		0.480	61,076	1.402
	4.90		187.6	112.8	21,157		0.486	63,179	1.450
	5.00		188.4	113.6	21,398		0.491	65,307	1.499
	5.10		189.2	114.4	21,640		0.497	67,459	1.549
	5.20		190.0	115.2	21,884		0.502	69,635	1.599
	5.30		190.8	116.0	22,129		0.508	71,836	1.649
	5.40		191.6	116.8	22,375		0.514	74,061	1.700
	5.50		192.4	117.6	22,622		0.519	76,311	1.752
	5.60		193.2	118.4	22,871		0.525	78,585	1.804
	5.70		194.0	119.2	23,121		0.531	80,885	1.857
	5.80		194.8	120.0	23,372		0.537	83,210	1.910
	5.90		195.6	120.8	23,624		0.542	85,559	1.964
Zone 3 (100-year)	6.00		196.4	121.6	23,878		0.548	87,934	2.019
	6.01		196.5	121.7	23,903		0.549	88,173	2.024
	6.10		197.2	122.4	24,133		0.554	90,335	2.074
	6.20		198.0	123.2	24,389		0.560	92,761	2.130
	6.30		198.8	124.0	24,647		0.566	95,213	2.186
	6.40		199.6	124.8	24,906		0.572	97,691	2.243
	6.50		200.4	125.6	25,166		0.578	100,194	2.300
	6.60		201.2	126.4	25,427		0.584	102,724	2.358
	6.70		202.0	127.2	25,690		0.590	105,280	2.417
	6.80		202.8	128.0	25,954		0.596	107,862	2.476
	6.90		203.6	128.8	26,219		0.602	110,471	2.536
	7.00		204.4	129.6	26,486		0.608	113,106	2.597
	7.10		205.2	130.4	26,754		0.614	115,768	2.658
	7.20		206.0	131.2	27,023		0.620	118,457	2.719
	7.30		206.8	132.0	27,293		0.627	121,172	2.782
	7.40		207.6	132.8	27,565		0.633	123,915	2.845
	7.50		208.4	133.6	27,838		0.639	126,685	2.908
	7.60		209.2	134.4	28,112		0.645	129,483	2.973
	7.70		210.0	135.2	28,387		0.652	132,308	3.037
	7.80		210.8	136.0	28,664		0.658	135,162	3.103
	7.90		211.6	136.8	28,942		0.664	138,041	3.169
	8.00		212.4	137.6	29,222		0.671	140,949	3.236
	8.10		213.2	138.4	29,502		0.677	143,885	3.303
	8.20		214.0	139.2	29,784		0.684	146,849	3.371
	8.30		214.8	140.0	30,067		0.690	149,842	3.440
	8.40		215.6	140.8	30,352		0.697	152,863	3.509
	8.50		216.4	141.6	30,638		0.703	155,912	3.579
	8.60		217.2	142.4	30,925		0.710	158,990	3.650
	8.70		218.0	143.2	31,213		0.717	162,097	3.721
	8.80		218.8	144.0	31,502		0.723	165,233	3.793
	8.90		219.6	144.8	31,793		0.730	168,398	3.866
	9.00		220.4	145.6	32,085		0.737	171,592	3.939
	9.10		221.2	146.4	32,379		0.743	174,815	4.013
	9.20		222.0	147.2	32,674		0.750	178,068	4.088
	9.30		222.8	148.0	32,970		0.757	181,350	4.163
	9.40		223.6	148.8	33,267		0.764	184,662	4.239
	9.50		224.4	149.6	33,565		0.771	188,003	4.316
	9.60		225.2	150.4	33,865		0.777	191,375	4.393

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

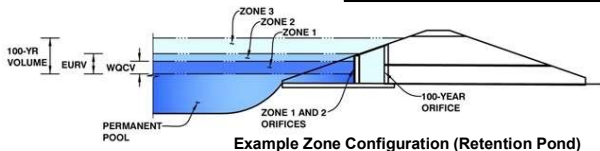


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 12**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.36	0.386	Orifice Plate
Zone 2 (5-year)	3.59	0.473	Circular Orifice
Zone 3 (100-year)	6.01	1.164	Weir&Pipe (Restrict)
Total (all zones)		2.023	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-5/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	1.35	1.35	1.35					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice

Zone 2 Circular Not Selected  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir

Zone 3 Weir Not Selected  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Zone 3 Restrictor Not Selected  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

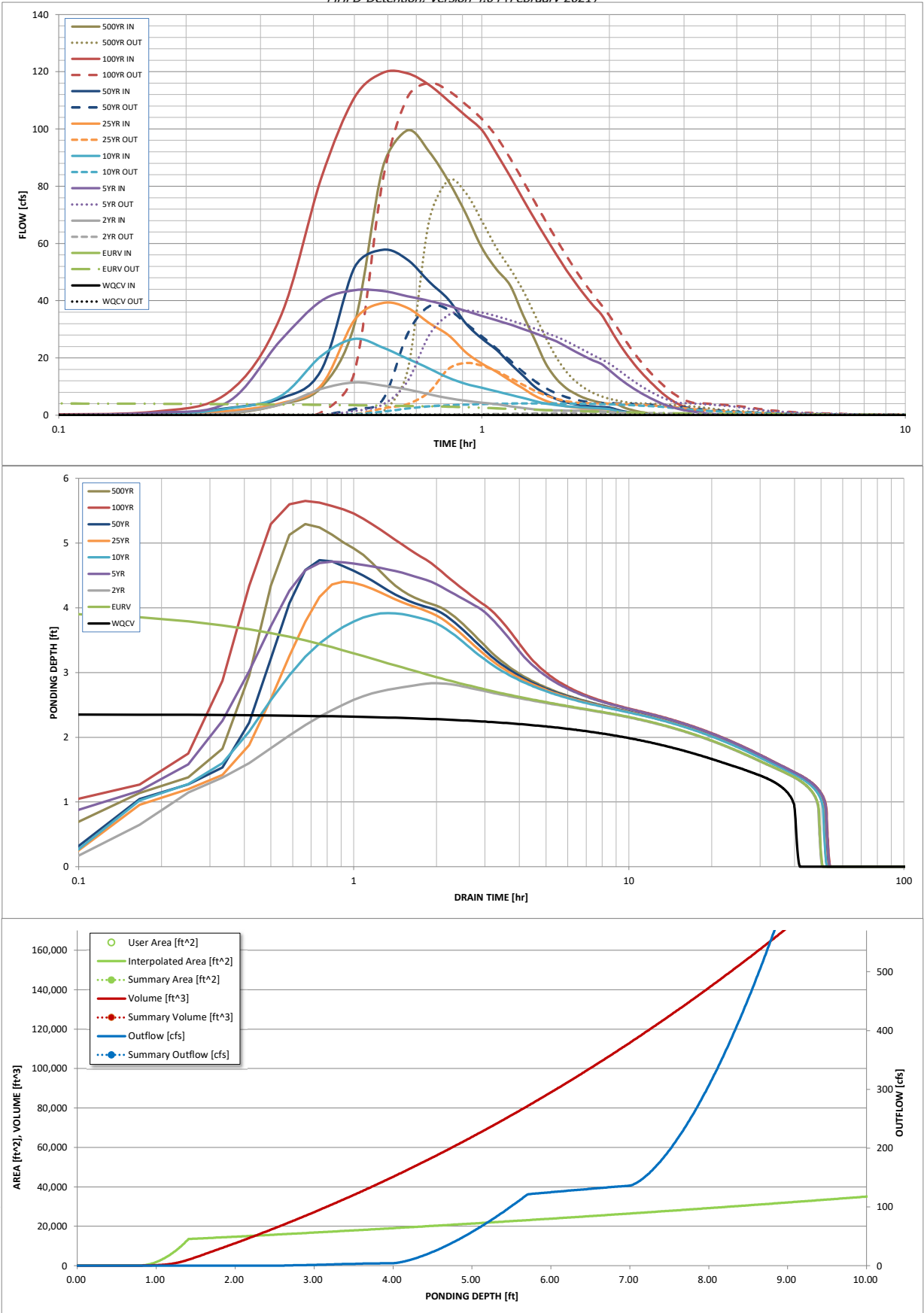
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.386	1.044	0.645	0.986	1.405	2.049	3.014	3.865	5.310
CUHP Runoff Volume (acre-ft) =	0.386	1.044	0.645	0.986	1.405	2.049	3.014	3.865	5.310
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.645	5.010	1.405	2.049	3.014	11.989	5.310
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	3.2	9.2	20.9	34.9	46.6	65.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		40.0				118.7	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	1.49	0.34	0.78	1.30	4.42	2.46
Peak Inflow Q (cfs) =	N/A	N/A	11.5	43.6	26.7	39.2	57.8	119.6	99.5
Peak Outflow Q (cfs) =	0.2	4.3	0.9	36.5	4.1	18.2	38.0	116.1	82.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.4	0.9	1.1	1.0	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	0.7	N/A	0.3	0.7	2.5	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	45	46	32	45	42	38	14	30
Time to Drain 99% of Inflow Volume (hours) =	40	48	48	45	49	48	47	36	44
Maximum Ponding Depth (ft) =	2.36	4.02	2.84	4.71	3.92	4.40	4.74	5.65	5.29
Area at Maximum Ponding Depth (acres) =	0.36	0.44	0.38	0.48	0.43	0.46	0.48	0.53	0.51
Maximum Volume Stored (acre-ft) =	0.387	1.044	0.559	1.359	0.996	1.214	1.369	1.830	1.644

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: ...[SWM]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	0.21	0.00
	0:10:00	0.00	0.00	0.00	0.83	0.00	0.00	0.07	1.21	0.58
	0:15:00	0.00	0.00	0.70	4.45	2.24	1.46	2.46	7.69	3.72
	0:20:00	0.00	0.00	3.72	25.87	6.56	4.14	5.77	33.96	9.61
	0:25:00	0.00	0.00	9.15	39.87	20.60	10.32	15.54	82.51	31.63
	0:30:00	0.00	0.00	11.45	43.63	26.69	33.21	51.53	110.95	86.57
	0:35:00	0.00	0.00	10.37	43.39	23.65	39.18	57.81	119.59	99.50
	0:40:00	0.00	0.00	9.02	41.58	19.77	37.53	54.38	119.42	92.11
	0:45:00	0.00	0.00	7.33	39.98	16.36	32.20	46.67	115.43	81.86
	0:50:00	0.00	0.00	5.96	38.23	13.10	28.01	40.49	109.84	70.36
	0:55:00	0.00	0.00	5.02	36.40	10.97	21.96	32.07	104.55	58.45
	1:00:00	0.00	0.00	4.38	34.66	9.57	18.01	26.76	99.56	50.93
	1:05:00	0.00	0.00	3.84	33.11	8.31	15.14	22.79	91.37	45.34
	1:10:00	0.00	0.00	3.13	31.67	7.13	12.09	18.06	83.43	35.09
	1:15:00	0.00	0.00	2.51	30.15	6.07	9.40	13.89	75.55	26.42
	1:20:00	0.00	0.00	2.05	28.66	4.99	6.80	9.92	68.44	18.03
	1:25:00	0.00	0.00	1.81	27.22	4.08	5.04	7.44	62.04	12.70
	1:30:00	0.00	0.00	1.69	25.81	3.52	3.85	5.66	56.14	9.42
	1:35:00	0.00	0.00	1.63	23.95	3.13	3.14	4.56	50.76	7.38
	1:40:00	0.00	0.00	1.60	22.16	2.86	2.68	3.81	46.02	5.96
	1:45:00	0.00	0.00	1.57	20.53	2.68	2.41	3.35	41.89	5.01
	1:50:00	0.00	0.00	1.55	19.09	2.54	2.23	3.03	38.24	4.34
	1:55:00	0.00	0.00	1.34	17.88	2.38	2.11	2.83	35.15	3.93
	2:00:00	0.00	0.00	1.18	15.74	2.12	2.03	2.71	30.68	3.79
	2:05:00	0.00	0.00	0.86	13.57	1.52	1.47	1.94	26.36	2.70
	2:10:00	0.00	0.00	0.62	11.63	1.07	1.03	1.36	22.56	1.91
	2:15:00	0.00	0.00	0.44	9.94	0.75	0.73	0.95	19.27	1.34
	2:20:00	0.00	0.00	0.30	8.48	0.52	0.50	0.65	16.43	0.92
	2:25:00	0.00	0.00	0.20	7.18	0.35	0.33	0.43	13.90	0.61
	2:30:00	0.00	0.00	0.13	6.01	0.23	0.23	0.30	11.63	0.41
	2:35:00	0.00	0.00	0.08	4.97	0.14	0.14	0.18	9.61	0.25
	2:40:00	0.00	0.00	0.04	4.06	0.07	0.08	0.10	7.77	0.13
	2:45:00	0.00	0.00	0.02	3.30	0.03	0.03	0.04	6.18	0.05
	2:50:00	0.00	0.00	0.01	2.70	0.01	0.01	0.01	4.87	0.00
	2:55:00	0.00	0.00	0.00	2.21	0.00	0.00	0.00	3.86	0.00
	3:00:00	0.00	0.00	0.00	1.80	0.00	0.00	0.00	3.05	0.00
	3:05:00	0.00	0.00	0.00	1.46	0.00	0.00	0.00	2.41	0.00
	3:10:00	0.00	0.00	0.00	1.18	0.00	0.00	0.00	1.89	0.00
	3:15:00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	1.48	0.00
	3:20:00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	1.15	0.00
	3:25:00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.91	0.00
	3:30:00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.74	0.00
	3:35:00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.59	0.00
	3:40:00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.47	0.00
	3:45:00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.36	0.00
	3:50:00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.27	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	0.07	0.00	0.00	0.00	0.12	0.00
	4:05:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.07	0.00
	4:10:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	4:15:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	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.

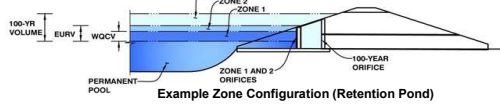
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

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

Basin ID: **Pond 13**



## Watershed Information

Selected BMP Type =	<b>EDB</b>	
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.

Water Quality Capture Volume (WQCV) =	0.488	acre-feet
Excess Urban Runoff Volume (EURV) =	1.634	acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	1.042	acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	1.456	acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	1.884	acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	2.406	acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	3.276	acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	3.989	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	5.262	acre-feet
Approximate 2-yr Detention Volume =	0.980	acre-feet
Approximate 5-yr Detention Volume =	1.359	acre-feet
Approximate 10-yr Detention Volume =	1.794	acre-feet
Approximate 25-yr Detention Volume =	1.972	acre-feet
Approximate 50-yr Detention Volume =	2.322	acre-feet
Approximate 100-yr Detention Volume =	2.595	acre-feet

## Optional User Overrides

		acre-feet
		acre-feet
0.92		inches
1.20		inches
1.45		inches
		inches
2.15		inches
2.49		inches

## Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.488	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.872	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.236	acre-feet
Total Detention Basin Volume =	2.595	acre-feet
Initial Surge Volume (ISV) =	64	ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4	H:V
Basin Length-to-Width Ratio (L <sub>WL</sub> ) =	2	

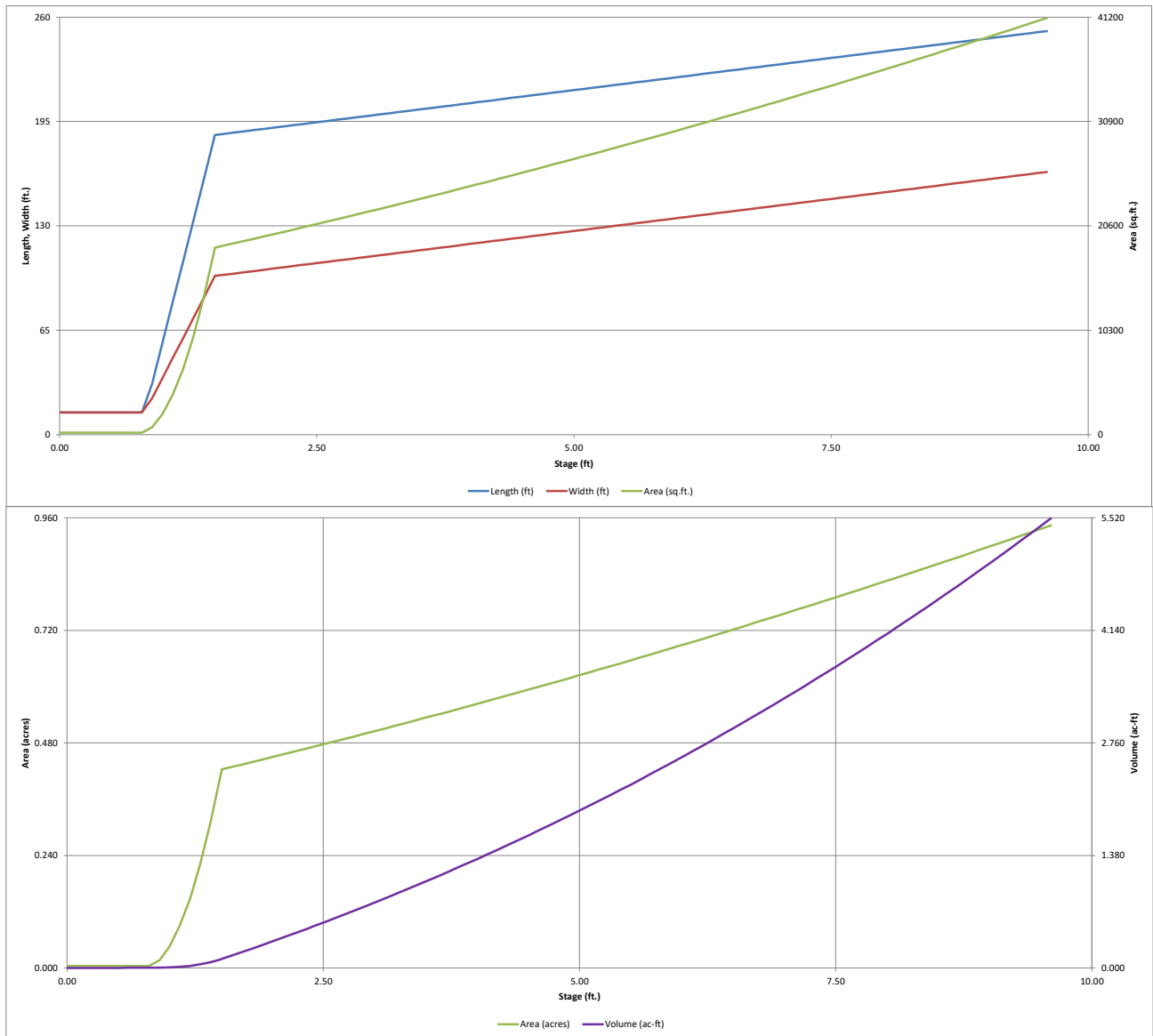
Initial Surge Area (A <sub>ISV</sub> ) =	193	ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	13.9	ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	13.9	ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.68	ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	186.6	ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	98.9	ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	18,456	ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	4,655	ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.49	ft
Length of Main Basin (L <sub>MAIN</sub> ) =	222.5	ft
Width of Main Basin (W <sub>MAIN</sub> ) =	134.8	ft
Area of Main Basin (A <sub>MAIN</sub> ) =	30,002	ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	107,744	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>2.584</b>	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		13.9	13.9	193		0.004		
<b>ISV</b>	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
<b>Floor</b>	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
<b>Zone 1 (WQCV)</b>	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
<b>Zone 2 (5-year)</b>	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
<b>Zone 3 (100-year)</b>	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

