

**PHASE II DRAINAGE REPORT
FOR
HILLCAMP**

Prepared for:

BC-RG Mesa Tops JV, LLC
6465 Greenwood Plaza Blvd, Suite 700
Centennial, CO, 80111
Contact: Brad Wilkin
(303) 393-5899

Prepared by:

JR ENGINEERING
7200 S Alton Way, Suite C400
Centennial, Colorado 80112
(303) 740-9393
Contact: Kevin Rohrbough, P.E.

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CERTIFICATION

“I hereby certify that this report for the Drainage Design of the Hillcamp Subdivision was prepared under my direct supervision in accordance with the provisions from the Douglas County Storm Drainage Criteria Design and Technical Criteria for the owners thereof. I understand that Douglas County does not and will not assume liability for drainage facilities designed by others.”

Kevin Rohrbough, P.E.
Colorado Registered Professional Engineer No. 48992
For and On Behalf of JR Engineering

BC-RG Mesa Tops JV, LLC hereby certifies that the storm water drainage facilities for Hillcamp shall be constructed according to the design presented in this report. I understand that the City of Lone Tree does not and will not assume liability for the drainage facilities designed and/or certified by engineer. I understand that the City of Lone Tree reviews drainage plans pursuant to Colorado Revised Statutes Title 30, Article 28; but cannot guarantee that final drainage design review will absolve BC-RG Mesa Tops JV, LLC and/or their successors and/or their assigns of future liability for improper design. I further understand that the approval does not imply approval of my engineer's drainage design.

BC-RG Mesa Tops JV, LLC

Authorized Signature

1 INTRODUCTION

The purpose of this Phase II Drainage Report is to investigate the existing and proposed conditions drainage patterns, and to develop drainage improvements for the proposed Hillcamp Subdivision. The proposed drainage improvements are intended to maintain existing drainage patterns and minimize drainage impacts from the proposed development.

1.1 Site Location and Project Description

The Hillcamp Subdivision is located within 2 separate Planned Development Districts (PDD). Southridge Preserve Development will consist of approximately 165 acres and includes 82 single-family residential lots, amenity center and open space. The RidgeGate Planned Development District portion of the site will consist of approximately 221 acres, 261 single family residential lots, amenity center, and open space.

The Site is located in Sections 21, 22, and 28, Township 6 South, Range 67 West of the 6th Principal Meridian, City of Lone Tree, Douglas County, Colorado. The site is located west of Interstate Highway 25 (I-25), south of existing open space and residential lots, east of residential lots in unincorporated Douglas County, and north of the Surrey Ridge residential development. The site is shown on the Vicinity Map, see Figure 1 below. The property is currently vacant and undeveloped, it is also worth noting that this project location is the top of a mesa and the very upstream area of four (4) Major Drainageways.

This project is located in four (4) Major Drainage Basins and proposed drainage infrastructure is intended to maintain and conform with the historical drainage patterns. Only 3 of the 4 Major Drainage Basins will be effected by the Hillcamp Development.

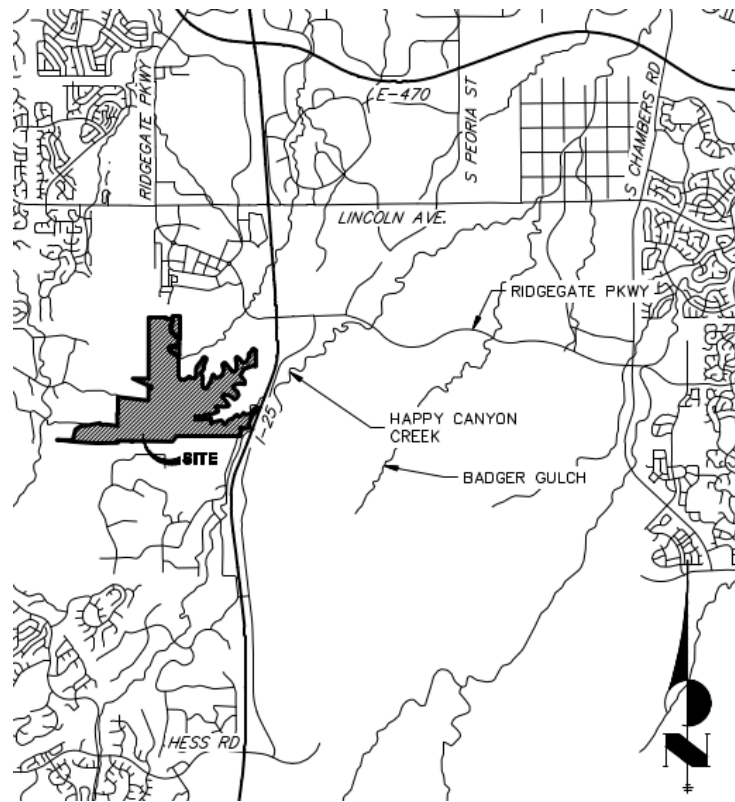


Figure 1: Vicinity Map

1.2 Geotechnical Description

The soils in the proposed development as classified by the Natural Resource Conservation Service (NRCS) include Hydrologic Groups C and D. Hydrologic Group C soils are described as “soils that have low infiltration rates when thoroughly wet and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.” Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clayey soils with high swelling capacity or potential, (2) soils with a high permanent water table, (3) soils with claypan or clay layer at or near the surface, and (4) shallow soils over nearly impervious materials. Hydrologic Group D soils are described “Soils have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. These soils have a very slow rate of water transmission.” Excerpts from the NRCS soils report are provided in **Appendix A**.

1.3 Related Drainage Studies

The site is located in the Big Dry Creek Watershed which is tributary to the South Platte River, the Happy Canyon Creek Watershed which is tributary to the Cherry Creek Reservoir, the Willow Creek Watershed which is Tributary to Little Dry Creek, and the Cottonwood Creek Watershed which is tributary to the Cherry Creek Reservoir. The Willow Creek Watershed will be unaffected by the Hillcamp Development. The site is located in Flood Zone X, areas determined outside the 500-year floodplain, as shown on Flood Insurance Rate Map Community Panels Nos. 08035C0044G, September 4, 2020 provided in **Appendix A**.

Due to the novel location of this proposed project the project area is part of four separate major drainage basins, but only upstream of three separate Major Drainageway Plans (MDPs). These MDPs are listed below:

Big Dry Creek MDPs;

- BIG DRY CREEK (ARAPCO) and Tributaries, Major Drainageway Planning, Phase A, Evaluation of Alternatives Report – WRC Engineering (July 1996)

Cottonwood Creek MDPs;

- Master Drainage Plan For Ridgeway – Cottonwood Creek Drainage Basin – Merrick And Company (January 2012)
- Phase III Drainage Report For Hillcamp Drive - JR Engineering, In review at time of this report.
- Ridgeway – Section 22, Filing No.1 Phase 3 Drainage Report ; Calibre Engineering, January 2017

Happy Canyon Creek MDPs;

- Happy Canyon Creek Major Drainageway Plan – Muller Engineering (March 2014)

No adverse downstream impacts will be produced by the proposed Hillcamp development, as developed runoff will be released at below or below 90% of the historic release rates. References from these studies are included in **Appendix D**.

Hillcamp Drive is the main access point for the proposed development and is to be extended as a part of the Metropolitan District improvements for the project. A separate drainage study, associated construction documents, and final plat have been prepared for Hillcamp Trail. Along the north side of Hillcamp Trail is a small single-family development, Retreat at Ridgeway. This development is downstream from the project

and excerpts from both the Phase III Drainage Report For Hillcamp Trail and Ridgeway – Section 22, Filing No.1 Phase 3 Drainage Report are also included in **Appendix D**.

2 HISTORIC DRAINAGE SYSTEM

2.1 Major Drainage Basins Descriptions

The Hillcamp Development conveys stormwater flows offsite to three (3) separate Major Drainage Basins.

2.1.1 Big Dry Creek

The first of the three (3) Major Drainage Basins receiving flows from the Hillcamp Development is the Big Dry Creek watershed. The western portion of the site that drains west is located within the southeast limits of the **Phase A MDP by WRC from 1996**.

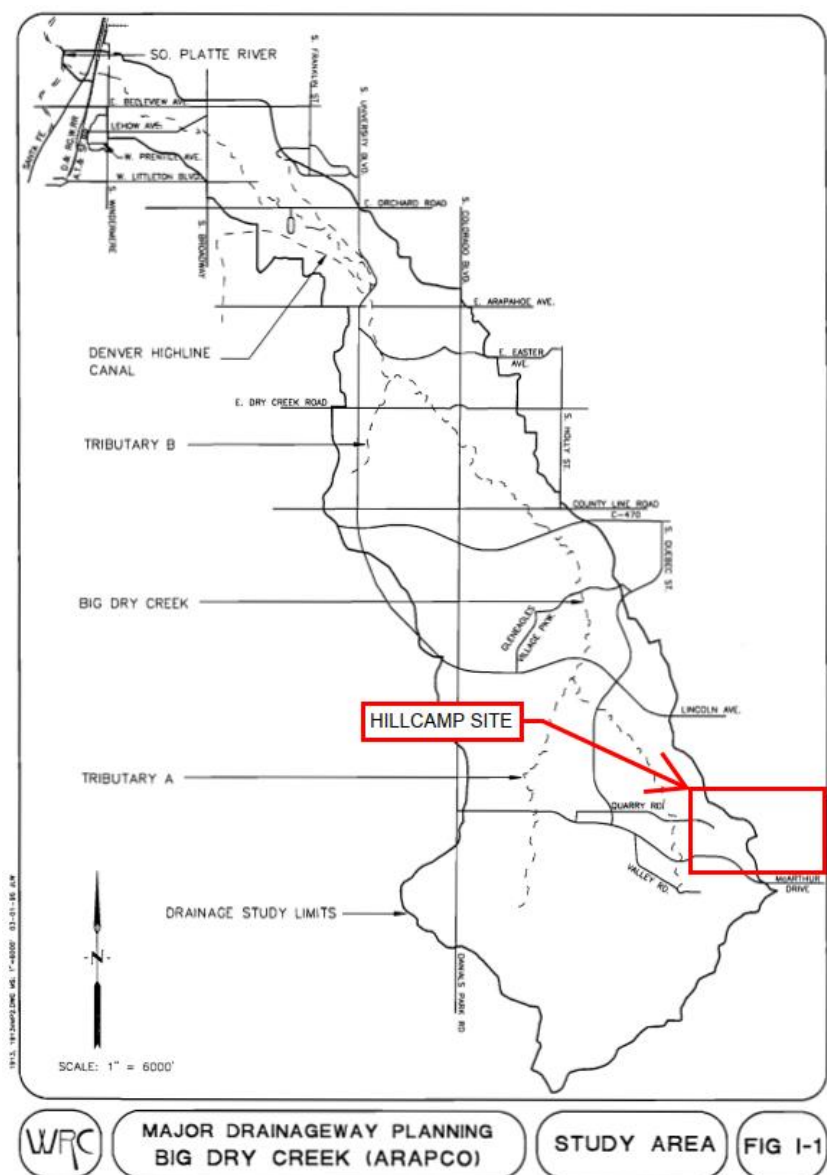


Figure 2: WRC Big Dry Creek MDP Excerpt

The project is located upstream of unnamed tributary which converges with the Big Dry Creek Tributary A. According to the **1996 MDP For Big Dry Creek & Tributaries by WRC Engineering**, flows from this region of the project, historically drain west and north away from the site. These flows historically enter the McArthur Ranch rural residential development located west of the project. From McArthur Ranch, flows are directed through tributary drainageways and continue northwest through a series of tributaries and culverts until they ultimately converge with Big Dry Creek downstream of Big Dry Creek Lettered cross section AN. These downstream drainageways will be unaffected by the development of Hillcamp, as developed flows are to be released at or below 90% of predeveloped flows.

2.1.2 Cottonwood Creek

The next of the three (3) Major Drainage Basins receiving flows from the Hillcamp Development is the Cottonwood Creek watershed.

Cottonwood Creek begins just north of the existing northern property line of the site, and is directly downstream of the proposed development. According to the **2012 MDP for Ridgeway - Cottonwood Creek Drainage Basin – Merrick and Company**, flows are to be conveyed down the existing slopes until they channelize in the steep existing slopes drainageways. Once channelized the flows converge to one drainageway and ultimately in to Cottonwood Creek, these flows are then to be conveyed along this path until they reach Ridgeway Parkway where an existing 48” RCP culvert conveys flows under Ridgeway Parkway until eventually reaching the existing CDOT MS4 Pond located at the intersection of Lincoln Ave and Interstate 25. The **Ridgeway – Section 22, Filing No. 1 Phase III Drainage Report – Calibre 2017** followed this MDP and a small subdivision (Ridgeway – Section 22, Filing No. 1, known as Retreat at Ridgeway) was located inside the Cottonwood Creek Drainage Basin. When this project was developed, the drainage patterns of the area were altered slightly to allow for development, and the existing 48” RCP Culvert at Ridgeway Parkway had a restrictor plate added to it to help attenuate the developed flows from Ridgeway – Section 22, Filing No. 1. This existing culvert lies within the newly improved Cottonwood Creek drainage channel as part of the Ridgeway – Section 22, Filing No. 1 improvements along with several other new culverts being used to attenuate flows throughout the development. These downstream drainageways will be unaffected by the development of Hillcamp. Developed flows are to be released at or below 90% of predeveloped flows.

2.1.3 Happy Canyon Creek

The final of the three (3) Major Drainage Basins receiving flows from the Hillcamp Development is the Happy Canyon Creek watershed. The **2014 Happy Canyon Creek MDP by Muller Engineering** states that all runoff within the Ridgeway development will be captured and attenuated in EURV only ponds. Happy Canyon Creek runs south to north along the west side of Interstate 25 (I-25), until flows are conveyed under I-25 to the east side of Havana Street. The Oak Hills Tributary as well as the Surrey Tributary both eventually converge with the mainstem of Happy Canyon Creek. The Surrey Tributary will be the main route for flows that are leaving the Hillcamp development.

Flows leaving the Site will be captured and attenuated within full spectrum ponds as specified by the Ridgeway PDD for this area. These ponds will be providing a more conservative treatment approach than the EURV ponds, due to the PDD stipulating detention on site.

Prior to being released into upstream Happy Canyon Creek or Badger Gulch tributaries, the stormwater runoff will receive water quality in the proposed offline detention ponds, which will mitigate adverse impacts to stormwater quality. Detention will be provided again downstream in Happy Canyon Creek and

Badger Gulch per the “**Master Drainage Plan for Ridgeway – Happy Canyon Creek and Badger Gulch Drainage Basins**”, by Merrick & Company, revised May 2017.

2.2 Sub-Basin Description

2.2.1 Big Dry Creek

According to the **1996 MDP For Big Dry Creek & Tributaries by WRC Engineering**, there are 7 existing Sub-Basins that the project will impact. The affected Sub-Basins are identified as 8-14. These existing Sub-Basins in this area are a result of natural drainage patterns, as well as the development of the McArthur Ranch rural residential development. The existing drainage patterns in this area, and like most mountainous watersheds, come from the high point located at the top of the drainage basin and then run down the existing hillside ultimately turns into channelized flow. These flows are then conveyed along one of the numerous unnamed drainageways that run along the existing local roads until ultimately converging downstream with Big Dry Creek further northwest.