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

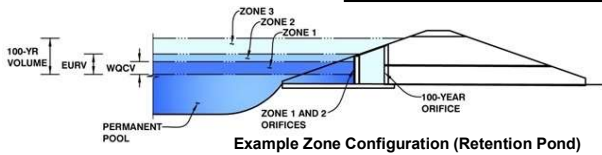


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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)	4.05	0.872	Circular Orifice
Zone 3 (100-year)	6.02	1.236	Weir&Pipe (Restrict)
Total (all zones)		2.595	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-5/16 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	1.36	1.36	1.36					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Zone 2 Circular Not Selected  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Zone 3 Weir Not Selected  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Zone 3 Restrictor Not Selected  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

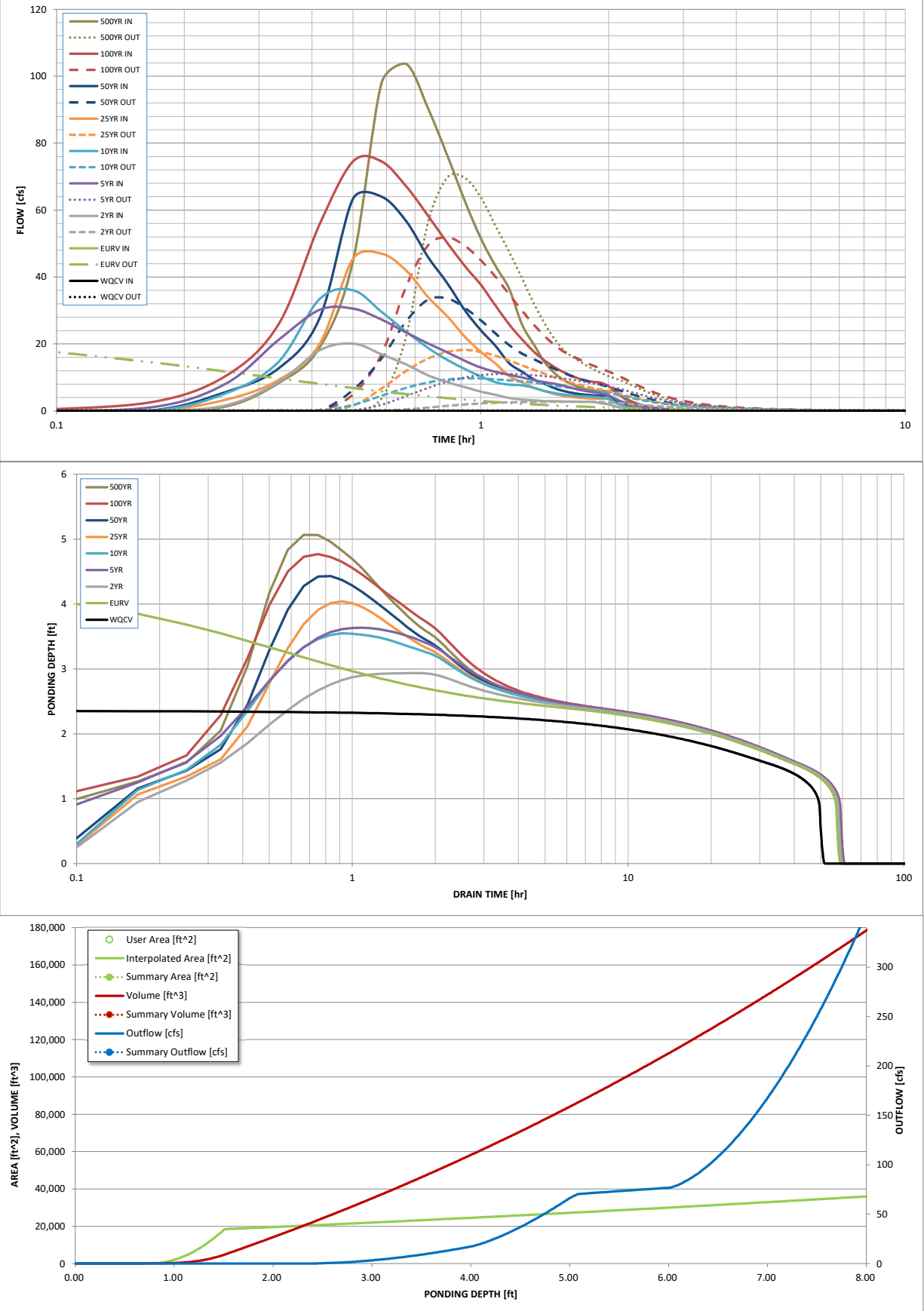
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.488	1.634	1.042	1.456	1.884	2.406	3.276	3.989	5.262
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.042	2.181	1.884	2.406	3.276	4.839	5.262
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.3	2.3	6.7	15.4	26.0	34.7	49.2
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.87	0.29	0.67	1.13	2.39	2.14
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	20.1	30.6	36.0	47.0	64.0	74.5	103.6
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	2.8	11.0	9.7	18.2	33.6	51.8	69.7
Peak Inflow Q (cfs) =	N/A	N/A	0.6	1.4	1.2	1.3	0.9	1.4	
Peak Outflow Q (cfs) =	N/A	N/A	0.6	1.4	1.2	1.3	0.9	1.4	
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	0.6	1.4	1.2	1.3	0.9	1.4	
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	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	0.87	N/A	N/A	N/A	0.0	0.7	1.6	2.5
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) =	48	50	53	49	50	48	45	39	38
Time to Drain 99% of Inflow Volume (hours) =	49	55	57	56	56	55	54	52	51
Maximum Ponding Depth (ft) =	2.36	4.52	2.94	3.64	3.55	4.04	4.43	4.77	5.07
Area at Maximum Ponding Depth (acres) =	0.47	0.59	0.50	0.54	0.54	0.57	0.59	0.61	0.63
Maximum Volume Stored (acre-ft) =	0.490	1.637	0.767	1.132	1.083	1.353	1.584	1.782	1.967

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: ...[SWM]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	0.07	0.00
	0:10:00	0.00	0.00	0.00	1.06	0.00	0.00	0.16	2.62	1.32
	0:15:00	0.00	0.00	1.65	8.07	5.18	3.36	5.62	10.41	8.33
	0:20:00	0.00	0.00	8.60	21.18	14.67	9.22	12.68	25.82	18.87
	0:25:00	0.00	0.00	18.09	30.18	33.40	19.95	27.64	55.67	44.82
	0:30:00	0.00	0.00	20.15	30.59	36.04	45.48	63.36	74.54	97.91
	0:35:00	0.00	0.00	16.94	27.30	29.63	47.00	64.04	74.51	103.64
	0:40:00	0.00	0.00	13.89	23.43	23.69	41.94	56.72	67.12	90.52
	0:45:00	0.00	0.00	10.69	20.22	18.86	34.08	46.05	58.41	76.40
	0:50:00	0.00	0.00	8.62	17.52	15.26	28.31	38.19	50.23	62.76
	0:55:00	0.00	0.00	7.12	15.00	12.58	22.18	30.11	43.34	51.52
	1:00:00	0.00	0.00	5.79	12.95	10.31	17.65	24.11	37.69	43.26
	1:05:00	0.00	0.00	4.82	11.66	8.58	14.12	19.40	31.41	36.45
	1:10:00	0.00	0.00	3.89	10.83	7.88	10.43	14.27	25.85	25.86
	1:15:00	0.00	0.00	3.42	9.99	7.67	8.59	11.74	21.45	19.89
	1:20:00	0.00	0.00	3.15	9.21	6.93	6.94	9.44	17.72	14.49
	1:25:00	0.00	0.00	3.00	8.58	5.95	5.95	8.05	14.98	11.02
	1:30:00	0.00	0.00	2.90	8.08	5.30	5.01	6.68	12.92	8.96
	1:35:00	0.00	0.00	2.84	7.44	4.86	4.43	5.82	11.30	7.57
	1:40:00	0.00	0.00	2.79	6.65	4.57	4.06	5.27	10.07	6.69
	1:45:00	0.00	0.00	2.77	6.06	4.38	3.81	4.90	9.26	6.17
	1:50:00	0.00	0.00	2.77	5.65	4.25	3.69	4.72	8.75	5.99
	1:55:00	0.00	0.00	2.30	5.30	4.02	3.61	4.60	8.43	5.90
	2:00:00	0.00	0.00	1.98	4.64	3.60	3.58	4.55	7.42	5.90
	2:05:00	0.00	0.00	1.30	3.54	2.36	2.35	2.99	5.60	3.89
	2:10:00	0.00	0.00	0.82	2.65	1.52	1.52	1.93	4.15	2.50
	2:15:00	0.00	0.00	0.52	1.99	0.95	0.96	1.21	3.06	1.58
	2:20:00	0.00	0.00	0.30	1.51	0.56	0.57	0.73	2.26	0.94
	2:25:00	0.00	0.00	0.16	1.16	0.32	0.34	0.43	1.69	0.56
	2:30:00	0.00	0.00	0.07	0.88	0.15	0.17	0.21	1.27	0.28
	2:35:00	0.00	0.00	0.02	0.68	0.05	0.06	0.07	0.95	0.09
	2:40:00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.71	0.00
	2:45:00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.56	0.00
	2:50:00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.46	0.00
	2:55:00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.37	0.00
	3:00:00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.29	0.00
	3:05:00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.25	0.00
	3:10:00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.20	0.00
	3:15:00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.15	0.00
	3:20:00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.12	0.00
	3:25:00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.09	0.00
	3:30:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.08	0.00
	3:35:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.00
	3:40:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.05	0.00
	3:45:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.04	0.00
	3:50:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00
	3:55:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.03	0.00
	4:00:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	4:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	4:10:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	4:15:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	4:20:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	4:25:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	4:30:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	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.

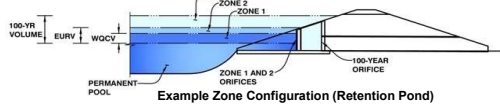
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 14**



## Watershed Information

Selected BMP Type =	<b>EDB</b>
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.

Water Quality Capture Volume (WQCV) =	0.545 acre-feet
Excess Urban Runoff Volume (EURV) =	0.917 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	0.450 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	1.153 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	2.407 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	4.971 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	8.392 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	11.684 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	16.938 acre-feet
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

## Optional User Overrides

	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.45	inches
	inches
2.15	inches
2.49	inches
	inches

## 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 Surge Volume (ISV) =	71 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	8.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LW</sub> ) =	2

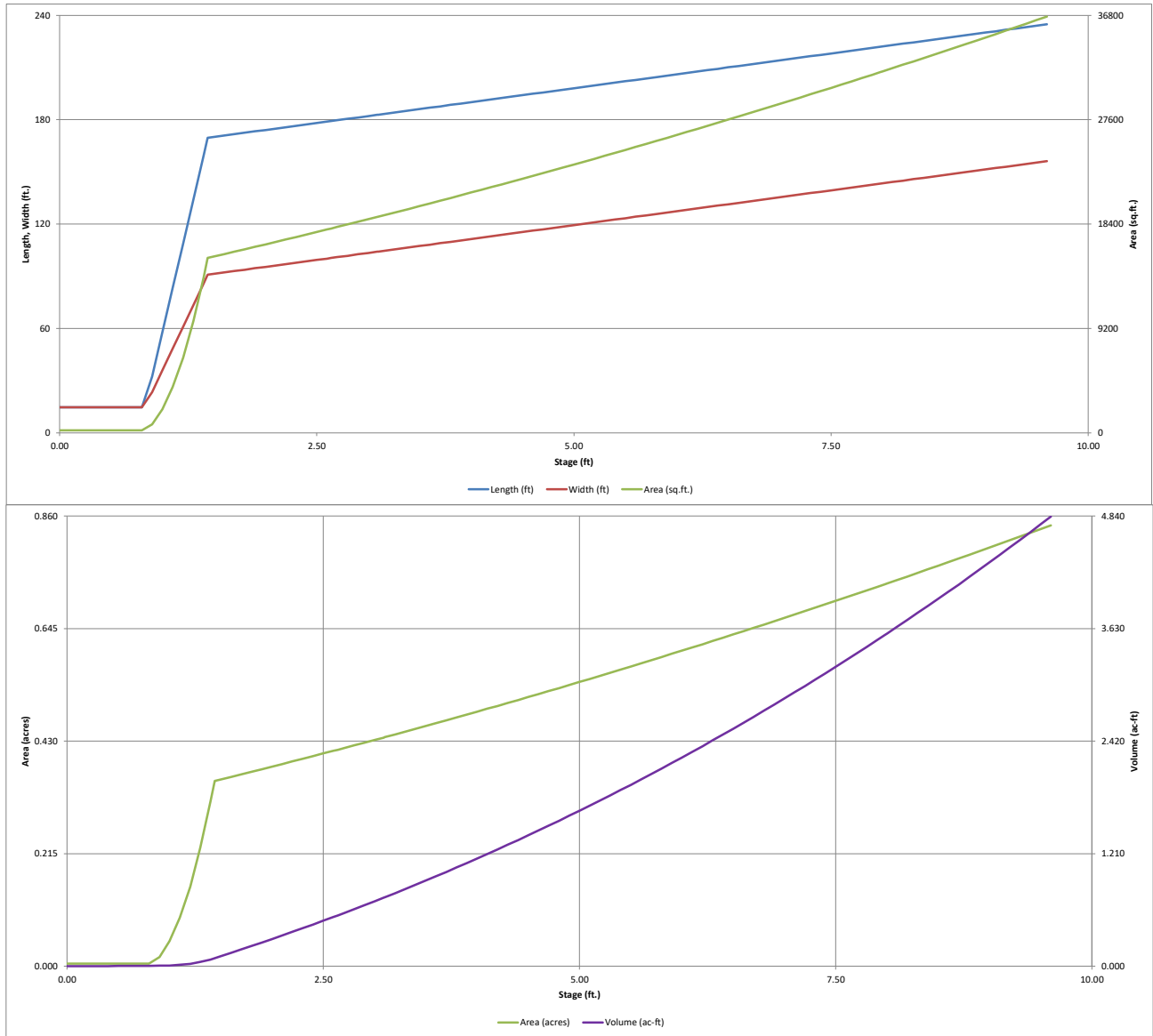
Initial Surge Area (A <sub>ISV</sub> ) =	216 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	14.7 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	14.7 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.61 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	169.6 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	90.9 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	15,425 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	3,551 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	6.56 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	222.1 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	143.4 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	31,853 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	151,852 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>3.572</b> acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	0.00		14.7	14.7	216		0.005		
<b>ISV</b>	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
<b>Floor</b>	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
<b>Zone 1 (WQCV)</b>	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
<b>Zone 2 (5-year)</b>	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
<b>Zone 3 (100-year)</b>	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

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

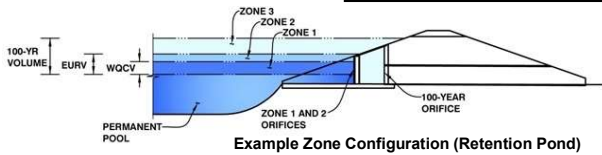


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **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 =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-1/2 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Circular Orifice Diameter or Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

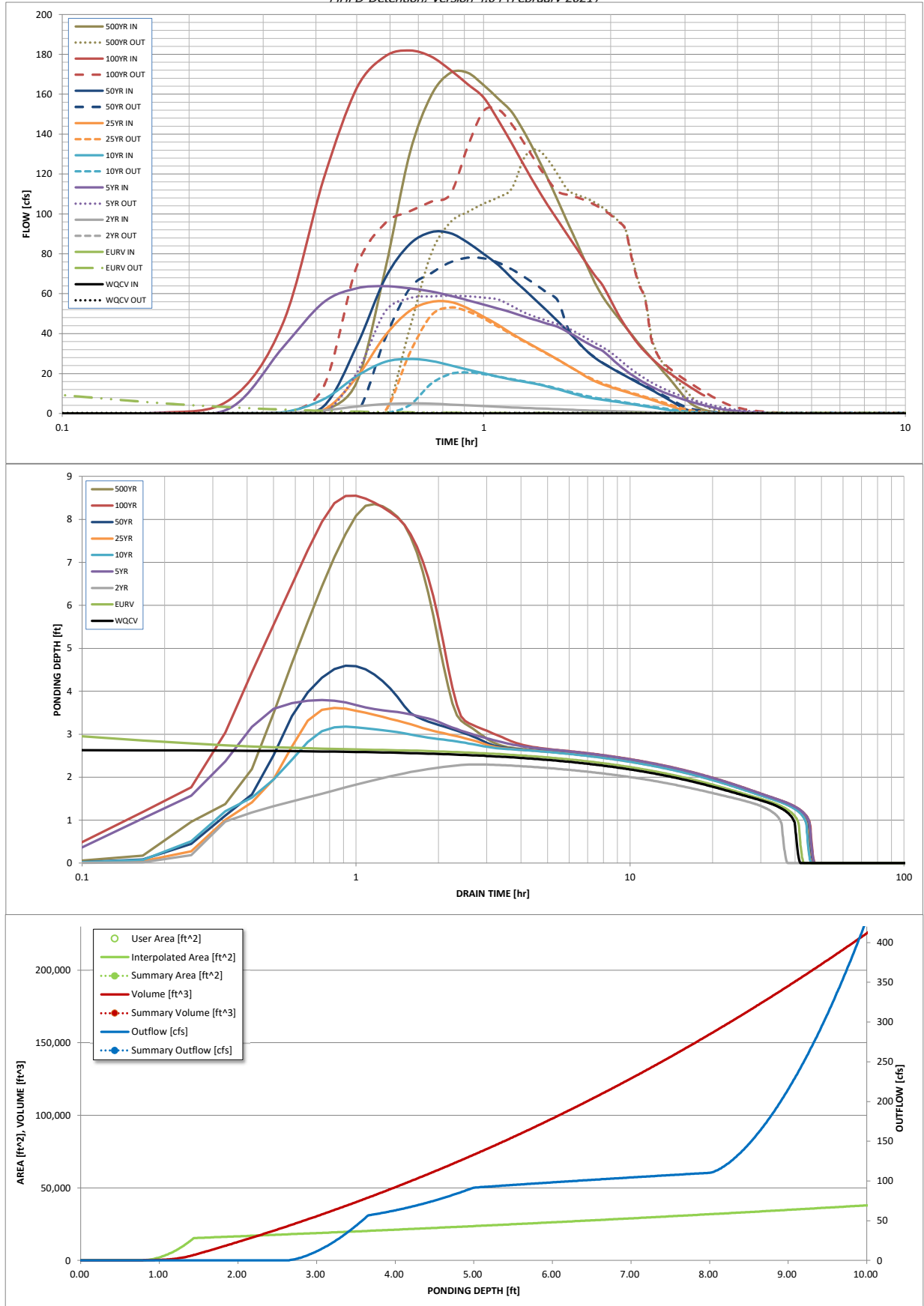
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.545	0.917	0.450	1.153	2.407	4.971	8.392	11.684	16.938
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.450	8.367	2.407	4.971	8.392	20.351	16.938
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.0	7.0	20.9	50.3	84.7	115.8	164.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	59.5	0.21	0.52	0.87	1.77	1.69
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	59.5	0.21	0.52	0.87	1.77	1.69
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	5.1	63.8	27.3	55.9	90.8	181.9	170.7
Peak Inflow Q (cfs) =	N/A	N/A	0.2	59.0	20.6	53.1	78.1	152.3	132.3
Peak Outflow Q (cfs) =	N/A	N/A	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: ...[SWM]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.