2.2.2 Cottonwood Creek

According to the **2012 MDP For Ridgeway - Cottonwood Creek Drainage Basin by Merrick and Co**, there are six (6) existing Sub-Basins that the project will impact. These Basins are named according to the **2012 MDP For Ridgeway - Cottonwood Creek Drainage Basin by Merrick and Co**; C15-A through C-15-G. These existing Sub-Basins are located directly down the hillside from the project. To prevent affecting the existing drainage patterns of these existing Sub-Basins, developed runoff will be directed to full spectrum ponds or treated via other water quality measures located along the top of the mesa. Flows released from these ponds will be designed to outfall at or below 90% of predeveloped flow rates.

In addition to the **2012 MDP by Merrick and Co** there is also the **Ridgeway – Section 22 Filing 1 Phase III Drainage Report by Calibre – 2017**. This Drainage Report outlines improvements made by the construction of the Retreat at Ridgeway Subdivision, this report shows several offsite Sub-Basins and several on site Sub-Basins that this development is capturing with swales, and then conveying to a central drainage channel within the development itself. This central channel (Sub-basin CH, **Calibre 2017**) is attenuated to historic release rates of an existing 48” RCP culvert located below Bluffside Drive; this culvert is referenced in the **Calibre** drainage report as the Ex-Cottonwood Creek Flow Control Structure. To help attenuate developed flows created by the Retreat at Ridgeway development’s added imperviousness, a restrictor plate was installed on the Ex-Cottonwood Creek Flow Control Structure to restrict major flows to **325.17 CFS** based upon the studies performed on downstream pond 311’s allowable capacity. These Sub-Basins, like the 2012 MDP Sub-Basins are intended to be left completely unaltered by the improvements associated with the Hillcamp Development. To prevent affecting the existing drainage patterns of these existing Sub-Basins, developed runoff will be directed to full spectrum ponds located along the top of the mesa. Any flows released from these proposed ponds will be designed to outfall at or below 90% of predeveloped flow rates.

2.2.3 Happy Canyon Creek

According to the **2014 Happy Canyon Creek MDP by Muller Engineering** the proposed Hillcamp project site is located within several existing MDP Sub-Basins. These Sub-Basins are; A234, A235, A220, and A230. These Sub-Basins are located within and around the Surrey tributary that converges with Happy Canyon Creek on the east side of I-25. These Sub-Basins are directly upstream of lettered cross section AO for Happy Canyon Creek. This Surrey tributary crosses I-25 at Muller MDP DP HC117, which is shown as a triple 8'x 6' RCBC. The development will release developed flows from the ponds at or below 90% historic flow rates reaching design point HC117. It is assumed there will be no increase in the WSEL at Happy Canyon Creek and a CLOMR will not be needed for this project. The assumed future development flows hitting DP HC117 is calculated to be **231 CFS** in the 100-year event according to the **2014 Happy Canyon Creek MDP by Muller Engineering**.

Due to the final grading required for the site there will be minimal basin transfer between the Major Drainageways. The project will be designed to ensure that flow rates at each of the three (3) Major Drainageways will not exceed 90% of the historic flow rates. See **Appendix D** for preliminary conceptual pond sizing and release rates. Note that these ponds are still conceptual and are subject to refinement during final design.

3 DRAINAGE DESIGN CRITERIA

This Drainage Report was prepared in accordance with the “Storm Drainage Design and Technical Criteria” by Douglas County, the “Urban Storm Drainage Criteria Manual” (USDCM) by Mile High Flood District (MHFD), and the three Major Drainageway MDP’s that have been referenced throughout.

3.1 Hydrology

The one-hour rainfall depth data was obtained from Chapter 6 of the “Storm Drainage Design and Technical Criteria” by Douglas County, which states a one-hour precipitation value for 5- and 100-year events in Zone 1 to be 1.43 inches and 2.60 inches respectively.

At this time the Rational Method was used to determine runoff values for the proposed site. These flows will be used to size storm drains. The minor storm was analyzed as the 5-year event and the major storm was analyzed as the 100-year event. CUHP-SWMM will be utilized in the subsequent Phase III Drainage Report for all hydrology values and pond sequencing. Results provided in **Appendix B**.

3.2 Hydraulics

All inlets, swales, culverts, and pipes will be designed for the 10-year storm. The latest version of Mile High Flood District’s workbook “MHFD-Inlet (Version 5.02, August 2022)” will be used to size the inlets. The inflows at the inlets are based on the Rational Method 5-year-minor/100-year-major storm results and can be referenced from the Routing Table in **Appendix B**. The inflows at the inlets are to be based on CUHP SWMM 5-year-minor/100-year-major storm results and will be referenced from the Routing Table in **Appendix B** in the subsequent PH III Drainage Report. Street capacity is to be based on allowable spread and the maximum depth of flow at the curb. Most of the roads within the site have roadside ditches to convey flows, these are to be sized using Bentley’s Flowmaster software and results can be found in **Appendix C**. Bentley’s StormCAD software will be utilized to calculate the hydraulic grade lines in the limited storm sewer pipes.

The outlet structures for the numerous proposed Detention Ponds are designed using the methods established by MHFD and MHFD-Detention spreadsheet (v4.07, June 2025).

4 PROPOSED DRAINAGE FACILITY DESIGN

4.1 General Concept

There will be a minimum of one (1) Full spectrum Pond located within each of the Major Drainage Basins, with high likeliness of several ponds in sequence per Major Drainage basin. They will discharge the developed flows offsite to match existing drainage patterns. Due to physical constraints such as steep slopes, dense scrub oak, and existing residential developments it has been determined that multiple ponds are needed to treat and convey stormwater downstream. To combat this, JR Engineering is proposing a series of ponds with the intent of providing over detention where necessary to reach 90% or less of predeveloped flows within the ultimate outfall of each Major Drainage Basin. There will be no negative impacts downstream of the proposed Hillcamp development.

Note that all pond locations, sizes, and calculations are conceptual in nature, and will be subject to refinement during the final design of the development.

The site will utilize Low Impact Development (LID) concepts. Roadside ditches are being utilized to convey storm flows, there is minimal Directly Connected Impervious Area (DCIA), and the site will be constructed near existing grade with minimal cut and fills.

In addition to the proposed Full spectrum Ponds and previously mentioned LID concepts, there will be locations utilizing water quality swales upstream of ponds. This is in order to reduce overall required Pond sizes where the existing terrain is constraining.

This report uses the three aforementioned Master Drainage Plans as the general basis for determining the drainage design, with modifications to reflect the existing conditions hydrology in these Sub-Basins. Supplemental hydrologic and hydraulic calculations will be prepared for this design and are to be included with the subsequent Phase III Drainage Report.

4.2 Proposed Basin Descriptions

Big Dry Creek (DC) Basins:

Basins DC-P1 - DC-P5 are located on the west side of the site within the Big Dry Creek watershed, these basins will consist of single-family lots (both rural and low density), asphalt roads, ribbon curb, roadside ditches, amenity center, ponds, landscaping, and natural vegetation. These lots will all generally carry flows to the west towards the existing McArthur Ranch rural development downstream of the Site.

Flows from Sub-Basin DC-P1 are conveyed to the northwest via roadside ditches and will reach a proposed Detention Pond (Pond A), to provide water quality and overdetention prior to outfalling into Cottonwood Creek.

Flows from Sub-Basin DC-P2 are conveyed to the northwest via roadside ditches and will reach a proposed Detention Pond (Pond J), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basins DC-P3 are conveyed to the northwest via roadside ditches and will reach a proposed Detention Pond (Pond F1), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basins DC-P4 are conveyed to the northwest via roadside ditches and will reach a proposed Detention Pond (Pond F2), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basin DC-P5 are conveyed to the west via roadside ditches and will reach a proposed Detention Pond (Pond I), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Cottonwood Creek (CW) Basins:

Basins CW-P1 – CW-P4 are located on the northwest side of the Site within the Cottonwood Creek watershed and these basins will consist of single-family lots, asphalt roads, ribbon curb, roadside ditches, ponds, landscaping, and natural vegetation. These lots will all generally carry flows to the northeast towards the existing Retreat at Ridgeway development downstream of the Site.