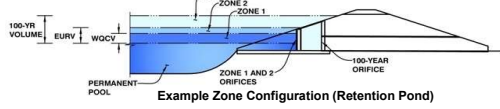
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

# 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 =	<b>EDB</b>
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 =	42.44% 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.

Water Quality Capture Volume (WQCV) =	0.634 acre-feet
Excess Urban Runoff Volume (EURV) =	1.830 acre-feet
2-yr Runoff Volume (P1 = 0.92 in.) =	1.183 acre-feet
5-yr Runoff Volume (P1 = 1.2 in.) =	1.755 acre-feet
10-yr Runoff Volume (P1 = 1.45 in.) =	2.437 acre-feet
25-yr Runoff Volume (P1 = 1.69 in.) =	3.439 acre-feet
50-yr Runoff Volume (P1 = 2.15 in.) =	4.961 acre-feet
100-yr Runoff Volume (P1 = 2.49 in.) =	6.292 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	8.572 acre-feet
Approximate 2-yr Detention Volume =	1.049 acre-feet
Approximate 5-yr Detention Volume =	1.509 acre-feet
Approximate 10-yr Detention Volume =	2.128 acre-feet
Approximate 25-yr Detention Volume =	2.412 acre-feet
Approximate 50-yr Detention Volume =	2.859 acre-feet
Approximate 100-yr Detention Volume =	3.364 acre-feet

## Optional User Overrides

	acre-feet
	acre-feet
0.92	inches
1.20	inches
1.45	inches
	inches
2.15	inches
2.49	inches
	inches

## Define Zones and Basin Geometry

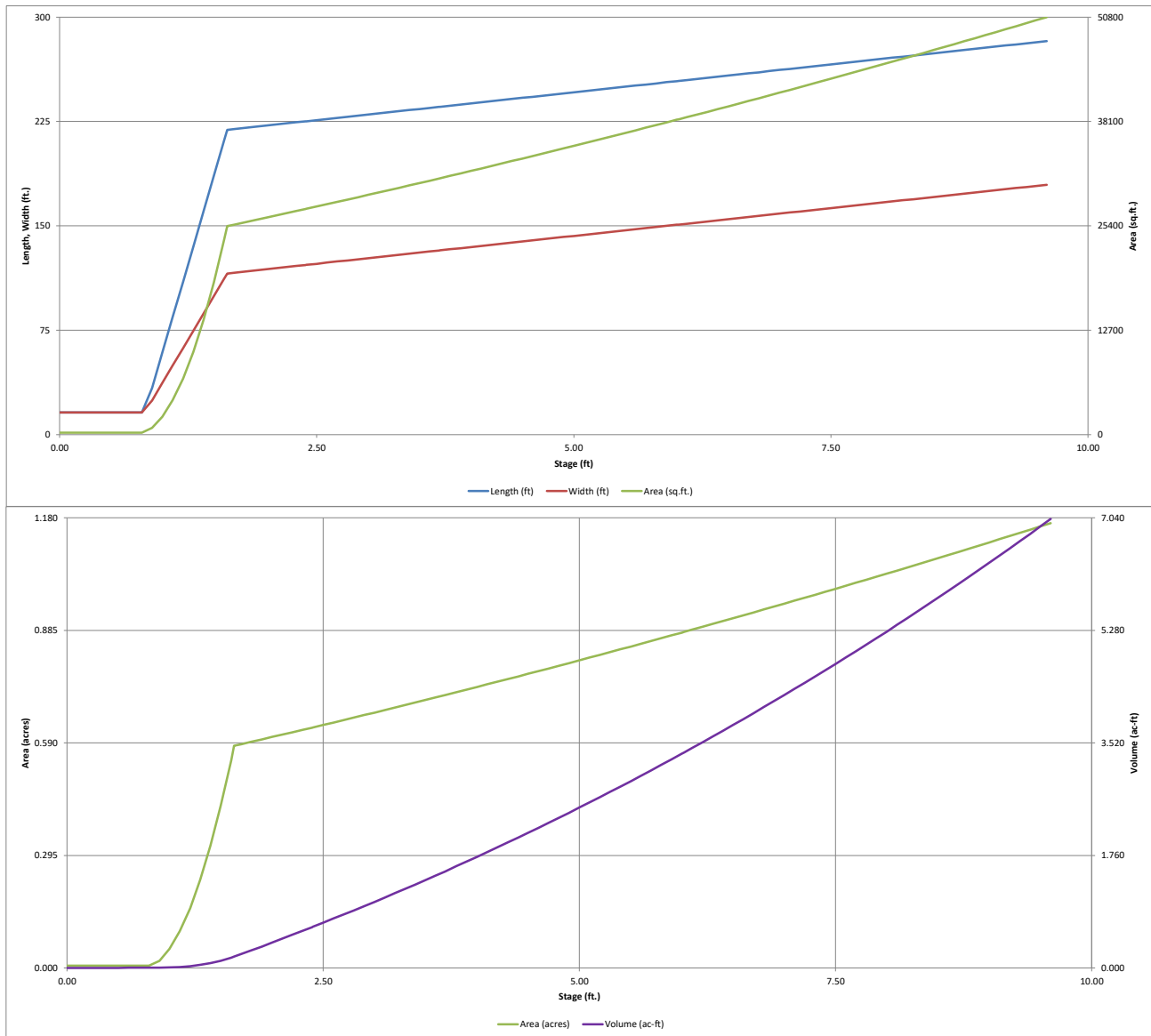
Zone 1 Volume (WQCV) =	0.634 acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.875 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.855 acre-feet
Total Detention Basin Volume =	3.364 acre-feet
Initial Surge Volume (ISV) =	83 ft <sup>3</sup>
Initial Surge Depth (ISD) =	0.33 ft
Total Available Detention Depth (H <sub>total</sub> ) =	6.00 ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	0.50 ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	0.004 ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	4 H:V
Basin Length-to-Width Ratio (R <sub>LWL</sub> ) =	2

Initial Surge Area (A <sub>ISV</sub> ) =	251 ft <sup>2</sup>
Surcharge Volume Length (L <sub>ISV</sub> ) =	15.8 ft
Surcharge Volume Width (W <sub>ISV</sub> ) =	15.8 ft
Depth of Basin Floor (H <sub>FLOOR</sub> ) =	0.80 ft
Length of Basin Floor (L <sub>FLOOR</sub> ) =	219.0 ft
Width of Basin Floor (W <sub>FLOOR</sub> ) =	115.8 ft
Area of Basin Floor (A <sub>FLOOR</sub> ) =	25,377 ft <sup>2</sup>
Volume of Basin Floor (V <sub>FLOOR</sub> ) =	7,507 ft <sup>3</sup>
Depth of Main Basin (H <sub>MAIN</sub> ) =	4.37 ft
Length of Main Basin (L <sub>MAIN</sub> ) =	254.0 ft
Width of Main Basin (W <sub>MAIN</sub> ) =	150.8 ft
Area of Main Basin (A <sub>MAIN</sub> ) =	38,307 ft <sup>2</sup>
Volume of Main Basin (V <sub>MAIN</sub> ) =	138,183 ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	<b>3.349</b> acre-feet

Depth Increment =	0.10	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft. <sup>2</sup> )	Optional Override Area (ft. <sup>2</sup> )	Area (acre)	Volume (ft. <sup>3</sup> )	Volume (ac-ft)
Top of Micropool	0.00		15.8	15.8	251		0.006		
ISV	0.33		15.8	15.8	251		0.006	83	0.002
	0.40		15.8	15.8	251		0.006	100	0.002
	0.50		15.8	15.8	251		0.006	126	0.003
	0.60		15.8	15.8	251		0.006	151	0.003
	0.70		15.8	15.8	251		0.006	176	0.004
	0.80		15.8	15.8	251		0.006	201	0.005
	0.90		33.6	24.6	827		0.019	244	0.006
	1.00		59.0	37.1	2,190		0.050	390	0.009
	1.10		84.4	49.6	4,188		0.096	704	0.016
	1.20		109.8	62.1	6,820		0.157	1,249	0.029
	1.30		135.2	74.6	10,088		0.232	2,089	0.048
	1.40		160.6	87.1	13,991		0.321	3,287	0.075
	1.50		186.0	99.6	18,528		0.425	4,908	0.113
	1.60		211.4	112.1	23,701		0.544	7,014	0.161
Floor	1.63		219.0	115.8	25,377		0.583	7,750	0.178
	1.70		219.6	116.4	25,565		0.587	9,533	0.219
	1.80		220.4	117.2	25,834		0.593	12,103	0.278
	1.90		221.2	118.0	26,105		0.599	14,700	0.337
	2.00		222.0	118.8	26,377		0.606	17,324	0.398
	2.10		222.8	119.6	26,650		0.612	19,976	0.459
	2.20		223.6	120.4	26,925		0.618	22,654	0.520
	2.30		224.4	121.2	27,201		0.624	25,361	0.582
Zone 1 (WQCV)	2.39		225.1	121.9	27,450		0.630	27,820	0.639
	2.40		225.2	122.0	27,478		0.631	28,094	0.645
	2.50		226.0	122.8	27,756		0.637	30,856	0.708
	2.60		226.8	123.6	28,036		0.644	33,646	0.772
	2.70		227.6	124.4	28,317		0.650	36,463	0.837
	2.80		228.4	125.2	28,599		0.657	39,309	0.902
	2.90		229.2	126.0	28,883		0.663	42,183	0.968
	3.00		230.0	126.8	29,167		0.670	45,086	1.035
	3.10		230.8	127.6	29,453		0.676	48,017	1.102
	3.20		231.6	128.4	29,741		0.683	50,976	1.170
	3.30		232.4	129.2	30,030		0.689	53,965	1.239
	3.40		233.2	130.0	30,319		0.696	56,982	1.308
	3.50		234.0	130.8	30,611		0.703	60,029	1.378
	3.60		234.8	131.6	30,903		0.709	63,105	1.449
Zone 2 (5-year)	3.69		235.5	132.3	31,167		0.716	65,898	1.513
	3.70		235.6	132.4	31,197		0.716	66,209	1.520
	3.80		236.4	133.2	31,492		0.723	69,344	1.592
	3.90		237.2	134.0	31,788		0.730	72,508	1.665
	4.00		238.0	134.8	32,086		0.737	75,702	1.738
	4.10		238.8	135.6	32,385		0.743	78,925	1.812
	4.20		239.6	136.4	32,685		0.750	82,179	1.887
	4.30		240.4	137.2	32,986		0.757	85,462	1.962
	4.40		241.2	138.0	33,289		0.764	88,776	2.038
	4.50		242.0	138.8	33,593		0.771	92,120	2.115
	4.60		242.8	139.6	33,898		0.778	95,495	2.192
	4.70		243.6	140.4	34,205		0.785	98,900	2.270
	4.80		244.4	141.2	34,513		0.792	102,336	2.349
	4.90		245.2	142.0	34,822		0.799	105,802	2.429
	5.00		246.0	142.8	35,132		0.807	109,300	2.509
	5.10		246.8	143.6	35,444		0.814	112,829	2.590
	5.20		247.6	144.4	35,757		0.821	116,389	2.672
	5.30		248.4	145.2	36,071		0.828	119,980	2.754
	5.40		249.2	146.0	36,387		0.835	123,603	2.838
	5.50		250.0	146.8	36,704		0.843	127,258	2.921
	5.60		250.8	147.6	37,022		0.850	130,944	3.006
	5.70		251.6	148.4	37,341		0.857	134,662	3.091
	5.80		252.4	149.2	37,662		0.865	138,412	3.178
	5.90		253.2	150.0	37,984		0.872	142,195	3.264
Zone 3 (100-year)	6.00		254.0	150.8	38,307		0.879	146,009	3.352
	6.02		254.2	151.0	38,372		0.881	146,776	3.370
	6.10		254.8	151.6	38,632		0.887	149,856	3.440
	6.20		255.6	152.4	38,957		0.894	153,736	3.529
	6.30		256.4	153.2	39,284		0.902	157,648	3.619
	6.40		257.2	154.0	39,613		0.909	161,593	3.710
	6.50		258.0	154.8	39,942		0.917	165,570	3.801
	6.60		258.8	155.6	40,273		0.925	169,581	3.893
	6.70		259.6	156.4	40,605		0.932	173,625	3.986
	6.80		260.4	157.2	40,939		0.940	177,702	4.079
	6.90		261.2	158.0	41,274		0.948	181,813	4.174
	7.00		262.0	158.8	41,610		0.955	185,957	4.269
	7.10		262.8	159.6	41,947		0.963	190,135	4.365
	7.20		263.6	160.4	42,285		0.971	194,346	4.462
	7.30		264.4	161.2	42,625		0.979	198,592	4.559
	7.40		265.2	162.0	42,966		0.986	202,871	4.657
	7.50		266.0	162.8	43,309		0.994	207,185	4.756
	7.60		266.8	163.6	43,653		1.002	211,533	4.856
	7.70		267.6	164.4	43,998		1.010	215,916	4.957
	7.80		268.4	165.2	44,344		1.018	220,333	5.058
	7.90		269.2	166.0	44,691		1.026	224,785	5.160
	8.00		270.0	166.8	45,040		1.034	229,271	5.263
	8.10		270.8	167.6	45,390		1.042	233,793	5.367
	8.20		271.6	168.4	45,742		1.050	238,349	5.472
	8.30		272.4	169.2	46,094		1.058	242,941	5.577
	8.40		273.2	170.0	46,448		1.066	247,568	5.683
	8.50		274.0	170.8	46,803		1.074	252,231	5.790
	8.60		274.8	171.6	47,160		1.083	256,929	5.898
	8.70		275.6	172.4	47,518		1.091	261,663	6.007
	8.80		276.4	173.2	47,877		1.099	266,432	6.116
	8.90		277.2	174.0	48,237		1.107	271,238	6.227
	9.00		278.0	174.8	48,599		1.116	276,080	6.338
	9.10		278.8	175.6	48,962		1.124	280,958	6.450
	9.20		279.6	176.4	49,326		1.132	285,872	6.563
	9.30		280.4	177.2	49,691		1.141	290,823	6.676
	9.40		281.2	178.0	50,058		1.149	295,810	6.791
	9.50		282.0	178.8	50,426		1.158	300,835	6.906
	9.60		282.8	179.6	50,795		1.166	305,896	7.022

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

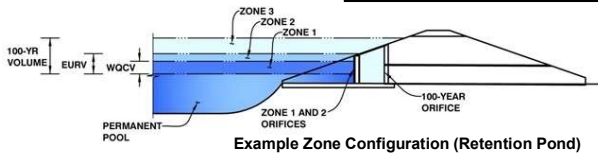


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

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

Basin ID: **Pond 15**



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.39	0.634	Orifice Plate
Zone 2 (5-year)	3.69	0.875	Weir&Pipe (Circular)
Zone 3 (100-year)	6.02	1.855	Weir&Pipe (Restrict)
Total (all zones)		3.364	

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

Underdrain Orifice Invert Depth =  ft (distance below the filtration media surface)  
Underdrain Orifice Diameter =  inches

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (diameter = 1-5/8 inches)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	2.11	2.11	2.11					

	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)

Invert of Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =  inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =  ft<sup>2</sup>  
Vertical Orifice Centroid =  feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =  ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =  feet  
Overflow Weir Grate Slope =  H:V  
Horiz. Length of Weir Sides =  feet  
Overflow Grate Type =   
Debris Clogging % =  %

Calculated Parameters for Overflow Weir  
Height of Grate Upper Edge, H<sub>u</sub> =  feet  
Overflow Weir Slope Length =  feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =  ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =  ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =  ft (distance below basin bottom at Stage = 0 ft)  
Circular Orifice Diameter or Pipe Diameter =  inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =  ft (relative to basin bottom at Stage = 0 ft)  
Spillway Crest Length =  feet  
Spillway End Slopes =  H:V  
Freeboard above Max Water Surface =  feet

Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

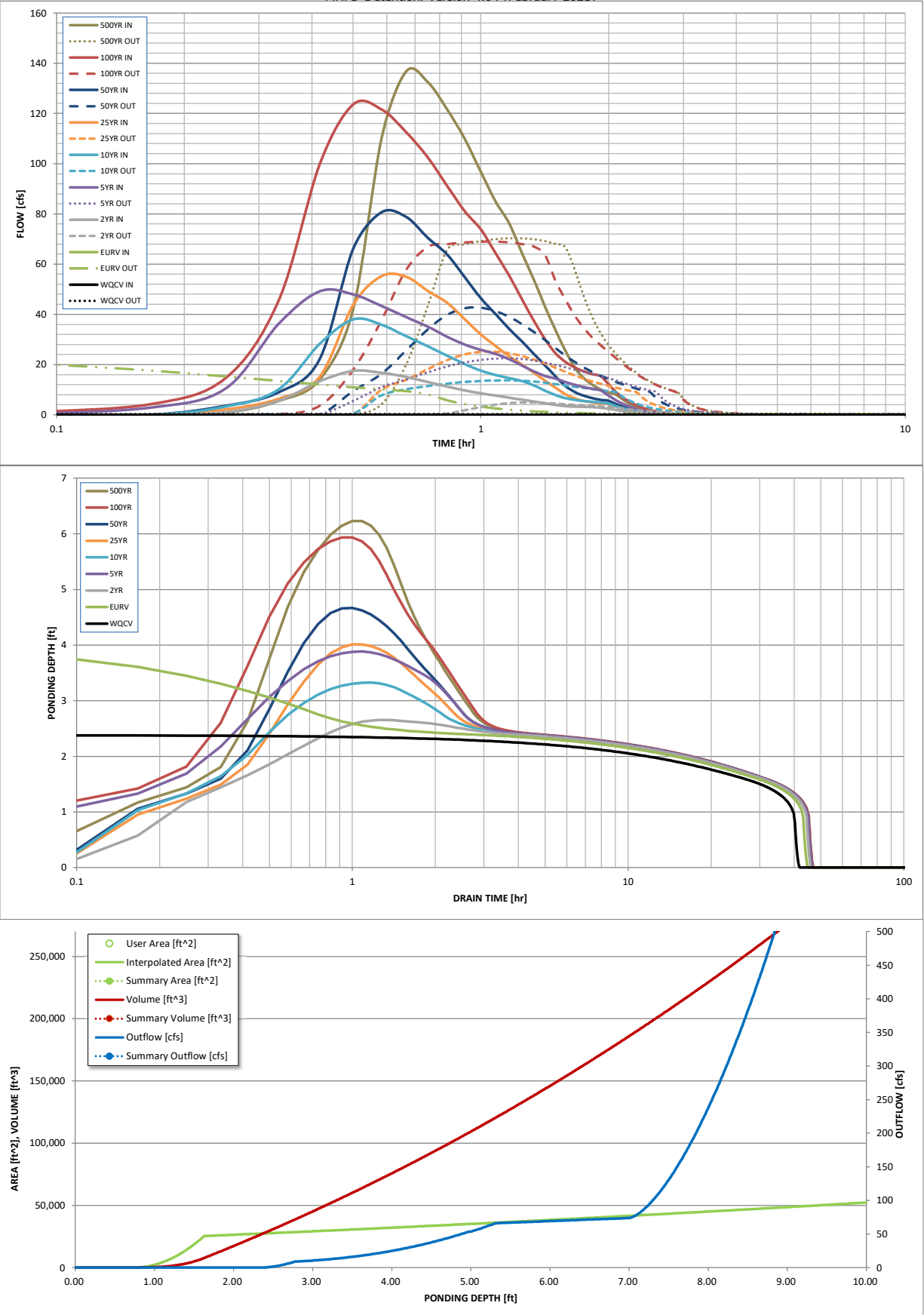
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.92	1.20	1.45	1.69	2.15	2.49	3.14
One-Hour Rainfall Depth (in) =	0.634	1.830	1.183	1.755	2.437	3.439	4.961	6.292	8.572
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.183	3.759	2.437	3.439	4.961	8.690	8.572
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.5	3.5	10.5	24.4	41.0	56.0	79.4
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.01	0.56	0.26	0.60	1.00	1.64	1.94
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	17.5	49.2	38.0	55.2	80.6	123.5	136.7
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	4.9	22.5	13.7	25.1	42.6	69.0	70.3
Peak Inflow Q (cfs) =	N/A	N/A	N/A	1.0	1.3	1.0	1.0	1.0	0.9
Peak Outflow Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio Peak Outflow to Predevelopment Q =	Overflow Weir 1	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Outlet Plate 2	Outlet Plate 2
Structure Controlling Flow =	N/A	0.52	0.25	0.5	0.5	0.5	0.5	0.6	0.6
Max Velocity through Grate 1 (fps) =	N/A	0.51	0.01	0.4	0.1	0.4	0.9	1.6	1.7
Max Velocity through Grate 2 (fps) =	39	38	41	35	38	36	32	25	25
Time to Drain 97% of Inflow Volume (hours) =	40	42	44	42	43	42	41	38	38
Time to Drain 99% of Inflow Volume (hours) =	2.39	4.13	2.65	3.89	3.32	4.01	4.67	5.93	6.23
Maximum Ponding Depth (ft) =	0.63	0.75	0.65	0.73	0.69	0.74	0.78	0.87	0.90
Area at Maximum Ponding Depth (acres) =	0.639	1.834	0.805	1.650	1.253	1.745	2.239	3.291	3.556
Maximum Volume Stored (acre-ft) =									

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: ...[SWM]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	0.74	0.00
	0:10:00	0.00	0.00	0.00	2.93	0.00	0.00	0.10	4.21	0.83
	0:15:00	0.00	0.00	1.02	10.34	3.24	2.11	3.57	14.52	5.50
	0:20:00	0.00	0.00	5.58	36.11	10.05	6.35	8.95	45.30	13.96
	0:25:00	0.00	0.00	13.35	49.16	28.17	15.03	22.00	99.45	41.78
	0:30:00	0.00	0.00	17.47	47.96	38.01	43.65	65.94	123.53	109.99
	0:35:00	0.00	0.00	16.72	43.32	35.85	55.21	80.62	121.60	136.72
	0:40:00	0.00	0.00	15.09	38.90	31.31	54.96	78.82	112.55	132.48
	0:45:00	0.00	0.00	13.05	35.12	27.30	49.29	70.50	102.46	121.56
	0:50:00	0.00	0.00	11.27	31.06	23.54	44.57	63.78	91.15	109.84
	0:55:00	0.00	0.00	9.75	27.93	20.22	38.04	54.78	81.08	96.70
	1:00:00	0.00	0.00	8.54	25.87	17.59	32.00	46.40	73.85	84.93
	1:05:00	0.00	0.00	7.73	24.24	15.88	27.35	40.09	64.35	76.27
	1:10:00	0.00	0.00	6.86	22.13	14.62	23.35	34.22	55.42	64.37
	1:15:00	0.00	0.00	6.04	19.65	13.42	20.05	29.24	46.03	53.84
	1:20:00	0.00	0.00	5.30	17.33	11.71	16.70	24.24	37.49	43.18
	1:25:00	0.00	0.00	4.59	15.46	9.65	13.66	19.73	30.15	33.76
	1:30:00	0.00	0.00	3.95	14.40	7.85	10.77	15.31	24.51	25.50
	1:35:00	0.00	0.00	3.49	13.06	6.62	8.21	11.44	21.02	18.69
	1:40:00	0.00	0.00	3.25	11.89	5.93	6.51	9.03	18.80	14.51
	1:45:00	0.00	0.00	3.14	11.03	5.49	5.51	7.58	17.27	11.93
	1:50:00	0.00	0.00	3.08	10.39	5.19	4.90	6.64	16.19	10.14
	1:55:00	0.00	0.00	2.75	9.67	4.89	4.50	6.00	15.40	8.89
	2:00:00	0.00	0.00	2.44	7.66	4.46	4.25	5.58	12.18	7.99
	2:05:00	0.00	0.00	1.92	5.75	3.48	3.32	4.32	9.04	5.98
	2:10:00	0.00	0.00	1.46	4.29	2.61	2.47	3.18	6.75	4.29
	2:15:00	0.00	0.00	1.11	3.19	1.96	1.85	2.37	5.05	3.17
	2:20:00	0.00	0.00	0.84	2.32	1.45	1.38	1.76	3.73	2.36
	2:25:00	0.00	0.00	0.63	1.64	1.07	1.02	1.29	2.70	1.75
	2:30:00	0.00	0.00	0.47	1.16	0.78	0.74	0.93	1.96	1.27
	2:35:00	0.00	0.00	0.34	0.80	0.57	0.54	0.68	1.39	0.93
	2:40:00	0.00	0.00	0.24	0.53	0.41	0.39	0.49	0.93	0.67
	2:45:00	0.00	0.00	0.16	0.31	0.27	0.27	0.33	0.56	0.45
	2:50:00	0.00	0.00	0.10	0.15	0.17	0.17	0.21	0.28	0.27
	2:55:00	0.00	0.00	0.05	0.05	0.09	0.09	0.11	0.10	0.14
	3:00:00	0.00	0.00	0.02	0.00	0.03	0.04	0.04	0.01	0.05
	3:05:00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	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.

## Appendix E

## 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	57.86	ft³/s

### Results

Normal Depth	2.16	ft
Flow Area	5.45	ft²
Wetted Perimeter	6.08	ft
Hydraulic Radius	0.90	ft
Top Width	2.69	ft
Critical Depth	2.46	ft
Percent Full	72.0	%
Critical Slope	0.00751	ft/ft
Velocity	10.62	ft/s
Velocity Head	1.75	ft
Specific Energy	3.91	ft
Froude Number	1.32	
Maximum Discharge	71.74	ft³/s
Discharge Full	66.69	ft³/s
Slope Full	0.00753	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	71.97	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.16	ft
Critical Depth	2.46	ft
Channel Slope	0.01000	ft/ft

---

Culvert 1

---

GVF Output Data

Critical Slope 0.00751 ft/ft

Culvert 1

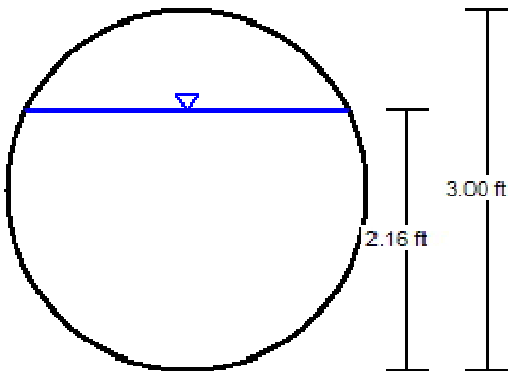
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Normal Depth	2.16	ft
Diameter	3.00	ft
Discharge	57.86	ft³/s

Cross Section Image



V: 1  
H: 1

## 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	114.67	ft³/s

### Results

Normal Depth	2.38	ft
Flow Area	6.97	ft²
Wetted Perimeter	6.79	ft
Hydraulic Radius	1.03	ft
Top Width	3.26	ft
Critical Depth	3.21	ft
Percent Full	68.0	%
Critical Slope	0.01130	ft/ft
Velocity	16.45	ft/s
Velocity Head	4.21	ft
Specific Energy	6.59	ft
Froude Number	1.98	
Maximum Discharge	153.05	ft³/s
Discharge Full	142.28	ft³/s
Slope Full	0.01299	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	68.03	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.38	ft
Critical Depth	3.21	ft
Channel Slope	0.02000	ft/ft

---

Culvert 2

---

GVF Output Data

Critical Slope 0.01130 ft/ft

---

Culvert 2

---

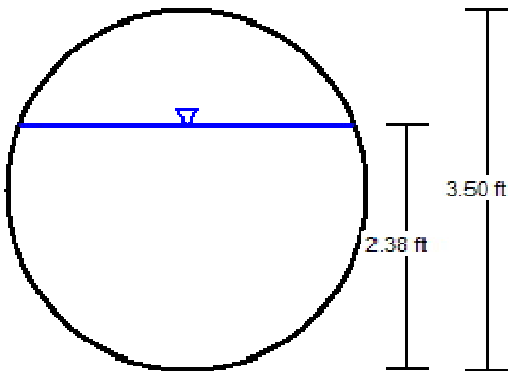
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02000	ft/ft
Normal Depth	2.38	ft
Diameter	3.50	ft
Discharge	114.67	ft <sup>3</sup> /s

Cross Section Image



V: 1  
H: 1

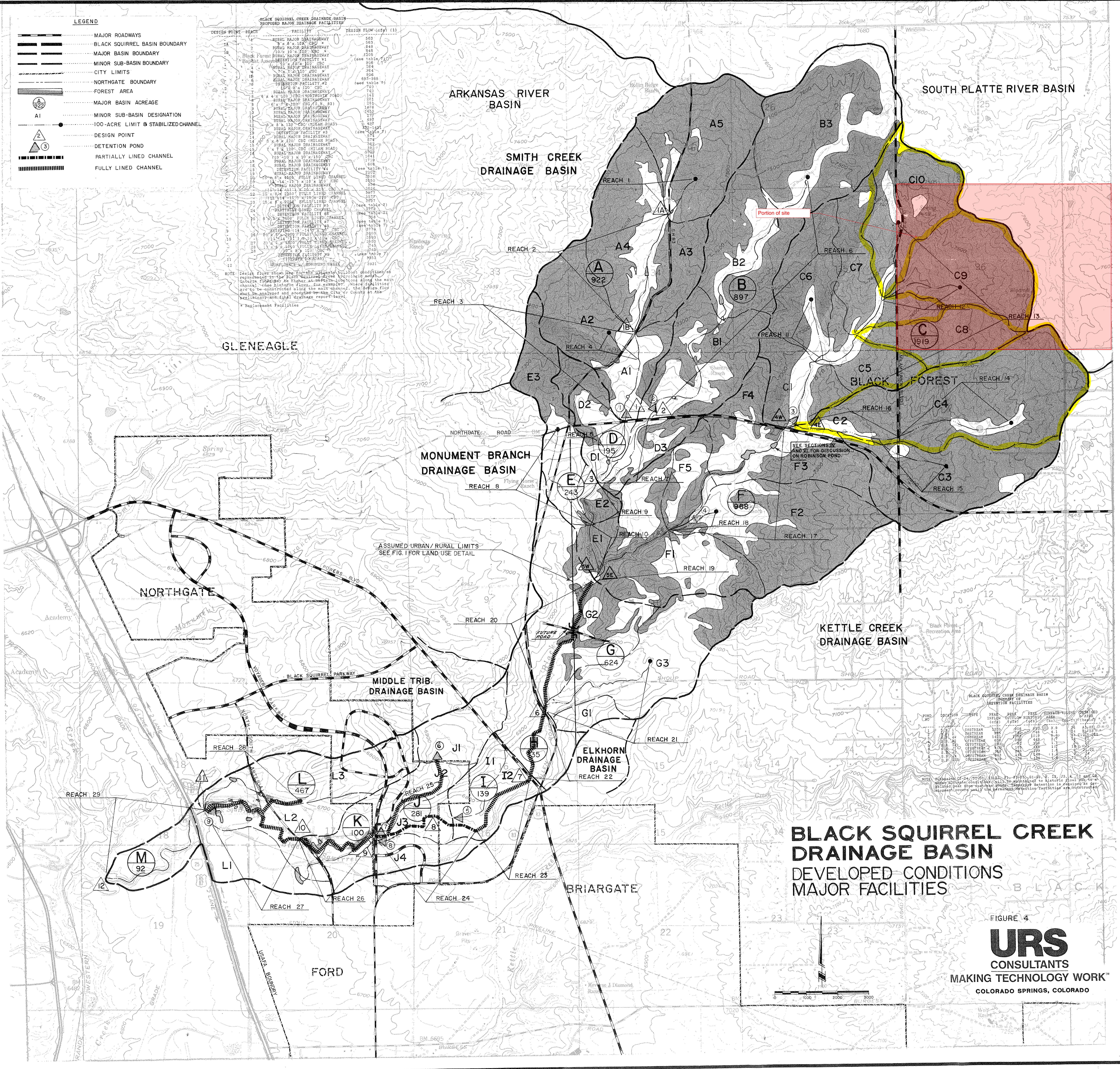
## Appendix F

**LEGEND**

- MAJOR ROADWAYS
- BLACK SQUIRREL BASIN BOUNDARY
- MAJOR BASIN BOUNDARY
- MINOR SUB-BASIN BOUNDARY
- CITY LIMITS
- NORTHGATE BOUNDARY
- FOREST AREA
- MAJOR BASIN ACREAGE
- MINOR SUB-BASIN DESIGNATION
- 100-ACRE LIMIT & STABILIZED CHANNEL
- DESIGN POINT
- DETENTION POND
- PARTIALLY LINED CHANNEL
- FULLY LINED CHANNEL

**BLACK SQUIRREL CREEK DRAINAGE BASIN  
DEVELOPED MAJOR DRAINAGE FACILITIES**

DESIGN POINT - REACH	FACILITY	DESIGN FLOW (cfs) (1)
1A	RURAL MAJOR DRAINAGEWAY	850
1B	RURAL MAJOR DRAINAGEWAY	850
2	RURAL MAJOR DRAINAGEWAY	850
3	RURAL MAJOR DRAINAGEWAY	850
4	RURAL MAJOR DRAINAGEWAY	850
5	RURAL MAJOR DRAINAGEWAY	850
6	RURAL MAJOR DRAINAGEWAY	850
7	RURAL MAJOR DRAINAGEWAY	850
8	RURAL MAJOR DRAINAGEWAY	850
9	RURAL MAJOR DRAINAGEWAY	850
10	RURAL MAJOR DRAINAGEWAY	850
11	RURAL MAJOR DRAINAGEWAY	850
12	RURAL MAJOR DRAINAGEWAY	850
13	RURAL MAJOR DRAINAGEWAY	850
14	RURAL MAJOR DRAINAGEWAY	850
15	RURAL MAJOR DRAINAGEWAY	850
16	RURAL MAJOR DRAINAGEWAY	850
17	RURAL MAJOR DRAINAGEWAY	850
18	RURAL MAJOR DRAINAGEWAY	850
19	RURAL MAJOR DRAINAGEWAY	850
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97	RURAL MAJOR DRAINAGEWAY	850
98	RURAL MAJOR DRAINAGEWAY	850
99	RURAL MAJOR DRAINAGEWAY	850
100	RURAL MAJOR DRAINAGEWAY	850



# **BLACK SQUIRREL CREEK DRAINAGE BASIN DEVELOPED CONDITIONS MAJOR FACILITIES**



INNOVATIVE DESIGN. **CLASSIC RESULTS.**

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

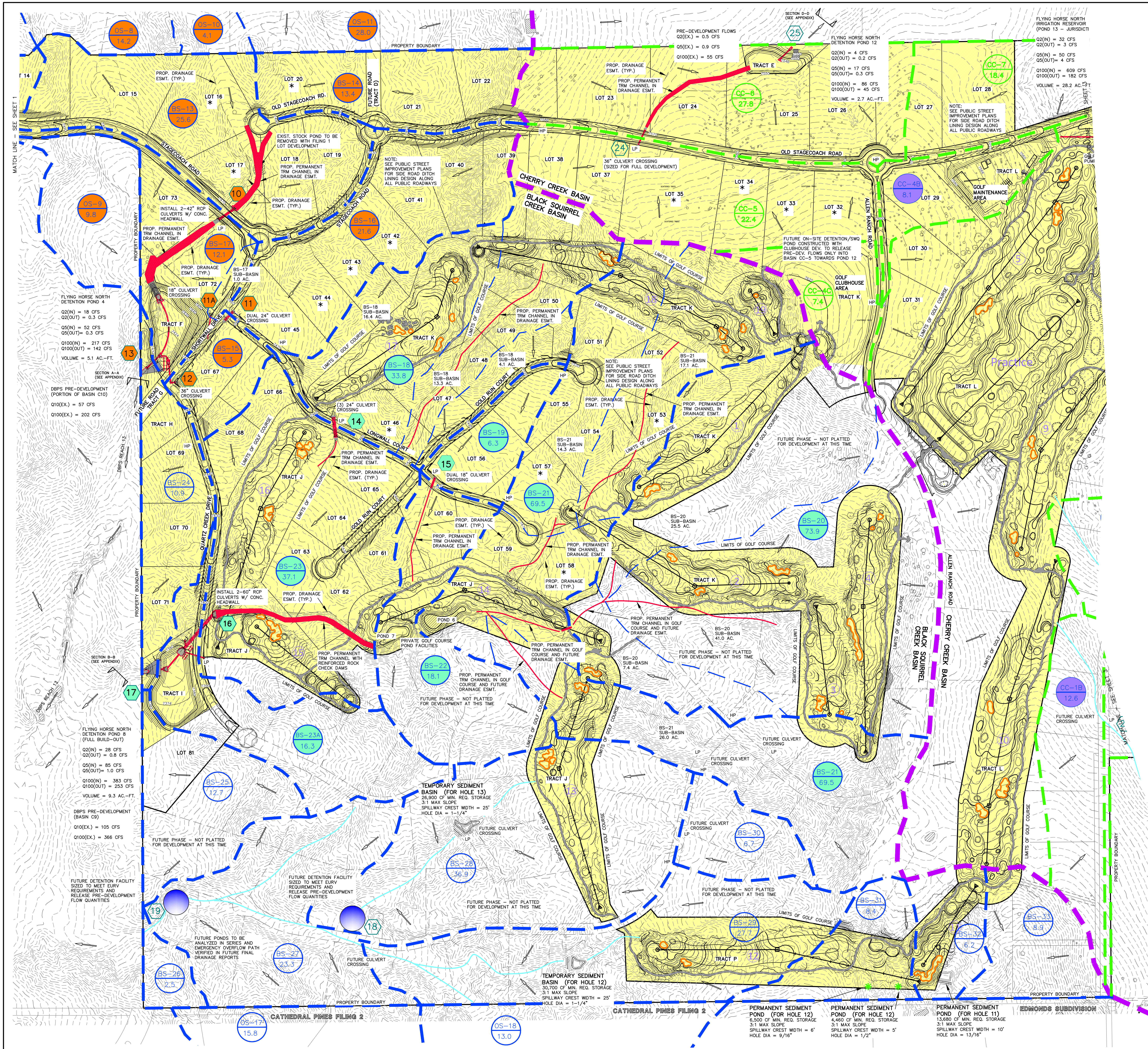
**NOVEMBER 2017**  
**Revised June 2018**