Flows from Sub-Basin CW-P1 are conveyed to a low point in Gambel Edge Drive via roadside ditches and will reach a proposed Detention Pond (Pond A), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basin CW-P2 are conveyed to the north via roadside ditches and will reach a proposed Detention Pond (Pond B), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basin CW-P3 are conveyed to the north via roadside ditches and will ultimately enter the proposed Hillcamp Trail System, here flows will be treated for water quality separate from the Hillcamp Development. These flows leaving the Hillcamp Site were accounted for in the historical drainage studies for Hillcamp Trail. See the subsequent Hillcamp Trail Report for more information.

Flows from Sub-Basin CW-P4 are conveyed to the east via roadside ditches and will reach a proposed Detention Pond (Pond G), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Happy Canyon Creek (HC) Basins:

Basins HC-P1 – HC-P8 are located on the southeast side of the Site within the Happy Canyon Creek watershed surrounding the Surrey tributary. These basins will consist of single-family lots (low density), asphalt roads, ribbon curb, roadside ditches, ponds, landscaping, and natural vegetation. These lots will all generally carry flows towards the existing Surrey tributary downstream of the Site. At the downstream location of the Site are 5 proposed Full Spectrum Ponds. The ponds are to attenuate developed flows and release them at or below 90% of predeveloped release rates to downstream regional flood control infrastructure within the Happy Canyon Creek/Badger Gulch Major Drainage way.

Flows from Sub-Basin HC-P1 are conveyed to the east via roadside ditches and will reach a proposed Full Spectrum Pond (Pond G), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basin HC-P2 are conveyed to the east via roadside ditches and will reach a proposed Full Spectrum Pond (Pond H), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basin HC-P3, HC-P4, HC-P6, and E-OS4 are conveyed to the east via roadside ditches and will reach a proposed Full Spectrum Pond (Pond E), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basin HC-P5 are conveyed to the east via roadside ditches and will reach a proposed Full Spectrum Pond (Pond D), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

Flows from Sub-Basin HC-P7 and HC-P8 are conveyed to the south via roadside ditches and will reach a proposed Full Spectrum Pond (Pond K), to attenuate developed flows and release them at or below 90% of predeveloped release rates.

UD Basins:

All Sub-Basins with the UD designation are located on the downstream side of the site. These UD Sub-Basins will be unaltered by the development and no detention or WQ is being provided for these Sub-Basin's flows. These basins are being analyzed in order to further analyze changes in downstream infrastructure tributary flows.

Sub-basin E-UD1 is located on the very northern edge of the site, along the northern property line. Flows from the Site, are unable to gravity flow towards the provided ponds within the development.

This area is to be excluded from the WQCV requirements according to CDPS General Permit COR090000 under the Excluded Sites section which states;

“Excluded Sites: Permittees may exclude the following from the requirements of an applicable development site.

G) Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped: Permittees may exclude sites with land disturbance to undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the site.”

Sub-basin E-UD2 is located on the very eastern edge of the site, along the eastern property line. Flows from the proposed Site are unable to gravity flow towards the provided ponds within the development.

This area is to be excluded from the WQCV requirements according to CDPS General Permit COR090000 under the Excluded Sites section which states;

“Excluded Sites: Permittees may exclude the following from the requirements of an applicable development site.

G) Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped: Permittees may exclude sites with land disturbance to undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the site.”

Sub-basin E-UD3 is located on the south eastern edge of the site, along the south eastern property line. Flows from the Site are unable to gravity flow towards the provided ponds within the development.

This area is to be excluded from the WQCV requirements according to CDPS General Permit COR090000 under the Excluded Sites section which states;

“Excluded Sites: Permittees may exclude the following from the requirements of an applicable development site.

G) Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped: Permittees may exclude sites with land disturbance to undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the site.”

OS Basins:

Sub-basin E-OS1 is located on the very southern edge of the site, along the southern property line. Flows from the adjacent property are flowing north across the property line onto the Site. Stormwater will be conveyed through its existing drainage way, and then sent through a proposed RCBC beneath the proposed Rambler’s Ridge Place Bridge, ultimately outfalling back into its historic drainageway untreated.

Sub-basin E-OS2 is located on the very southwestern edge of the Site, along the southwestern property line. Flows from the adjacent property are flowing north across the property line onto the Site. Stormwater will ultimately outfall back into its historic drainageway untreated.

Sub-basin E-OS3 is located on the very northeastern edge of the site, along the eastside of the northeastern property line. Flows from the adjacent property are flowing north across the property line away from the Site. These flows will be left unaltered, and will have no impact on the runoff from the site.

Sub-basin E-OS4 is located on the very southern edge of the site, along the southern property line. Flows from the adjacent property are flowing north across the property line onto the Site. These flows will be captured and routed to an onsite Pond and detained within the stormwater facilities and released below historic release rates.

4.3 Detention Pond(s)

There are eleven (11) proposed ponds oriented across the proposed development. See the Pond Summary table as well as conceptual UD-Detention printouts in **Appendix D**.

The Ponds will be designed and constructed to blend with the surrounding environment as natural features where feasible.

Flows outfalling from ponds will be released via storm sewer into low tailwater rip rap basins at the bottom of the slopes that the ponds sit on top of. This is being proposed in addition to drop manholes, to reduce erosion and scour caused by the velocities of the flows being released.

DC Ponds:

There are four (4) full spectrum ponds being proposed to attenuate flows leaving the site in the Big Dry Creek Major Drainage Basin. These are ponds; F1, F2, I and J. Overdetention due to basin transfer is to be provided.

CW Ponds:

There are two (2) full spectrum ponds being proposed to attenuate flows leaving the site in the Cottonwood Creek Major Drainage Basin. These are ponds; A, and B. Overdetention due to basin transfer is to be provided.

HC Ponds:

There are five (5) full spectrum Ponds being proposed to provide water quality for flows leaving the site in the Happy Canyon Creek Major Drainage Basin. These are ponds; D, E, G, H, and K.

See UD-Detention Outputs in **Appendix D** along with Proposed Pond Summary table in **Appendix D** for complete Pond design Summary info.

5 CONCLUSIONS

5.1 Impact of Improvements

This proposed Hillcamp residential development follows the assumed/existing drainage patterns shown in the **1996 MDP For Big Dry Creek & Tributaries by WRC Engineering**, the **2012 MDP for Ridgeway - Cottonwood Creek Drainage Basin by Merrick and Company**, and the **2014 Happy Canyon Creek MDP by Muller Engineering**. The proposed ponds' outlet structure for each major drainage basin will be sized to release 90% or below the historic release for each major drainage basins' downstream existing design points. The proposed ponds in the Happy Canyon major drainage basin are also designed for over-detention that includes the flows from the OS basins even though they cannot reach the pond. Therefore, this proposed Hillcamp residential development will have no adverse impact on quantity, quality, or timing of stormwater discharges to its downstream tributary historic drainage systems.

5.2 Compliance with Applicable Criteria

This hydrologic analysis indicates that the proposed improvements will comply with the applicable drainage criteria for the "Storm Drainage Design and Technical Criteria" by Douglas County, Mile High Flood District "Urban Storm Drainage Criteria Manual", and will be consistent with the three (3) Major Drainageway MDP's that have been referenced throughout the report.

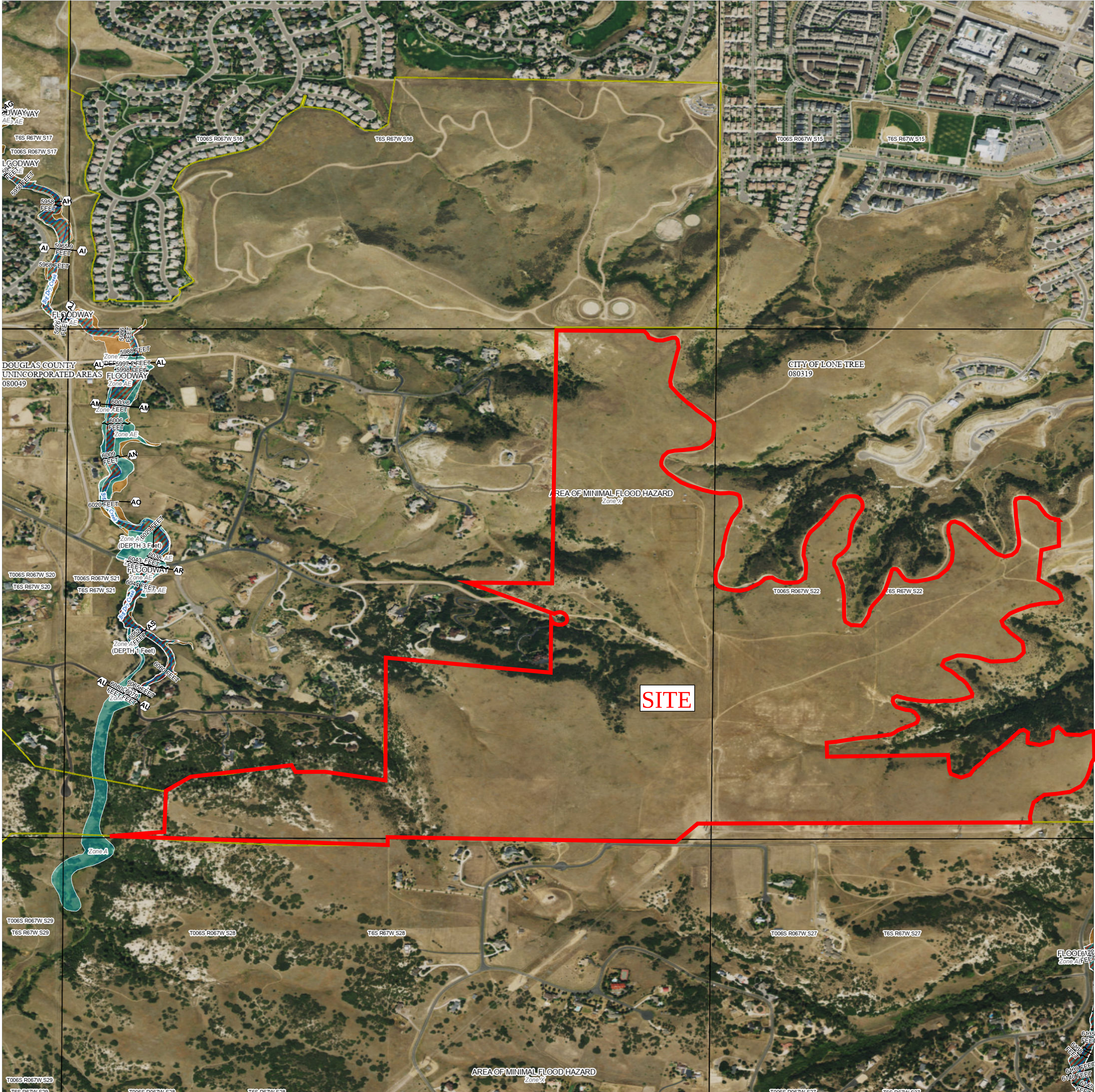
6 REFERENCES

1. Big Dry Creek (ARAPCO) AND TRIUBTARIES, MAJOR DRAINAGE PLANNING, PHASE A, EVALUATION OF ALTERNATIVES REPORT; WRC ENGINEERING, July 1996.
2. MASTER DRAINAGE PLAN FOR RIDGEGATE – COTTONWOOD CREEK DRAINAGE BASIN; Merrick and Company, January 2012.
3. HAPPY CANYON CREEK MAJOR DRAINAGEWAY PLAN; Muller Engineering, March 2014
4. PHASE III DRAINAGE REPORT FOR HILLCAMP TRAIL; JR Engineering, In review at time of this report.
5. Ridgeway – Section 22, Filing No.1 Phase 3 Drainage Report–; Calibre Engineering, January 2017.
6. Storm Drainage Design and Technical Criteria; Douglas County, Updated June 2022.
7. Urban Storm Drainage Criteria Manual Volumes I, II and III; Mile High Flood District, Updated January 2016.
8. CDPS General Permit COR090000, Stormwater Discharges Associated With Municipal Separate Storm Sewers (MS4s), Authorization to Discharge Under the Colorado Discharge Permit System; Colorado Department of Public Health and Environment, Effective May 2018.

APPENDIX A

FIGURES

FIGURE 10



FLOOD HAZARD INFORMATION

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE)
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee See Notes Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance
		Water Surface Elevation
		Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-6627) or visit the FEMA Flood Map Service Center website at <https://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to 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.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on 5/20/2024 4:23 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at <https://www.fema.gov/media-library/assets/documents/118418>

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD83

For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at <https://msc.fema.gov>

1 inch = 500 feet

1:6,000

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

0 50 100 200 300 400 Meters

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

PANEL 44 OF 461

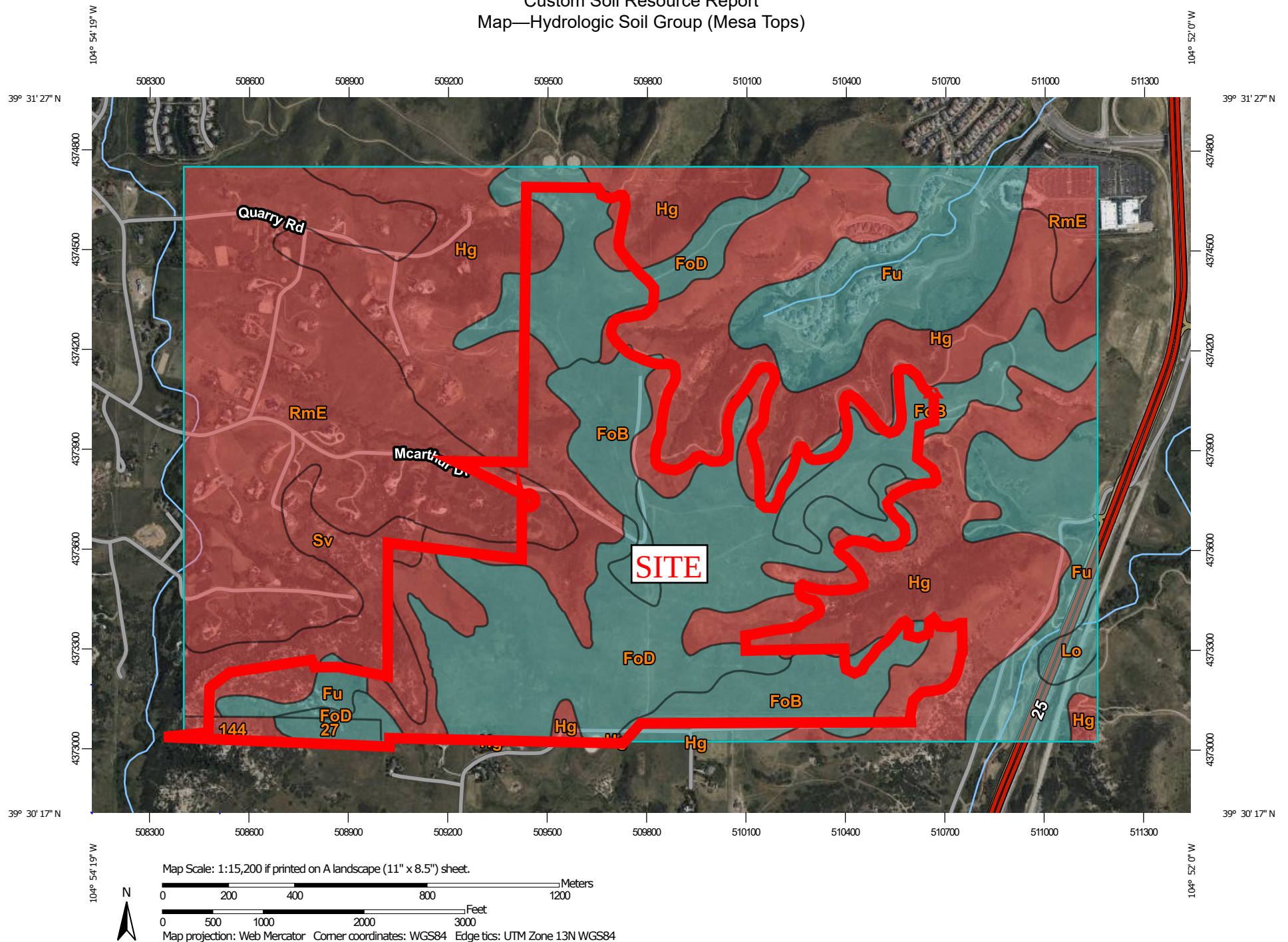
Panel Contains:
CITY OF LONE TREE
COMMUNITY
DOUGLAS COUNTY