Prepared for:  
**PRI #2 LLC**  
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. 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)	Q (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	38.90	63.0	0.33	1.4	7.4	45.0	
OS-14	28.40	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	0.16	1.6	3.7	12.2	
BS-16	21.50	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-24	16.30	64.4	0.29	5.5	12.0	36.3	
BS-25	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	2.90	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	63.5	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. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (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

LOTS WITH NON-STANDARD CULVERT SIZE

BASIN IDENTIFIER

AREA IN ACRES

EXISTING DIRECTION OF FLOW

PROPOSED DIRECTION OF FLOW

STORM SEWER

FILING NO. 1 PLAT AREA







INNOVATIVE DESIGN. **CLASSIC RESULTS.**

**FLYING HORSE NORTH  
IRRIGATION RESERVOIR EMBANKMENT  
DESIGN REPORT**

**DAMID: 080459  
Construction File No.: C-2085**

**AUGUST 2018**

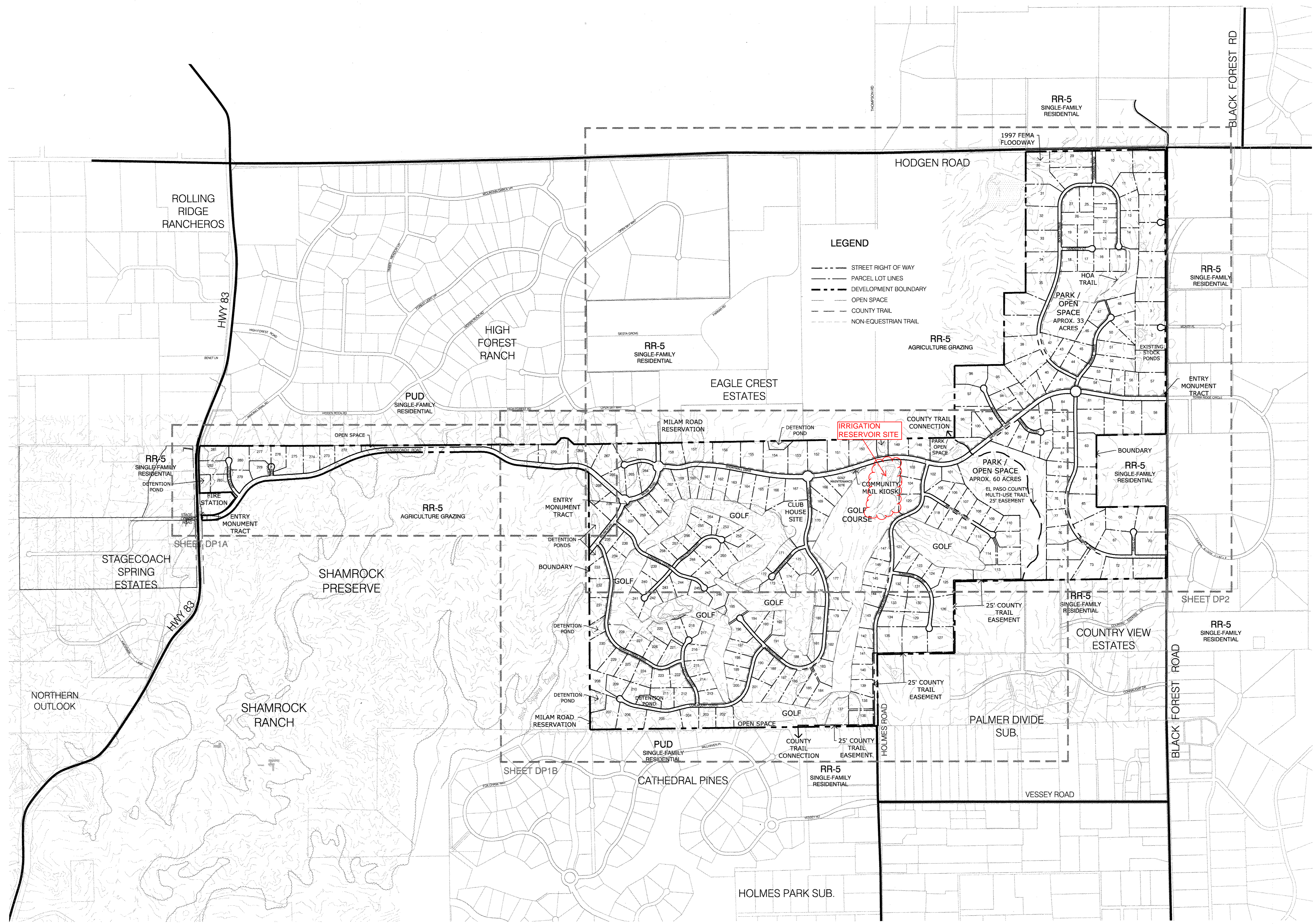
Prepared for:  
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Job no. 1096.11  
PCD File No. SF-18-001



P:\Class2\Shamrock Ranch\Drawings\Planning\Develop\DP-Layout\Flynn\_Horse\_North-DP-6wg [Full.dwg] 3/8/2017 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  
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**FLYING HORSE  
NORTH**

**PLANNED UNIT  
DEVELOPMENT**

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

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

**DEVELOPMENT PLAN  
OVERALL SITE**

**DP**  
2 OF 6

**FIGURE 1.2**

3/22/2017 217032585

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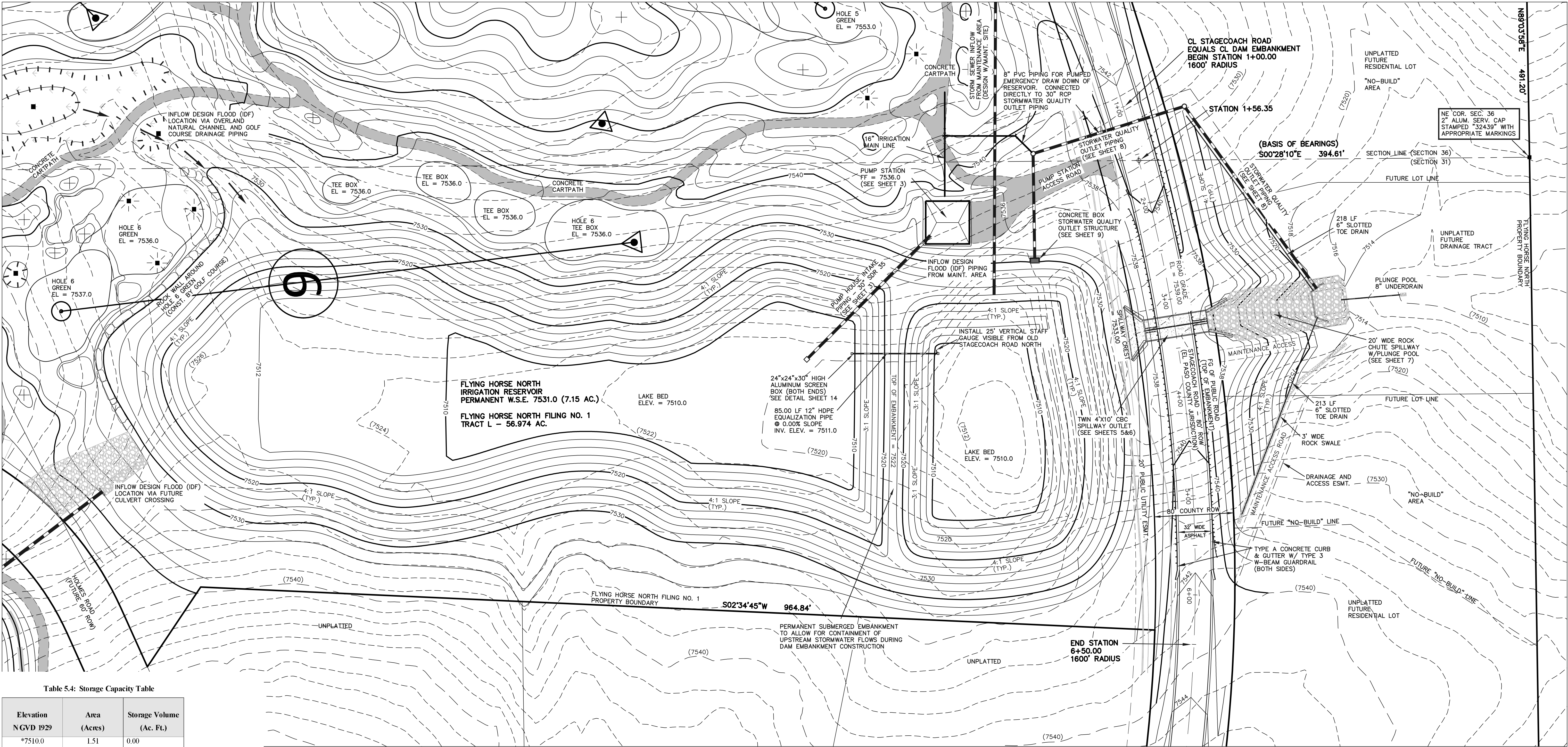


Table 5.4: Storage Capacity Table

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:

- 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.
- PERMANENT WSE = 7531.0
- RESERVOIR LINER INSTALLED UP TO ELEVATION 7534.0

STAFF GAUGE DETAILS:

- 12"x25"x1/2" PVC
- LASER CUT ACRYLIC NUMBERS AND HATCH MARKS LIQUID WELDED TO PVC ON 1 FT. INCREMENTS
- MOUNTED ON ALUMINUM FRAME WITH CROSS BRACKETS ANCHORED INTO SLOPE
- BASE FASTENED TO 12" PIPE
- ELEVATION DISPLAY RANGE: 7512-7535

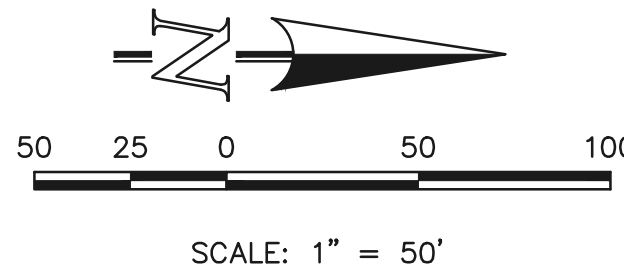


FIGURE 1.3

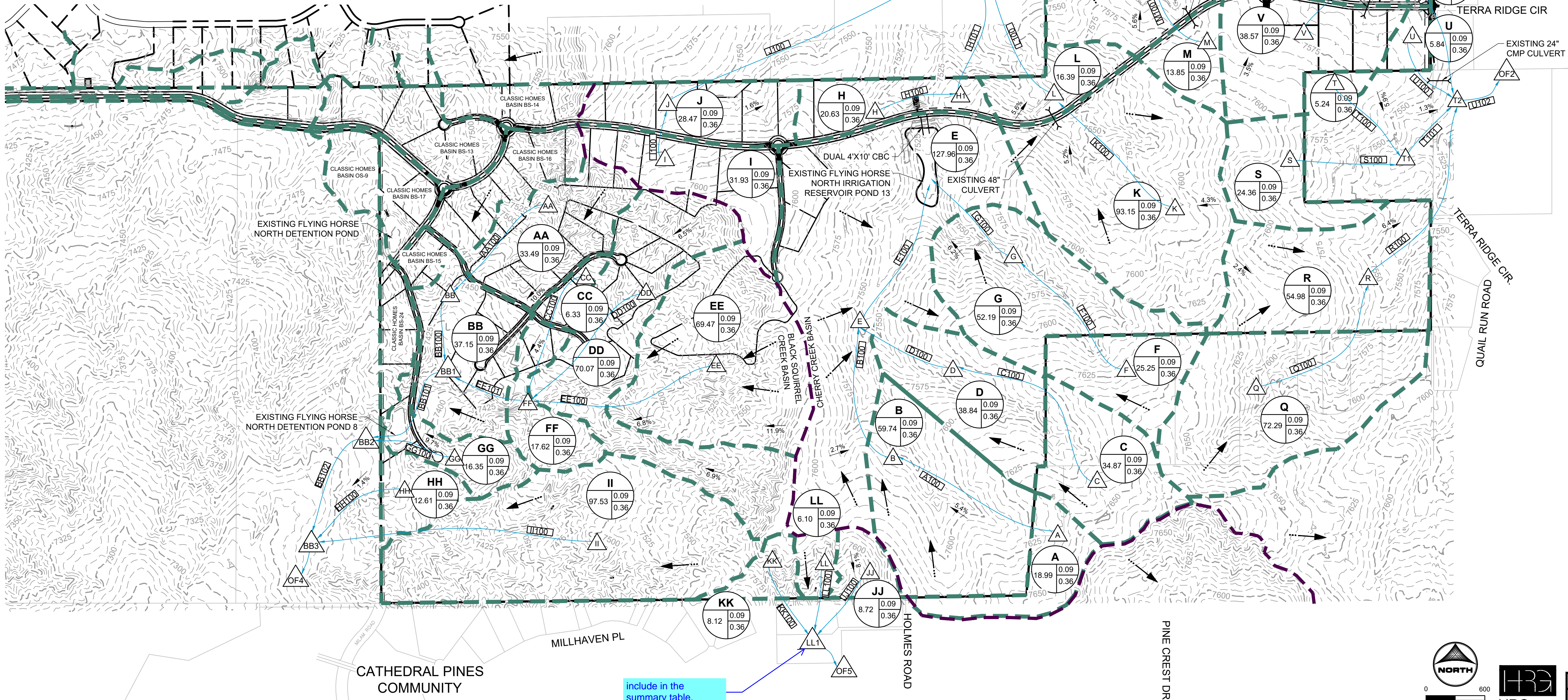
STATE ENGINEER'S CONSTRUCTION FILE NUMBER: C-2085

<div>48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS</div> <div>811</div> <div>UTILITY NOTIFICATION CENTER OF COLORADO IT'S THE LAW</div> <div>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.</div>	NO. REVISION		DATE	REVIEW:  PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC  <div>MARC A. WHORTON, COLORADO P.E. #37155</div> <div>DATE</div>	<div>CLASSIC CONSULTING ENGINEERS &amp; SURVEYORS</div> <div>619 N. Cascade Avenue, Suite 200 Colorado Springs, Colorado 80903 (719)785-0790 (719)785-0799(Fax)</div>	FLYING HORSE NORTH IRRIGATION RESERVOIR EMBANKMENT SITE LAYOUT WITH GRADING DAM ID - 080459				<div>CLASSIC CONSULTING ENGINEERS &amp; SURVEYORS</div>
	1	REVISED PER STATE COMMENTS	5-14-18							
	2	REVISED PER COUNTY COMMENTS	7-31-18							
						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

## Appendix G

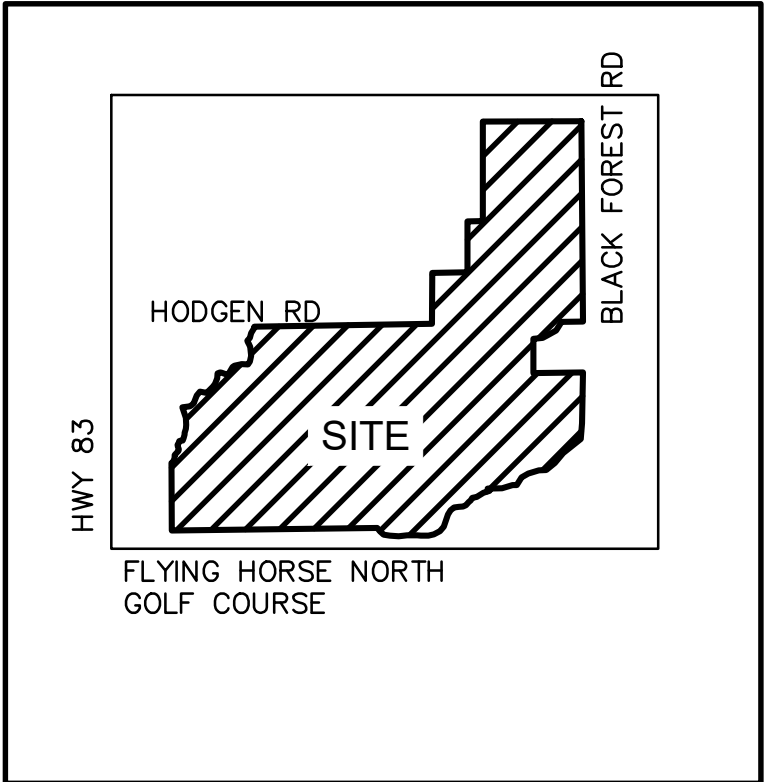
Basin	Design Point	5 Year Pre Development	100 Year Pre Development
A	A	15.02	43.23
B	B	56.78	167.03
C	C	17.53	50.63
D	D	46.10	136.63
E	E	165.14	490.42
F	F	17.17	50.63
G	G	55.41	163.11
H	H	13.21	39.01
I	I	24.30	71.18
J	J	40.02	118.13
K	K	65.28	191.61
L	L	76.34	224.26
M	M	8.14	24.12
N	N	47.86	140.25
O	O	16.12	47.59
P	P	27.28	80.55
Q	Q	45.68	135.06
R	R	76.92	227.48
S	S	18.27	53.55
T	T	2.86	8.51
	T1	97.43	288.88
	T2	102.80	304.83
U	U	2.95	8.77
V	V	21.15	62.69
W	W	2.43	7.19

Basin	Design Point	5 Year Pre Development	100 Year Pre Development
X	X	119.92	354.59
	IRR_Pond	219.03	648.71
	SP1	136.85	513.41
	SP2	200.26	648.95
	SP3	227.54	719.82
AA	AA	26.45	77.29
BB	BB	27.49	80.65
	BB1	164.58	484.58
	BB2	175.20	515.94
	BB3	240.91	712.38
CC	CC	4.44	13.06
DD	DD	40.43	119.56
EE	EE	55.10	160.96
FF	FF	111.42	328.76
GG	GG	10.62	31.36
HH	HH	9.15	26.87
II	II	58.34	172.21
JJ	JJ	6.87	20.09
KK	KK	5.30	15.68
LL	LL	4.86	14.19
	OF1	227.54	719.82
	OF2	102.80	304.83
	OF3	119.92	354.59
	OF4	240.91	712.38
	OF5	16.99	49.87



Show & label the FEMA Zone A boundary

include in the summary table.

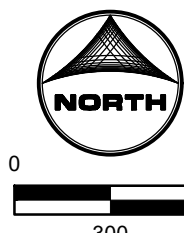


VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- 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
- POTENTIAL WATER QUALITY LOCATION
- SWM CONVEYANCE ELEMENT
- PROPOSED PEAK FLOW RATE (CFS)
- DESIGN POINT
- PROPOSED BASIN LABEL
- BASIN DESIGNATION
- AREA (AC)
- C5
- C100

NOTES:



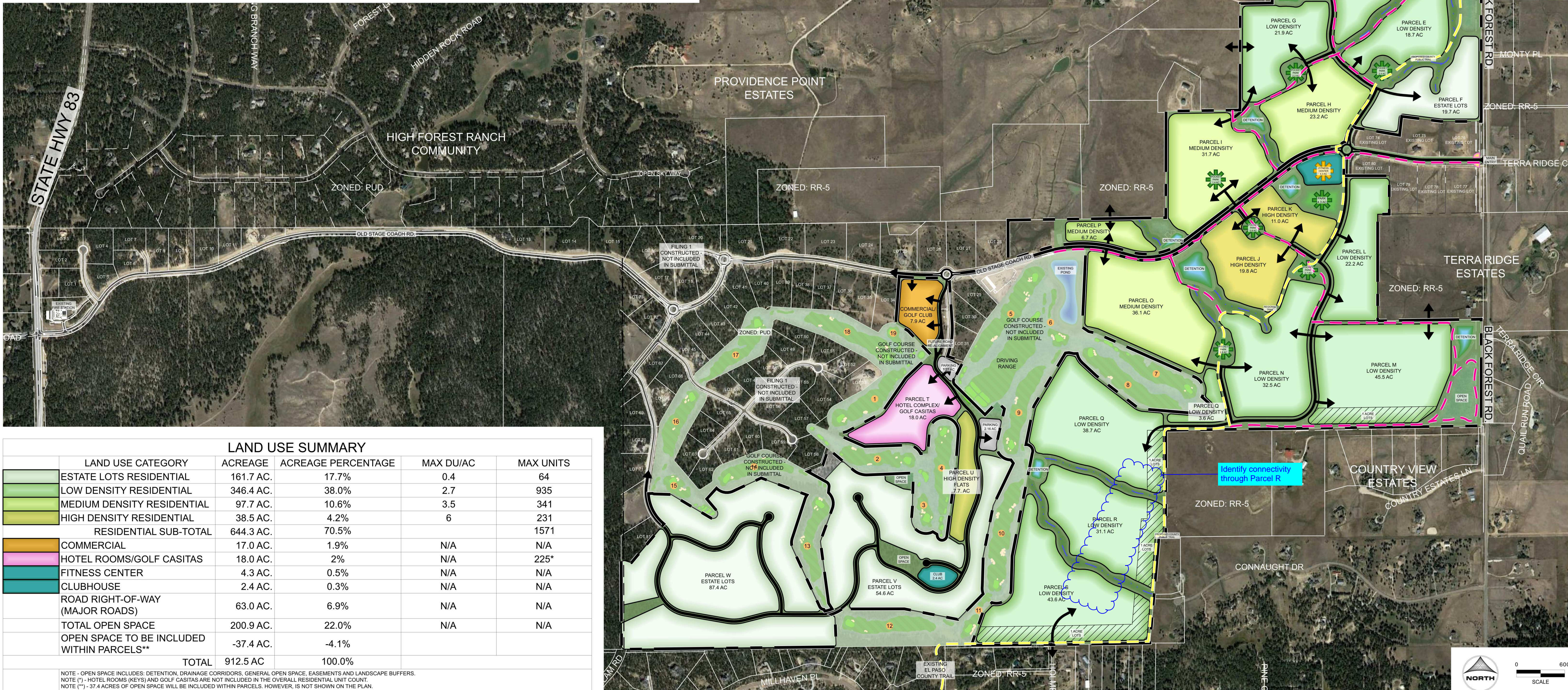
Job No.: 211030.01  
Prepared By: CLB  
Date: 02/21/2022

EXISTING EX1

# FLYING HORSE NORTH SKETCH PLAN

## LEGEND

	ESTATE LOTS		SITE BOUNDARY
	LOW DENSITY		FHN TRAIL
	1 ACRE LOTS		PUBLIC COUNTY TRAIL
	MEDIUM DENSITY		DRAINAGE WAY
	HIGH DENSITY		PARK/POCKET PARK
	COMMERCIAL/GOLF CLUB		FITNESS CENTER
	HOTEL COMPLEX		POTENTIAL FIRE STATION
	CLUB		
	HOTEL PARKING		
	ROADWAY		
	DETENTION		



### LAND USE SUMMARY

LAND USE CATEGORY	ACREAGE	ACREAGE PERCENTAGE	MAX DU/AC	MAX UNITS
ESTATE LOTS RESIDENTIAL	161.7 AC.	17.7%	0.4	64
LOW DENSITY RESIDENTIAL	346.4 AC.	38.0%	2.7	935
MEDIUM DENSITY RESIDENTIAL	97.7 AC.	10.6%	3.5	341
HIGH DENSITY RESIDENTIAL	38.5 AC.	4.2%	6	231
RESIDENTIAL SUB-TOTAL	644.3 AC.	70.5%		1571
COMMERCIAL	17.0 AC.	1.9%	N/A	N/A
HOTEL ROOMS/GOLF CASITAS	18.0 AC.	2%	N/A	225*
FITNESS CENTER	4.3 AC.	0.5%	N/A	N/A
CLUBHOUSE	2.4 AC.	0.3%	N/A	N/A
ROAD RIGHT-OF-WAY (MAJOR ROADS)	63.0 AC.	6.9%	N/A	N/A
TOTAL OPEN SPACE	200.9 AC.	22.0%	N/A	N/A
OPEN SPACE TO BE INCLUDED WITHIN PARCELS**	-37.4 AC.	-4.1%		
TOTAL	912.5 AC	100.0%		

NOTE - OPEN SPACE INCLUDES: DETENTION, DRAINAGE CORRIDORS, GENERAL OPEN SPACE, EASEMENTS AND LANDSCAPE BUFFERS.  
NOTE (\*) - HOTEL ROOMS (KEYS) AND GOLF CASITAS ARE NOT INCLUDED IN THE OVERALL RESIDENTIAL UNIT COUNT.  
NOTE (\*\*) - 37.4 ACRES OF OPEN SPACE WILL BE INCLUDED WITHIN PARCELS. HOWEVER, IS NOT SHOWN ON THE PLAN.

DRAWN BY: JAG  
APPROVED: PLS  
CAD DATE: 2/25/2022  
CAD FILE: J:\2021\211030\CAD\Drawings\Sketch-Plan\BUBBLE-PLAN

JOB DATE: 2/25/2022  
JOB NUMBER: 211030

BAR IS ONE INCH ON  
OFFICIAL DRAWINGS.  
0" 1" IF NOT ONE INCH,  
ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

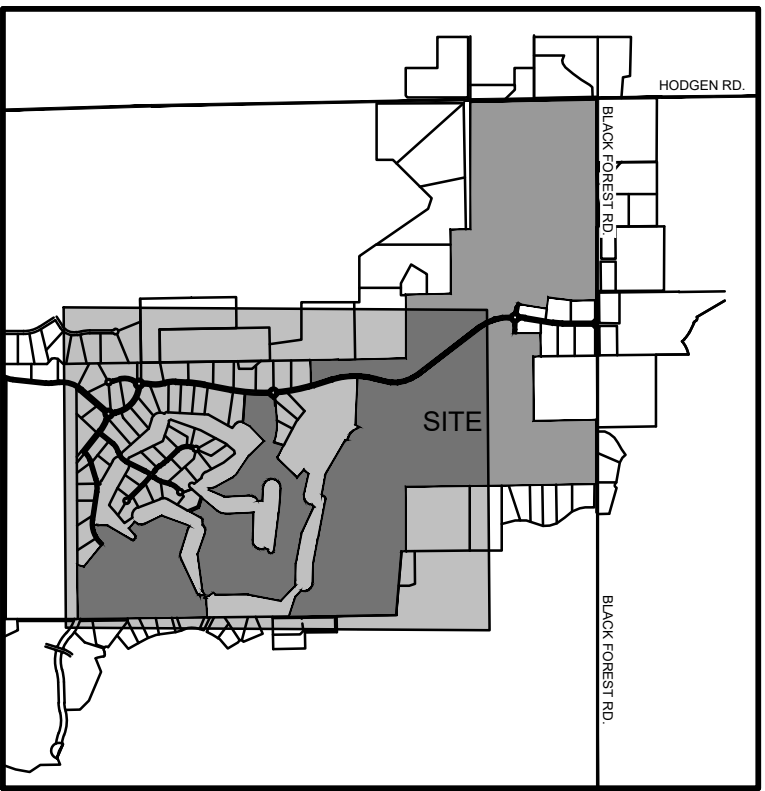
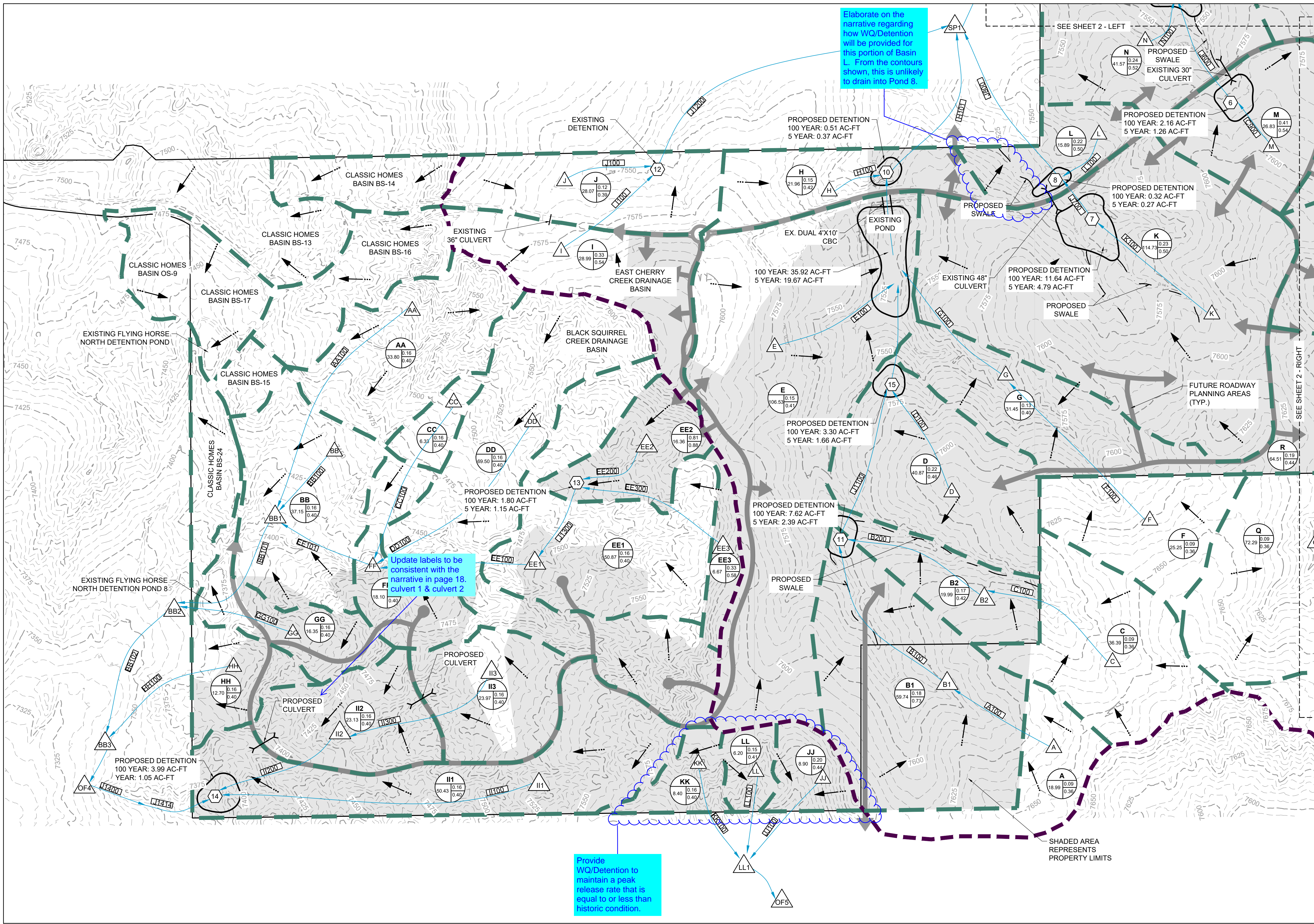
HRGreen.com  
HRGreen

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

FLYING HORSE NORTH SKETCH PLAN  
SKETCH PLAN DRAWING

SHEET  
SP.2

2



VICINITY MAP

- LEGEND:**
- PROPOSED MAJOR CONTOUR (solid line)
  - PROPOSED MINOR CONTOUR (dashed line)
  - EXISTING MAJOR CONTOUR (solid line)
  - EXISTING MINOR CONTOUR (dashed line)
  - PROPOSED STORM DRAIN PIPE (thick solid line)
  - EXISTING STORM DRAIN PIPE (thin solid line)
  - PROPOSED DRAINAGE CHANNEL (blue line)
  - PROPOSED ROAD (thick solid line)
  - PROPERTY LINE (thin solid line)
  - DIRECTIONAL FLOW ARROW (arrow)
  - EMERGENCY OVERFLOW ARROW (thick arrow)
  - EXISTING 100-YR FLOODWAY (dashed line)
  - EXISTING 100-YR FLOODPLAIN (shaded area)
  - PROPOSED 100-YR FLOODPLAIN (dashed line)
  - WATERSHED BOUNDARY (thick dashed line)
  - MAJOR BASIN LINE (thick solid line)
  - 100YR ZONE A FLOODPLAIN (shaded area)
  - PROPOSED DETENTION LOCATION (circle with letter)
  - POTENTIAL WATER QUALITY LOCATION (circle with WQ)
  - SWMM CONVEYANCE ELEMENT (SWMM)
  - PROPOSED PEAK FLOW RATE (CFS) (circle with number)
  - DESIGN POINT (triangle with letter)
  - PROPOSED BASIN LABEL (circle with XX)
  - BASIN DESIGNATION (circle with C5, C100)

**NOTES:**  
SEE SHEET 2 FOR DESIGN FLOWS

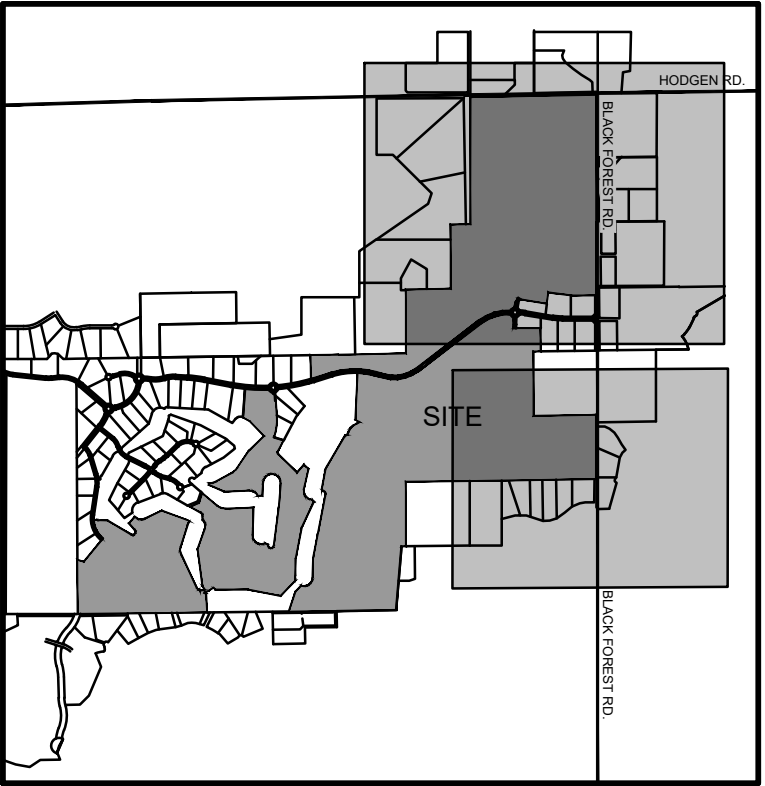
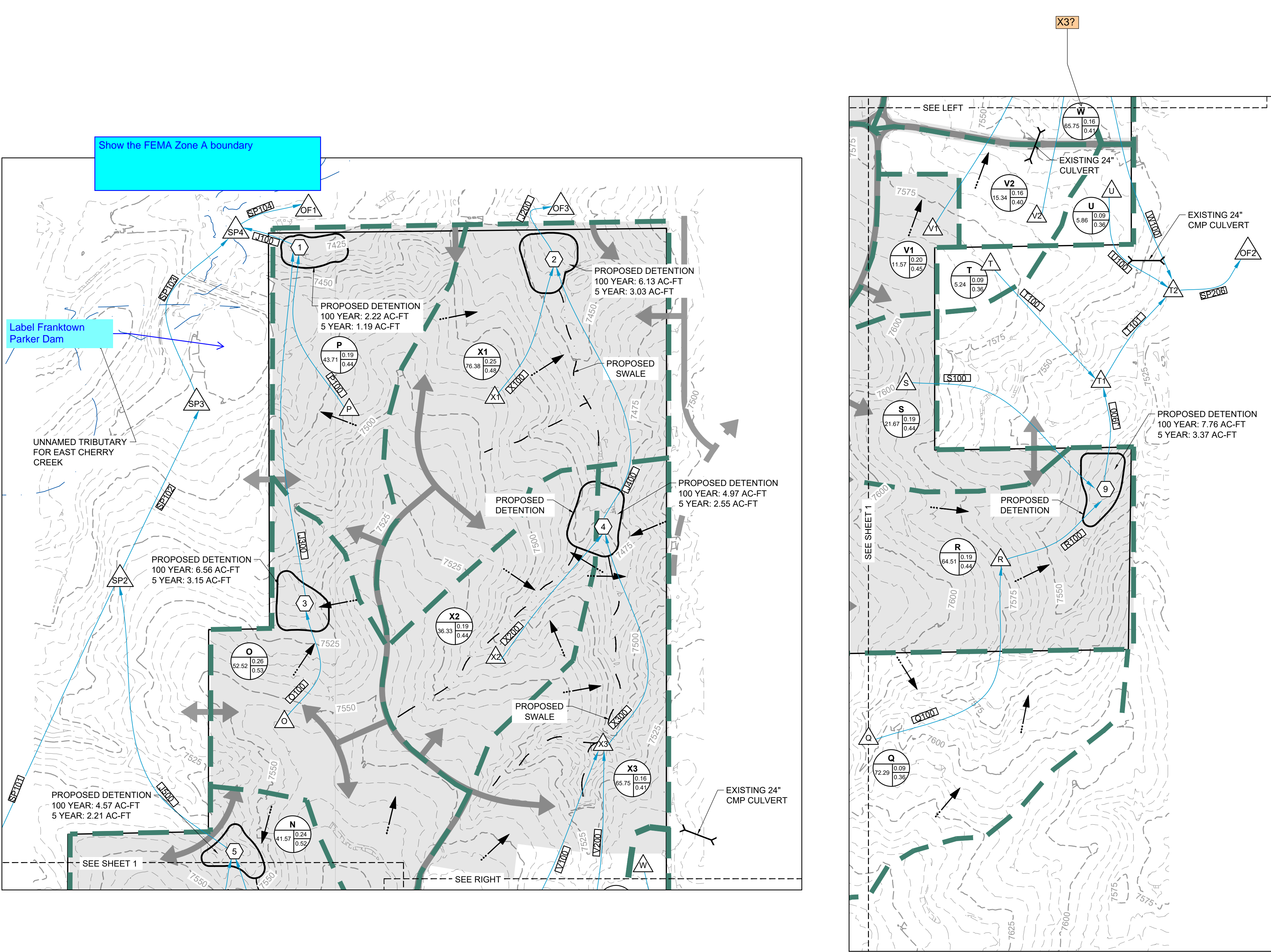