NUMBER
080319
080049

PANEL
0004
0044

MAP NUMBER
08035C0044G
EFFECTIVE DATE
September 04, 2024

FIGURE 11
Custom Soil Resource Report
Map—Hydrologic Soil Group (Mesa Tops)



Custom Soil Resource Report

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 scales ranging from 1:20,000 to 1:24,000.

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Castle Rock Area, Colorado

Survey Area Data: Version 16, Aug 24, 2023

Soil Survey Area: Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties

Survey Area Data: Version 18, Aug 24, 2023

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

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

Table—Hydrologic Soil Group (Mesa Tops)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FoB	Fondis clay loam, 1 to 3 percent slopes	C	108.7	9.2%
FoD	Fondis clay loam, 3 to 9 percent slopes	C	200.1	16.9%
Fu	Fondis-Kutch association	C	137.3	11.6%
Hg	Hilly gravelly land	D	429.8	36.4%
Lo	Loamy alluvial land	C	6.2	0.5%
RmE	Renohill-Buick complex, 5 to 25 percent slopes	D	239.0	20.2%
Sv	Stony steep land	D	50.3	4.3%
Subtotals for Soil Survey Area			1,171.5	99.1%
Totals for Area of Interest			1,182.2	100.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
27	Denver clay loam, 5 to 9 percent slopes	C	5.2	0.4%
144	Rooney-Rock outcrop complex, 50 to 70 percent slopes	D	5.4	0.5%
Subtotals for Soil Survey Area			10.6	0.9%
Totals for Area of Interest			1,182.2	100.0%

Rating Options—Hydrologic Soil Group (Mesa Tops)*Aggregation Method: Dominant Condition**Component Percent Cutoff: None Specified**Tie-break Rule: Higher*

APPENDIX B
HYDROLOGIC CALCULATIONS

Subdivision:

Hillcamp Existing

Project No.: 15950.12

Location:

Lone Tree

Date:

12/12/25

EXISTING SUB-BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
DC-E1	17.36	5.0%	0.08	0.50	19.2	3.9	45.8
DC-E2	19.50	5.0%	0.08	0.50	19.3	4.3	51.2
DC-E3	59.92	5.5%	0.08	0.51	29.7	11.0	124.3
DC-E4	4.77	5.0%	0.08	0.50	17.6	1.1	13.2
DC-E5	35.57	5.0%	0.08	0.50	37.0	5.5	64.4
DC-E6	17.18	5.0%	0.08	0.50	31.3	2.9	34.5
DC-E7	5.51	5.0%	0.08	0.50	17.7	1.3	15.1
DC-E8	7.98	5.0%	0.08	0.50	27.4	1.5	17.3
DC-E9	17.27	5.0%	0.08	0.50	31.2	2.9	34.7
BIG DRY CREEK TRIBUTARY	185.06	5.1%	---	---	---	34.40	400.40
W-E1	9.49	5.0%	0.08	0.50	27.0	1.8	20.8
WILLOW CREEK TRIBUTARY	9.49	8.6%	---	---	---	1.76	20.76
CW-E1	22.00	5.0%	0.08	0.50	23.1	4.4	52.6
CW-E2	37.79	5.0%	0.08	0.50	28.6	6.8	80.0
CW-E3	40.22	5.0%	0.08	0.50	33.2	6.6	77.8
CW-E4	9.84	5.1%	0.08	0.50	18.2	2.3	26.6
CW-E5	5.56	8.6%	0.10	0.52	14.6	2.0	17.3
COTTONWOOD CREEK TRIBUTARY	115.41	6.6%	---	---	---	22.04	254.28
HC-E1	12.39	8.6%	0.10	0.52	18.8	3.9	34.0
HC-E2	9.33	6.8%	0.09	0.51	26.9	2.0	20.8
HC-E3	13.89	6.2%	0.09	0.51	27.7	2.9	30.3
HC-E4	66.76	6.4%	0.09	0.51	38.5	11.4	119.5
HC-E5	8.00	7.8%	0.10	0.52	25.4	2.0	18.5
HC-E6	2.61	8.0%	0.10	0.52	21.9	0.7	6.6
HC-E7	2.37	6.6%	0.09	0.51	16.9	0.7	6.7
HC-E8	3.71	6.8%	0.09	0.51	23.1	0.9	9.0
HC-E9	8.70	5.0%	0.08	0.50	27.1	1.6	19.0
HC-E10	4.35	5.0%	0.08	0.50	21.4	0.9	10.8
HC-E11	10.34	5.0%	0.08	0.50	23.9	2.1	24.2
HAPPY CANYON CREEK TRIBUTARY	142.45	5.2%	---	---	---	29.06	299.36
E-OS1	20.86	5.0%	0.08	0.50	27.0	3.9	45.6
E-OS2	41.99	5.0%	0.08	0.50	41.1	6.0	71.3
E-OS3	1.70	5.0%	0.08	0.50	24.3	0.3	3.9
E-OS4	3.74	5.1%	0.08	0.51	25.0	0.8	8.6
OFFSITE TOTAL	68.29	8.7%	---	---	---	11.03	129.52
E-UD1	3.60	5.0%	0.08	0.50	19.9	0.8	9.3
E-UD2	23.37	5.0%	0.08	0.50	28.6	4.2	49.4
E-UD3	10.60	5.0%	0.08	0.50	21.4	2.2	26.4
UNDETAINED TOTAL	37.57	5.3%	---	---	---	6.41	75.74
Total	558.27	6.0%	---	---	---	104.70	1180.07

DESIGN POINT TABLE

Design Point	Q ₅ (cfs)	Q ₁₀₀ (cfs)
1	3.9	45.8
2	4.3	51.2
3	11.0	124.3
4	1.1	13.1
5	5.5	64.4
6	8.7	50.0
7	2.9	34.5
8.1	10.8	80.3
9	1.3	15.2
10	1.5	17.3
11	2.9	34.7
12	6.0	71.3
13	1.0	9.5
14	2.4	21.4
15	5.3	53.4
16	7.7	80.8
17	7.5	78.8
18	2.9	27.2
19	1.9	17.2
20	0.3	4.0
21	3.4	33.5
22	1.7	20.4
23	2.5	30.0
24	1.0	8.8
25	10.0	118.1
26.1	10.8	124.9
27	1.5	18.1
28	0.5	6.4
29	0.6	6.6
30	0.7	8.8
31	4.2	49.4
32.1	20.3	248.3
33	2.2	26.4
34	1.6	19.0
35	1.0	10.9
36	2.1	24.2

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Hillcamp Existing
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/12/25