Job No.: 211030.01  
Prepared By: TBI  
Date: 3/9/2022

PROPOSED DRAINAGE BASINS

FIG.1

BASIN	DESIGN POINT	5 YEAR POST DEVELOPMENT	100 YEAR POST DEVELOPMENT
A	A	15.02	43.23
AA	AA	28.57	80.08
B1	B1	59.13	163.37
B2	B2	38.72	110.42
BB	BB	29.52	83.01
	BB1	155.72	476.52
	BB2	166.97	507.87
	BB3	230.07	638.06
C	C	25.59	74.26
CC	CC	4.74	13.39
D	D	50.3	125.58
DD	DD	42.26	120.76
E	E	128.26	346.92
EE1	EE1	42.6	154.16
EE2	EE2	27.82	62.84
EE3	EE3	7.88	19.08
F	F	17.53	50.93
FF	FF	100.04	325.29
G	G	37.69	107.75
GG	GG	11.25	32.04
H	H	13.74	38.52
HH	HH	9.86	27.77
I	I	26.84	71.19
II1	II1	25.77	73.38
II2	II2	40.9	114.68
II3	II3	20.65	57.86
	IRR_J	64.13	263.28
	IRR_POND	184.14	511.28
J	J	17.72	50.49
JJ	JJ	11.06	28.04
K	K	159.05	395.37
KK	KK	5.91	16.72
L	L	15.11	39.52
LL	LL	5.85	15.68
LL1	LL1	22.38	59.47
M	M	36.75	91.76
N	N	65.41	159.57
O	O	62.67	156.19
	OF1	202.1	624.16
	OF2	98.8	273.21
	OF3	108.31	343.11
	OF4	230.07	638.06
	OF5	22.38	59.47
P	P	39.34	103.06
Q	Q	46.69	135.9
R	R	98.48	273.3
S	S	20.17	52.94
	SP1	137.11	453.51
	SP2	166.63	531.76
	SP3	161.89	530.35
	SP4	202.13	624.19
T	T	2.92	8.56
	T1	93.32	258.02
	T2	98.8	273.21
U	U	3.63	10.37
V1	V1	10.41	27.11
V2	V2	11.32	31.98
W	W	2.6	7.36
X1	X1	67.88	177.48
X2	X2	30.87	81.3
X3	X3	59.32	163.53



**VICINITY MAP**

**LEGEND:**

- PROPOSED MAJOR CONTOUR: 5250
- PROPOSED MINOR CONTOUR: 5250
- EXISTING MAJOR CONTOUR: 5250
- EXISTING MINOR CONTOUR: 5250
- PROPOSED STORM DRAIN PIPE: [Symbol]
- EXISTING STORM DRAIN PIPE: [Symbol]
- PROPOSED DRAINAGE CHANNEL: [Symbol]
- PROPOSED ROAD: [Symbol]
- PROPERTY LINE: [Symbol]
- DIRECTIONAL FLOW ARROW: [Symbol]
- EMERGENCY OVERFLOW ARROW: [Symbol]
- EXISTING 100-YR FLOODWAY: [Symbol]
- EXISTING 100-YR FLOODPLAIN: [Symbol]
- PROPOSED 100-YR FLOODPLAIN: [Symbol]
- WATERSHED BOUNDARY: [Symbol]
- MAJOR BASIN LINE: [Symbol]
- 100YR ZONE A FLOODPLAIN: [Symbol]
- PROPOSED DETENTION LOCATION: [Symbol]
- POTENTIAL WATER QUALITY LOCATION: [Symbol]
- SWM CONVEYANCE ELEMENT: [Symbol]
- PROPOSED PEAK FLOW RATE (CFS): 850
- DESIGN POINT: [Symbol]
- PROPOSED BASIN LABEL: [Symbol]
- AREA (AC.): [Symbol]
- BASIN DESIGNATION: C5, C100

NOTES:



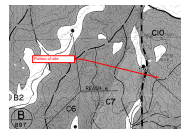
Job No.: 211030.01  
Prepared By: TBI  
Date: 3/9/2022

PROPOSED DRAINAGE BASINS

FIG.1

# Master Development Drainage Plan\_v1.pdf Markup Summary

## Callout (15)



**Subject:** Callout  
**Page Label:** 194  
**Author:** cbudge  
Portion of site



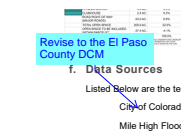
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**Page Label:** 25  
**Author:** cmcfarl  
SITE



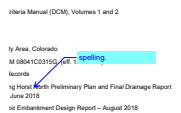
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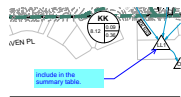
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SITE



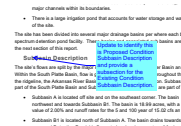
**Subject:** Callout  
**Page Label:** 6  
**Author:** dsdlaforce  
Revise to the El Paso County DCM



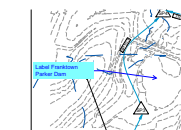
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**Author:** dsdlaforce  
spelling.



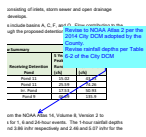
**Subject:** Callout  
**Page Label:** [1] Exhibit  
**Author:** dsdlaforce  
include in the summary table.



**Subject:** Callout  
**Page Label:** 9  
**Author:** dsdlaforce  
Update to identify this is Proposed Condition Subbasin Description and provide a subsection for the Existing Condition Subbasin Description.

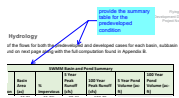


**Subject:** Callout  
**Page Label:** [1] Exhibit (2)  
**Author:** dsdlaforce  
Label Franktown Parker Dam



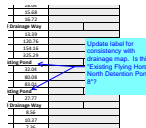
**Subject:** Callout  
**Page Label:** 14  
**Author:** dsdlaforce

Revise to NOAA Atlas 2 per the 2014 City DCM adopted by the County.  
Revise rainfall depths per Table 6-2 of the City DCM



**Subject:** Callout  
**Page Label:** 15  
**Author:** dsdlaforce

provide the summary table for the predeveloped condition



**Subject:** Callout  
**Page Label:** 16  
**Author:** dsdlaforce

Update label for consistency with drainage map. Is this "Existing Flying Horse North Detention Pond 8"?



**Subject:** Callout  
**Page Label:** 13  
**Author:** dsdlaforce

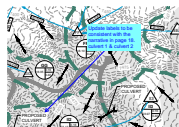
Expand on the narrative for Basin HH. The plan does not identify WQCV, so explain or identify the specific exclusion from WQCV. See Engineering Criteria Manual Appendix I Section I.7.1.B for the type of sites excluded from permanent WQ.

Also explain why flow rate in the developed condition is lower when imperviousness is higher than predevelopment condition.



**Subject:** Callout  
**Page Label:** 18  
**Author:** dsdlaforce

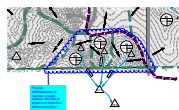
Ponds are designed in a series. Explain how the system will be analyzed as detailed UD-Detention modeling is provided with subsequent preliminary and final drainage report for the pond design and ensuring the downstream ponds maintain compliance with Senate Bill 15-212 to drain the ponds within 72 hours for 5yr storm or within 120 hours for storm events greater than the 5yr storm.



**Subject:** Callout  
**Page Label:** [1] Exhibit  
**Author:** dsdlaforce

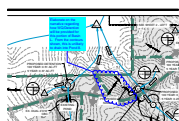
Update labels to be consistent with the narrative in page 18.  
culvert 1 & culvert 2

## Cloud+ (3)



**Subject:** Cloud+  
**Page Label:** [1] Exhibit  
**Author:** dsdlaforce

Provide WQ/Detention to maintain a peak release rate that is equal to or less than historic condition.



**Subject:** Cloud+  
**Page Label:** [1] Exhibit  
**Author:** dsdlaforce

Elaborate on the narrative regarding how WQ/Detention will be provided for this portion of Basin L. From the contours shown, this is unlikely to drain into Pond 8.



**Subject:** Cloud+  
**Page Label:** 204  
**Author:** dsdlaforce

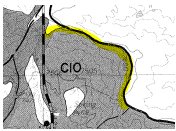
Identify connectivity through Parcel R

Engineer (7)

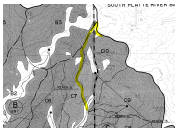
<p>ly.</p> <p>st side of the site in be</p> <p>ards <b>Subbasin C5</b> via</p> <p>e basin is 11.57 acres,</p> <p>and 100 year of 10.41</p>	<p><b>Subject:</b> Engineer</p> <p><b>Page Label:</b> 11</p> <p><b>Author:</b> dotprete</p>	<p>Subbasin C5</p>
<p>the 5 and 100 year of</p> <p>uth of subbasin X3 an</p> <p>ards <b>subbasin C5</b>. The</p>	<p><b>Subject:</b> Engineer</p> <p><b>Page Label:</b> 11</p> <p><b>Author:</b> dotprete</p>	<p>subbasin C5</p>
<p>illy to <b>Detention Pond 5</b>. The</p> <p>2.5 acre lots that cover the l</p> <p>f 10.00% and runoff rates for</p>	<p><b>Subject:</b> Engineer</p> <p><b>Page Label:</b> 12</p> <p><b>Author:</b> dotprete</p>	<p>Detention Pond 5</p>
<p>side of the site in be</p> <p>ards <b>Subbasin C5</b> via</p> <p>e basin is 11.57 acres,</p> <p>and 100 year of 10.41</p>	<p><b>Subject:</b> Engineer</p> <p><b>Page Label:</b> 11</p> <p><b>Author:</b> dotprete</p>	<p>should this be subbasin X3?</p>
<p><b>X3?</b></p>	<p><b>Subject:</b> Engineer</p> <p><b>Page Label:</b> [1] Exhibit (2)</p> <p><b>Author:</b> dotprete</p>	<p>X3?</p>
<p><b>4?</b></p>	<p><b>Subject:</b> Engineer</p> <p><b>Page Label:</b> 12</p> <p><b>Author:</b> dotprete</p>	<p>4?</p>
<p>in Pond 5. There are no</p>	<p><b>Subject:</b> Engineer</p> <p><b>Page Label:</b> 10</p> <p><b>Author:</b> dotprete</p>	<p>Discuss proposed stormwater WQ treatment for subbasin I. Will flows be directed to Existing Detention Pond 12? Does Detention Pond 12 have capacity for developed flows from subbasin I?</p>

Highlight (6)

	<p><b>Subject:</b> Highlight</p> <p><b>Page Label:</b> 194</p> <p><b>Author:</b> cbudge</p>	
	<p><b>Subject:</b> Highlight</p> <p><b>Page Label:</b> 194</p> <p><b>Author:</b> cbudge</p>	
	<p><b>Subject:</b> Highlight</p> <p><b>Page Label:</b> 194</p> <p><b>Author:</b> cbudge</p>	



**Subject:** Highlight  
**Page Label:** 194  
**Author:** cbudge



**Subject:** Highlight  
**Page Label:** 194  
**Author:** cbudge

O	62.67	196.19
OF5	202.1	624.16
OF2	98.8	273.21
OF3	108.31	343.11
OF4	230.07	638.06
OF5	22.38	59.47
P	39.34	101.06
Q	46.89	131.9
R	98.48	273.3
S	20.17	52.94
SP1	137.11	453.51

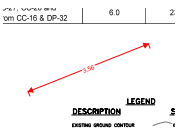
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**Page Label:** [1] Exhibit (2)  
**Author:** dsdlaforce  
OF5 22.38 59.47

Image (1)

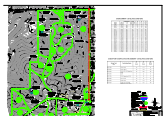


**Subject:** Image  
**Page Label:** 22  
**Author:** dsdlaforce

Length Measurement (2)



**Subject:** Length Measurement  
**Page Label:** 198  
**Author:** cbudge  
3.56



**Subject:** Length Measurement  
**Page Label:** 198  
**Author:** cbudge  
23.07

Line (1)

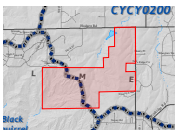


**Subject:** Line  
**Page Label:** 200  
**Author:** MWhorton

Polygon (3)



**Subject:** Polygon  
**Page Label:** 200  
**Author:** MWhorton

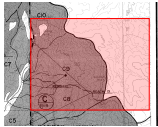


**Subject:** Polygon  
**Page Label:** 25  
**Author:** cbudge



**Subject:** Polygon  
**Page Label:** 31  
**Author:** cmcfarl

Rectangle (2)



**Subject:** Rectangle  
**Page Label:** 194  
**Author:** cbudge



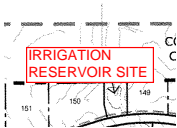
**Subject:** Rectangle  
**Page Label:** 30  
**Author:** cmcfarl

Stormwater Comments Color (1)



**Subject:** Stormwater Comments Color  
**Page Label:** 1  
**Author:** dotprete

Text Box (6)



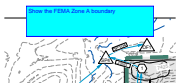
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**Page Label:** 200  
**Author:** MWhorton

IRRIGATION RESERVOIR SITE



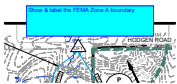
**Subject:** Text Box  
**Page Label:** 1  
**Author:** dsdlaforce

Add "PCD File No. SKP223"



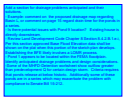
**Subject:** Text Box  
**Page Label:** [1] Exhibit (2)  
**Author:** dsdlaforce

Show the FEMA Zone A boundary



**Subject:** Text Box  
**Page Label:** [1] Exhibit  
**Author:** dsdlaforce

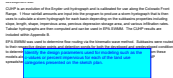
Show & label the FEMA Zone A boundary



**Subject:** Text Box  
**Page Label:** 22  
**Author:** dsdlaforce

Add a section for drainage problems anticipated and their solutions.

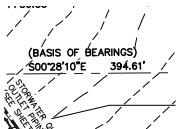
- Example: comment on the proposed drainage map regarding Basin L, or comment on page 15 regard drain time for the ponds in a series.
- Is there potential issues with Pond 9 location? Existing house is directly downstream.
- Review Land Development Code Chapter 8 Section 8.4.2.B.1.e.i, Per this section approved Base Flood Elevation data shall be shown on the plat when this portion of the sketch plan develops. Establishing the BFE likely involves a LOMR process.
- Pond 1 appears to be located within the FEMA floodplain. Identify anticipated drainage problems and design considerations.
- Some of the MHFD-Detention worksheet show outflow greater than predevelopment Q for certain design storm. Criteria requires that ponds release at below historic. Additionally some of these ponds are in a series which may exacerbate the problem with compliance to Senate Bill 15-212.



**Subject:** Text Box  
**Page Label:** 14  
**Author:** dsdlaforce

Identify the design parameters used for modeling such as the c-values or percent impervious for each of the land use categories presented on the sketch plan.

(205)



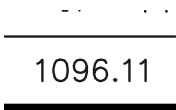
**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

S00°28'10"E 394.61'



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

619 N. Cascade Avenue, Suite 200



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

1096.11



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

(7526)



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

STATION 1+56.35



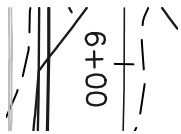
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7542



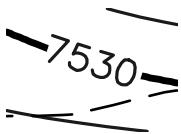
**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

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.



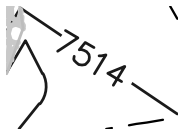
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**Author:** AutoCAD SHX Text

6+00



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

7530



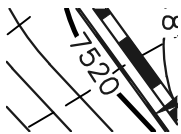
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7514

REVIEW:

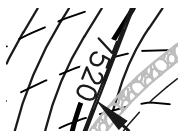
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**Author:** AutoCAD SHX Text

REVIEW:



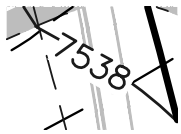
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7520



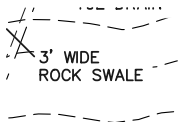
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7520



**Subject:**  
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**Author:** AutoCAD SHX Text

7538



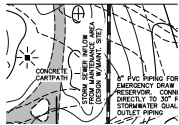
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3' WIDE ROCK SWALE

DATE	1-4-18
SHEET	4 OF 1
JOB NO.	1096.11

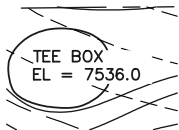
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**Page Label:** 201  
**Author:** AutoCAD SHX Text

SHEET OF



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

STORM SEWER INFLOW FROM MAINTENANCE  
AREA (DESIGN W/MAINT. SITE)



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

TEE BOX EL = 7536.0



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

3+00



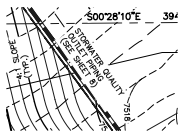
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**Author:** AutoCAD SHX Text

20' PUBLIC UTILITY ESMT.



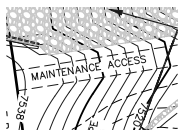
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**Page Label:** 201  
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INFLOW DESIGN FLOOD (IDF) LOCATION VIA  
OVERLAND NATURAL CHANNEL AND GOLF  
COURSE DRAINAGE PIPING



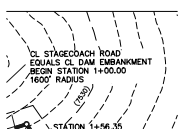
**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

STORWATER QUALITY OUTLET PIPING (SEE  
SHEET 8)



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

MAINTENANCE ACCESS



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

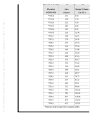
CL STAGECOACH ROAD EQUALS CL DAM  
EMBANKMENT BEGIN STATION 1+00.00 1600'  
RADIUS

(7540)

Subject: (7540)  
Page Label: 201  
Author: AutoCAD SHX Text

(7540)

Subject: (7540)  
Page Label: 201  
Author: AutoCAD SHX Text



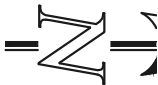
Subject: STAFF GAUGE DETAILS: 1. 12"X25'X1/2" PVC  
Page Label: 201 12"X25'X1/2" PVC 2. LASER CUT ACRYLIC  
Author: AutoCAD SHX Text NUMBERS AND HATCH LASER CUT ACRYLIC  
NUMBERS AND HATCH MARKS LIQUID  
WELDED TO PVC ON 1 FT. INCREMENTS  
3. MOUNTED ON ALUMINUM FRAME WITH  
MOUNTED ON ALUMINUM FRAME WITH  
CROSS BRACKETS ANCHORED INTO SLOPE  
4. BASE FASTENED TO 12" PIPE BASE  
FASTENED TO 12" PIPE 5. ELEVATION  
DISPLAY RANGE: 7512-7535ELEVATION  
DISPLAY RANGE: 7512-7535

7530

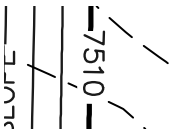
Subject: 7530  
Page Label: 201  
Author: AutoCAD SHX Text



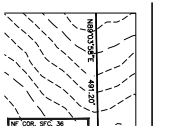
Subject: HOLE 6 GREEN EL = 7537.0  
Page Label: 201  
Author: AutoCAD SHX Text



Subject: N  
Page Label: 201  
Author: AutoCAD SHX Text



Subject: 7510  
Page Label: 201  
Author: AutoCAD SHX Text



Subject: N89°03'58"E 491.20'  
Page Label: 201  
Author: AutoCAD SHX Text



Subject: 32' WIDE  
Page Label: 201  
Author: AutoCAD SHX Text

811  
IFICATION CENTER C  
IT'S THE LAW  
EXISTING UNDERGROU  
NIMATE WAY ONLY

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

IT'S THE LAW

24"x24"x30" HIGH  
ALUMINUM SCREEN  
BOX (BOTH ENDS)  
SEE DETAIL SHEET 14  
85.00 LF 12" HDPE  
EQUALIZATION PIPE  
0.00% SLOPE

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

24"x24"x30" HIGH ALUMINUM SCREEN BOX  
(BOTH ENDS) SEE DETAIL SHEET 14

(7520)

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

(7520)

4:1 SLOPE  
(TYP.)

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

4:1 SLOPE (TYP.)

PERMANENT SUBMERGED EMBANKMENT  
TO ALLOW FOR CONTAINMENT OF UPSTREAM  
STORMWATER FLOWS DURING DAM  
EMBANKMENT CONSTRUCTION

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

PERMANENT SUBMERGED EMBANKMENT TO  
ALLOW FOR CONTAINMENT OF UPSTREAM  
STORMWATER FLOWS DURING DAM  
EMBANKMENT CONSTRUCTION

MAW

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

MAW

(7540)

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

(7540)

BOX (BOTH ENDS)  
SEE DETAIL SHEET 14  
85.00 LF 12" HDPE  
EQUALIZATION PIPE  
0.00% SLOPE  
INV. ELEV. = 7511.0

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

85.00 LF 12" HDPE EQUALIZATION PIPE @  
0.00% SLOPE INV. ELEV. = 7511.0

7530

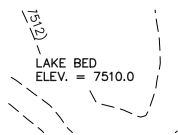
Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

7530

CONCRETE BOX  
STORMWATER QUALITY  
OUTLET STRUCTURE  
(SEE SHEET 9)

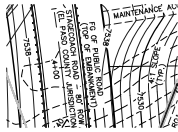
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Author: AutoCAD SHX Text

CONCRETE BOX STORMWATER QUALITY  
OUTLET STRUCTURE (SEE SHEET 9)



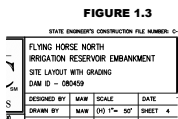
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LAKE BED ELEV. = 7510.0



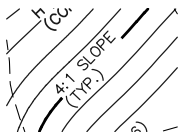
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FG OF PUBLIC ROAD (TOP OF EMBANKMENT)



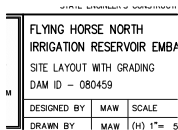
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IRRIGATION RESERVOIR EMBANKMENT



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

4:1 SLOPE (TYP.)



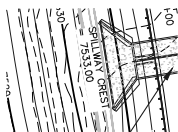
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SITE LAYOUT WITH GRADING



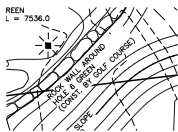
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"NO-BUILD" AREA



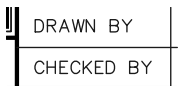
**Subject:**  
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**Author:** AutoCAD SHX Text

SPILLWAY CREST = 7533.00



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

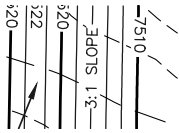
ROCK WALL AROUND HOLE 6 GREEN (CONST. BY GOLF COURSE)



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

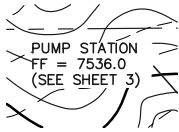
CHECKED BY

**Subject:**  
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**Author:** AutoCAD SHX Text



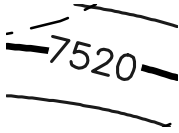
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3:1 SLOPE



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

PUMP STATION FF = 7536.0 (SEE SHEET 3)



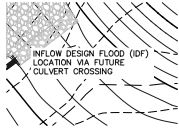
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7520



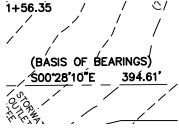
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MAW



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

INFLOW DESIGN FLOOD (IDF) LOCATION VIA  
FUTURE CULVERT CROSSING



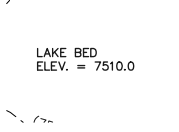
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(BASIS OF BEARINGS)



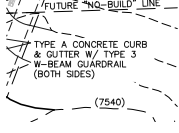
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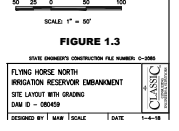
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LAKE BED ELEV. = 7510.0



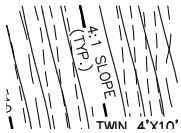
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**Author:** AutoCAD SHX Text

TYPE A CONCRETE CURB & GUTTER W/ TYPE  
3 W-BEAM GUARDRAIL (BOTH SIDES)



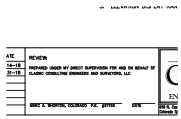
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**Author:** AutoCAD SHX Text

STATE ENGINEER'S CONSTRUCTION FILE  
NUMBER: C-2085



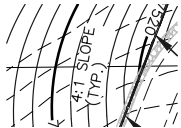
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**Author:** AutoCAD SHX Text

4:1 SLOPE (TYP.)



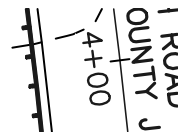
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**Page Label:** 201  
**Author:** AutoCAD SHX Text

PREPARED UNDER MY DIRECT SUPERVISION  
FOR AND ON BEHALF OF



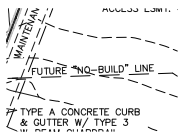
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4:1 SLOPE (TYP.)



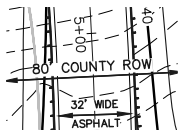
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4+00



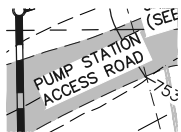
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FUTURE "NO-BUILD" LINE



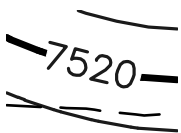
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80' COUNTY ROW



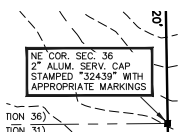
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PUMP STATION ACCESS ROAD



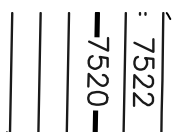
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7520



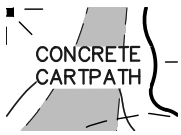
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NE COR. SEC. 36 2" ALUM. SERV. CAP  
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MARKINGS



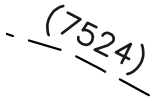
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**Author:** AutoCAD SHX Text

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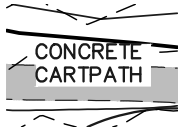
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CONCRETE CARTPATH



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

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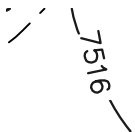
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CONCRETE CARTPATH



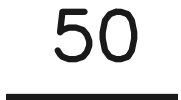
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7510



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7516



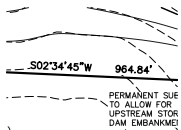
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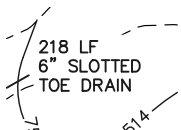
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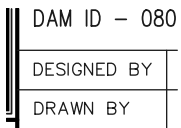
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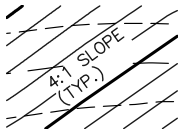
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218 LF 6" SLOTTED TOE DRAIN

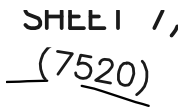


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DESIGNED BY



**Subject:** 4:1 SLOPE (TYP.)  
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**Author:** AutoCAD SHX Text



**Subject:** N/A  
**Page Label:** 201  
**Author:** AutoCAD SHX Text



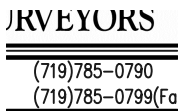
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**Subject:** PUMP HOUSE INTAKE PIPING - 30" SDR 35  
**Page Label:** 201  
**Author:** AutoCAD SHX Text (SEE SHEET 3)



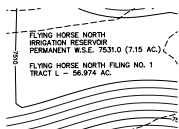
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**Subject:** (719)785-0790  
**Page Label:** 201  
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**Subject:** NOTES: 1. TOPOGRAPHIC BASE MAPPING  
**Page Label:** 201 PRODUCED TOPOGRAPHIC BASE MAPPING  
**Author:** AutoCAD SHX Text PRODUCED 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 PERMANENT WSE = 7531.0  
3. RESERVOIR LINER INSTALLED UP TO  
RESERVOIR LINER INSTALLED UP TO  
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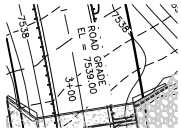


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(7530)

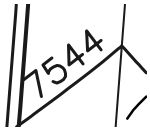
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Subject:  
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Author: AutoCAD SHX Text

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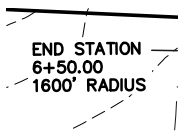
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7544



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

"NO-BUILD" AREA



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

END STATION 6+50.00 1600' RADIUS



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

CONCRETE CARTPATH



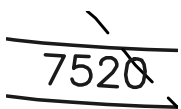
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213 LF 6" SLOTTED TOE DRAIN



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

SCALE



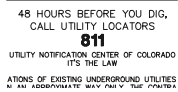
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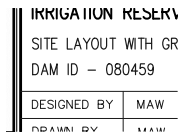
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7530



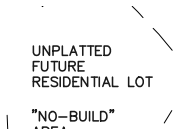
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CALL UTILITY LOCATORS



**Subject:**  
**Page Label:** 201  
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DAM ID - 080459



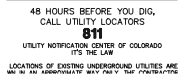
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UNPLATTED FUTURE RESIDENTIAL LOT



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

7510



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

48 HOURS BEFORE YOU DIG,



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

Colorado Springs, Colorado 80903



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

7538



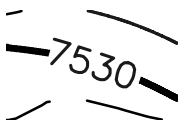
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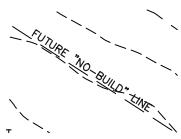
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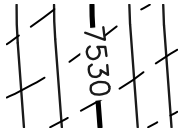
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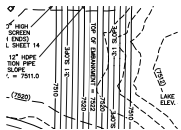
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FUTURE "NO-BUILD" LINE



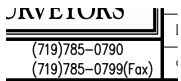
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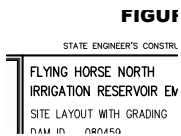
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TOP OF EMBANKMENT = 7522



**Subject:**  
**Page Label:** 201  
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(719)785-0799(Fax)



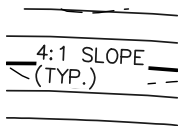
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FLYING HORSE NORTH



**Subject:**  
**Page Label:** 201  
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7538



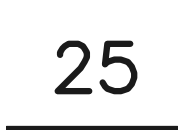
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4:1 SLOPE (TYP.)



**Subject:**  
**Page Label:** 201  
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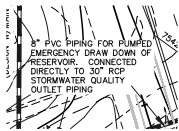
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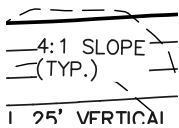


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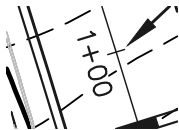
STAGECOACH ROAD - 80' ROW (EL PASO COUNTY JURISDICTION)



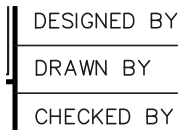
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QUALITY OUTLET PIPING



**Subject:** 4:1 SLOPE (TYP.)  
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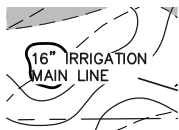
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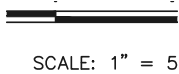
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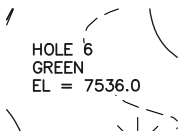
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**Subject:** HOLE 6 GREEN EL = 7536.0  
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Subject:  
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Author: AutoCAD SHX Text

(7522)

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

7514

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

UNPLATTED  
FUTURE  
DRAINAGE TRACT

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

SECTION LINE (SECTION 36)  
FUTURE LOT LINE

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

TOP OF EMBA  
3:1 SLOPE

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

NO.

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

DATE

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

REVISION  
REVISED P

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

REVIEW  
CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

CLASSIC CONSULTING ENGINEERS AND  
SURVEYORS, LLC



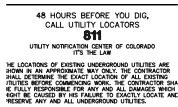
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Author: AutoCAD SHX Text

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Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

UNPLATTED



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

UTILITY NOTIFICATION CENTER OF COLORADO

14

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

14



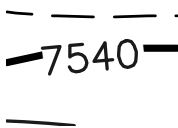
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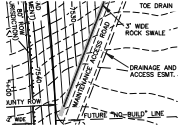
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STORWATER QUALITY OUTLET PIPING (SEE SHEET 8)



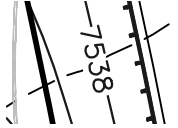
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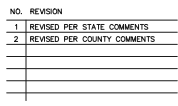
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MAINTENANCE ACCESS ROAD



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

7538



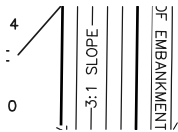
Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

REVISED PER COUNTY COMMENTS



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

ASPHALT



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

3:1 SLOPE



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

UNPLATTED FUTURE RESIDENTIAL LOT



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

FUTURE LOT LINE

NO.	REVISION
1	REVISED PER STATE COMMENTS
2	REVISED PER COUNTY COMMENTS

**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

REVISED PER STATE COMMENTS

1

**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

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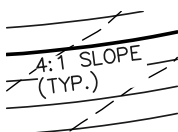
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TWIN 4'X10' CBC SPILLWAY OUTLET (SEE SHEETS 5&6)



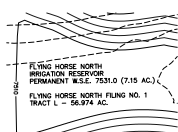
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4:1 SLOPE (TYP.)



**Subject:**  
**Page Label:** 201  
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FLYING HORSE NORTH IRRIGATION  
RESERVOIR PERMANENT W.S.E. 7531.0 (7.15  
AC.)

2

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

2



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

UNPLATTED



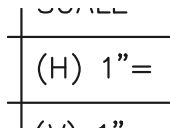
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Author: AutoCAD SHX Text

20' WIDE ROCK CHUTE SPILLWAY W/PLUNGE  
POOL (SEE SHEET 7)



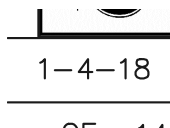
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(7520)



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Page Label: 201  
Author: AutoCAD SHX Text

(H) 1"=



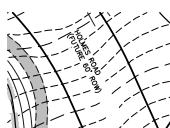
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1-4-18



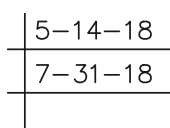
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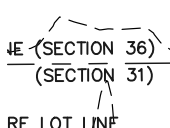
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HOLMES ROAD (FUTURE 60' ROW)



Subject:  
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7-31-18

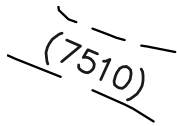


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(SECTION 31)

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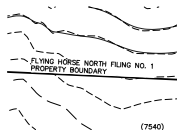
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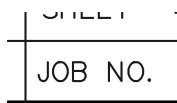
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PROPERTY BOUNDARY



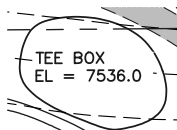
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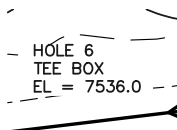
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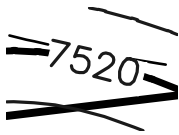
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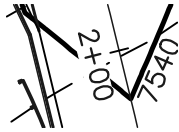
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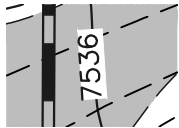
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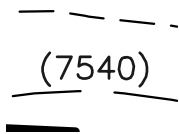
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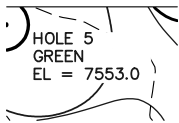
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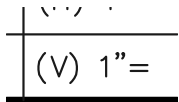
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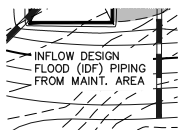
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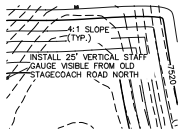
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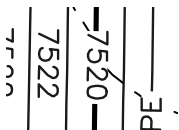
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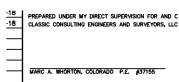
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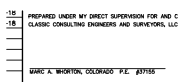
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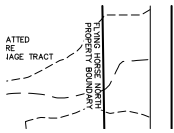


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**Page Label:** 201  
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FLYING HORSE NORTH PROPERTY  
BOUNDARY

DATE

**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

DATE

50'

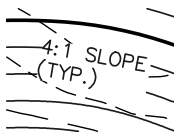
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50'



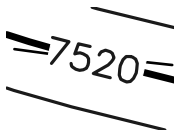
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DRAINAGE AND ACCESS ESMT.



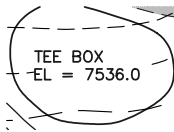
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4:1 SLOPE (TYP.)



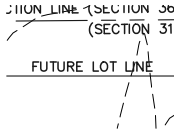
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7520



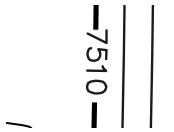
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TEE BOX EL = 7536.0



**Subject:**  
**Page Label:** 201  
**Author:** AutoCAD SHX Text

FUTURE LOT LINE



**Subject:**  
**Page Label:** 201  
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7510

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

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

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



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

7542



Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

7530

DATE

Subject:  
Page Label: 201  
Author: AutoCAD SHX Text

DATE