Basin ID	Total Area (ac)	SFH-RURAL			Asphalt			Gravel-Low Traffic/Substations			Undisturbed Native Grasses			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
DC-E1	17.36	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	17.36	5.0%	5.0%
DC-E2	19.50	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	19.50	5.0%	5.0%
DC-E3	59.92	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.50	0.5%	5%	59.42	5.0%	5.5%
DC-E4	4.77	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	4.77	5.0%	5.0%
DC-E5	35.57	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	35.57	5.0%	5.0%
DC-E6	17.18	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	17.18	5.0%	5.0%
DC-E7	5.51	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	5.51	5.0%	5.0%
DC-E8	7.98	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	7.98	5.0%	5.0%
DC-E9	17.27	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	17.27	5.0%	5.0%
BIG DRY CREEK TRIBUTARY	185.06													5.15%
W-E1	9.49	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.62	3.9%	5%	8.87	4.7%	8.6%
WILLOW CREEK TRIBUTARY	9.49													8.59%
CW-E1	22.00	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.70	1.9%	5%	21.30	4.8%	6.8%
CW-E2	37.79	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.80	1.3%	5%	36.99	4.9%	6.2%
CW-E3	40.22	35%	0.00	0.0%	95%	0.00	0.0%	60%	1.00	1.5%	5%	39.22	4.9%	6.4%
CW-E4	9.84	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.50	3.0%	5%	9.34	4.7%	7.8%
CW-E5	5.56	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.30	3.2%	5%	5.26	4.7%	8.0%
COTTONWOOD CREEK TRIBUTARY	115.41													6.57%
HC-E1	12.39	35%	0.00	0.0%	95%	0.03	0.2%	60%	0.36	1.7%	5%	12.00	4.8%	6.8%
HC-E2	9.33	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	9.33	5.0%	5.0%
HC-E3	13.89	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	13.89	5.0%	5.0%
HC-E4	66.76	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	66.76	5.0%	5.0%
HC-E5	8.00	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	8.00	5.0%	5.0%
HC-E6	2.61	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	2.61	5.0%	5.0%
HC-E7	2.37	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	2.37	5.0%	5.0%
HC-E8	3.71	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	3.71	5.0%	5.0%
HC-E9	8.70	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	8.70	5.0%	5.0%
HC-E10	4.35	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.08	1.1%	5%	4.27	4.9%	6.0%
HC-E11	10.34	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	10.34	5.0%	5.0%
HAPPY CANYON CREEK TRIBUTARY	142.45													5.19%
E-OS1	20.86	35%	6.79	11.4%	95%	0.40	1.8%	60%	0.00	0.0%	5%	13.67	3.3%	16.5%
E-OS2	41.99	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	41.99	5.0%	5.0%
E-OS3	1.70	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	1.70	5.0%	5.0%
E-OS4	3.74	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.22	3.5%	5%	3.52	4.7%	8.2%
OFFSITE TOTAL	68.29													8.69%
E-UD1	3.60	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.20	3.3%	5%	3.40	4.7%	8.1%
E-UD2	23.37	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	23.37	5.0%	5.0%
E-UD3	10.60	35%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	10.60	5.0%	5.0%
UNDETAINED TOTAL	37.57													5.29%
SITE TOTAL	558.27													5.95%

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Hillcamp Existing
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/12/25

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Hydrologic Soil Group			Minor Coefficients			Major Coefficients			Basins Total Weighted C ₅	Basins Total Weighted C ₁₀₀
			Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	C _{5,A}	C _{5,B}	C _{5,C/D}	C _{100,A}	C _{100,B}	C _{100,C/D}		
DC-E1	17.36	5.0%	0.00	0.00	17.36	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E2	19.50	5.0%	0.00	0.00	19.50	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E3	59.92	5.5%	0.00	0.00	59.92	0%	0%	100%	0.02	0.04	0.08	0.15	0.45	0.51	0.08	0.51
DC-E4	4.77	5.0%	0.00	0.00	4.77	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E5	35.57	5.0%	0.00	0.00	35.57	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E6	17.18	5.0%	0.00	0.00	17.18	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E7	5.51	5.0%	0.00	0.00	5.51	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E8	7.98	5.0%	0.00	0.00	7.98	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E9	17.27	5.0%	0.00	0.00	17.27	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
W-E1	9.49	8.6%	0.00	0.00	9.49	0%	0%	100%	0.04	0.06	0.10	0.18	0.47	0.52	0.10	0.52
CW-E1	22.00	6.8%	0.00	0.00	22.00	0%	0%	100%	0.03	0.05	0.09	0.16	0.46	0.51	0.09	0.51
CW-E2	37.79	6.2%	0.00	0.00	37.79	0%	0%	100%	0.03	0.04	0.09	0.16	0.46	0.51	0.09	0.51
CW-E3	40.22	6.4%	0.00	0.00	40.22	0%	0%	100%	0.03	0.04	0.09	0.16	0.46	0.51	0.09	0.51
CW-E4	9.84	7.8%	0.00	0.00	9.84	0%	0%	100%	0.03	0.05	0.10	0.17	0.46	0.52	0.10	0.52
CW-E5	5.56	8.0%	0.00	0.00	5.56	0%	0%	100%	0.03	0.05	0.10	0.17	0.46	0.52	0.10	0.52
HC-E1	12.39	6.8%	0.00	0.00	12.39	0%	0%	100%	0.03	0.05	0.09	0.16	0.46	0.51	0.09	0.51
HC-E2	9.33	5.0%	0.00	0.00	9.33	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E3	13.89	5.0%	0.00	0.00	13.89	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E4	66.76	5.0%	0.00	0.00	66.76	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E5	8.00	5.0%	0.00	0.00	8.00	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E6	2.61	5.0%	0.00	0.00	2.61	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E7	2.37	5.0%	0.00	0.00	2.37	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E8	3.71	5.0%	0.00	0.00	3.71	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E9	8.70	5.0%	0.00	0.00	8.70	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E10	4.35	6.0%	0.00	0.00	4.35	0%	0%	100%	0.02	0.04	0.08	0.16	0.45	0.51	0.08	0.51
HC-E11	10.34	5.0%	0.00	0.00	10.34	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
E-OS1	20.86	16.5%	0.00	0.00	20.86	0%	0%	100%	0.09	0.12	0.17	0.24	0.50	0.55	0.17	0.55
E-OS2	41.99	5.0%	0.00	0.00	41.99	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
E-OS3	1.70	5.0%	0.00	0.00	1.70	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
E-OS4	3.74	8.2%	0.00	0.00	3.74	0%	0%	100%	0.04	0.06	0.10	0.17	0.47	0.52	0.10	0.52
E-UD1	3.60	8.1%	0.00	0.00	3.60	0%	0%	100%	0.04	0.06	0.10	0.17	0.46	0.52	0.10	0.52
E-UD2	23.37	5.0%	0.00	0.00	23.37	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
E-UD3	10.60	5.0%	0.00	0.00	10.60	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Hillcamp
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/12/25

SUB-BASIN					INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA					(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Impervious (%)	C ₅	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
DC-E1	17.36	5.00%	0.08	0.50	300	7.55%	16.4	480	17.20%	7	2.9	2.8	19.2	780.0	27.1	19.19
DC-E2	19.50	5.00%	0.08	0.50	300	10.00%	15.0	600	11.00%	7	2.3	4.3	19.3	900.0	28.3	19.29
DC-E3	59.92	5.46%	0.08	0.51	300	7.00%	16.8	1720	10.00%	7	2.2	13.0	29.7	2020.0	34.4	29.73
DC-E4	4.77	5.00%	0.08	0.50	300	7.00%	16.8	164	30.00%	7	3.8	0.7	17.6	464.0	25.7	17.56
DC-E5	35.57	5.00%	0.08	0.50	300	3.67%	20.9	1800	6.77%	7	1.8	16.5	37.3	2100.0	37.0	37.04
DC-E6	17.18	5.00%	0.08	0.50	300	2.30%	24.3	1350	14.30%	7	2.6	8.5	32.8	1650.0	31.3	31.28
DC-E7	5.51	5.00%	0.08	0.50	300	8.86%	15.6	320	13.00%	7	2.5	2.1	17.7	620.0	26.7	17.70
DC-E8	7.98	5.00%	0.08	0.50	300	4.49%	19.5	1005	9.09%	7	2.1	7.9	27.4	1305.0	30.9	27.44
DC-E9	17.27	5.00%	0.08	0.50	300	4.36%	19.7	1488	9.54%	7	2.2	11.5	31.2	1788.0	33.4	31.17
W-E1	9.49	8.59%	0.10	0.52	217	0.76%	29.0	595	15.79%	7	2.8	3.6	32.5	812.0	27.0	26.99
CW-E1	22.00	6.75%	0.09	0.51	300	4.10%	19.8	390	8.10%	7	2.0	3.3	23.1	690.0	27.1	23.09
CW-E2	37.79	6.16%	0.09	0.51	300	5.00%	18.6	1145	7.56%	7	1.9	9.9	28.6	1445.0	32.0	28.56
CW-E3	40.22	6.37%	0.09	0.51	300	4.96%	18.7	1700	7.72%	7	1.9	14.6	33.2	2000.0	35.2	33.24
CW-E4	9.84	7.79%	0.10	0.52	300	7.35%	16.2	264	9.60%	7	2.2	2.0	18.2	564.0	26.1	18.24
CW-E5	5.56	7.97%	0.10	0.52	300	12.50%	13.6	139	11.44%	7	2.4	1.0	14.6	439.0	25.3	14.57

STANDARD FORM SF-2 **TIME OF CONCENTRATION**

Subdivision: Hillcamp
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/12/25

SUB-BASIN					INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA					(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Impervious (%)	C _s	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
HC-E1	12.39	6.80%	0.09	0.51	500	13.92%	17.1	263	13.65%	7	2.6	1.7	18.8	763.0	26.0	18.78
HC-E2	9.33	5.00%	0.08	0.50	500	4.11%	25.9	429	18.33%	7	3.0	2.4	28.3	929.0	26.9	26.87
HC-E3	13.89	5.00%	0.08	0.50	500	5.43%	23.7	538	10.16%	7	2.2	4.0	27.7	1038.0	28.1	27.67
HC-E4	66.76	5.00%	0.08	0.50	500	5.71%	23.3	1958	6.37%	7	1.8	18.5	41.7	2458.0	38.5	38.48
HC-E5	8.00	5.00%	0.08	0.50	500	5.91%	23.0	334	10.82%	7	2.3	2.4	25.4	834.0	26.9	25.42
HC-E6	2.61	5.00%	0.08	0.50	400	5.49%	21.1	166	23.00%	7	3.4	0.8	21.9	566.0	25.7	21.90
HC-E7	2.37	5.00%	0.08	0.50	261	6.27%	16.3	135	30.00%	7	3.8	0.6	16.9	396.0	25.6	16.88
HC-E8	3.71	5.00%	0.08	0.50	413	5.19%	21.8	300	30.00%	7	3.8	1.3	23.1	713.0	26.1	23.12
HC-E9	8.70	5.00%	0.08	0.50	500	4.89%	24.5	510	20.20%	7	3.1	2.7	27.2	1010.0	27.1	27.10
HC-E10	4.35	6.01%	0.08	0.51	300	4.41%	19.5	215	6.99%	7	1.9	1.9	21.4	515.0	26.4	21.41
HC-E11	10.34	5.00%	0.08	0.50	500	5.99%	22.9	91	4.61%	7	1.5	1.0	23.9	591.0	25.9	23.91
E-OS1	20.86	16.49%	0.17	0.55	500	3.71%	24.4	670	6.77%	7	1.8	6.1	30.5	1170.0	27.0	26.99
E-OS2	41.99	5.00%	0.08	0.50	500	9.00%	20.0	2564	7.64%	7	1.9	22.1	42.1	3064.0	41.1	41.09
E-OS3	1.70	5.00%	0.08	0.50	300	2.72%	23.0	150	7.94%	7	2.0	1.3	24.3	450.0	26.1	24.28
E-OS4	3.74	8.24%	0.10	0.52	300	2.37%	23.5	607	86.00%	7	6.5	1.6	25.0	907.0	25.7	25.01
E-UD1	3.60	8.06%	0.10	0.52	300	4.33%	19.3	67	6.69%	7	1.8	0.6	19.9	367.0	25.1	19.88
E-UD2	23.37	5.00%	0.08	0.50	300	27.89%	10.7	1375	3.33%	7	1.3	17.9	28.6	1675.0	38.1	28.62
E-UD3	10.60	5.00%	0.08	0.50	500	11.92%	18.2	589	20.30%	7	3.2	3.1	21.4	1089.0	27.4	21.36

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Hillcamp Existing
Location: Lone Tree
Design Storm: 5-Year P1 = 1.46 in/hr

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/12/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{divert} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _c (min)	
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E1
	1	DC-E1	17.36	0.08	19.2	1.3	2.9	3.9															FLows TO LOCAL UNNAMED CREEK ALONG DEER MEADOW LANE AT DP 1
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E2
	2	DC-E2	19.50	0.08	19.3	1.5	2.9	4.3															FLows TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 2
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E3
	3	DC-E3	59.92	0.08	29.7	4.8	2.3	11.0															FLows TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 3
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E4
	4	DC-E4	4.77	0.08	17.6	0.4	3.1	1.1															FLows TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 4
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E5
	5	DC-E5	35.57	0.08	37.0	2.7	2.0	5.5															FLows TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 5
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS1
	6	E-OS1	20.86	0.17	27.0	3.6	2.4	8.7															FLows TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 6
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E6
	7	DC-E6	17.18	0.08	31.3	1.3	2.2	2.9															FLows TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 7
																							SUM OF FLOWS FROM DP 6 & 7
	8.1								31.3	4.86	2.23	10.8											FLows TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 8.1
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E7
	9	DC-E7	5.51	0.08	17.7	0.4	3.1	1.3															FLows TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 9
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E8
	10	DC-E8	7.98	0.08	27.4	0.6	2.4	1.5															FLows TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 10
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E9
	11	DC-E9	17.27	0.08	31.2	1.3	2.2	2.9															FLows TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 11
																							TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS2
	12	E-OS2	41.99	0.08	41.1	3.2	1.9	6.0															FLows TOWARDS UNNAMED CREEK ALONG VALLEY ROAD AT DP 12

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE				TRAVEL TIME			REMARKS	
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		t _c (min)
	13	E-UD1	3.60	0.10	19.9	0.4	2.9	1.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-UD1 FLOWS TOWARDS LOCAL LOW AT DP 13. LEAVES UNDETAINED
	14	W-E1	9.49	0.10	27.0	1.0	2.4	2.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN W-E1 FLOWS TOWARDS WILLOW CREEK AT DP 14
	15	CW-E1	22.00	0.09	23.1	2.0	2.7	5.3															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E1 FLOWS TOWARDS COTTONWOOD CREEK AT DP 15
	16	CW-E2	37.79	0.09	28.6	3.3	2.4	7.7															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E2 FLOWS TOWARDS COTTONWOOD CREEK AT DP 16
	17	CW-E3	40.22	0.09	33.2	3.5	2.2	7.5															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E3 FLOWS TOWARDS COTTONWOOD CREEK AT DP 17
	18	CW-E4	9.84	0.10	18.2	1.0	3.0	2.9															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E4 FLOWS TOWARDS COTTONWOOD CREEK AT DP 18
	19	CW-E5	5.56	0.10	14.6	0.6	3.4	1.9															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E5 FLOWS TOWARDS COTTONWOOD CREEK AT DP 19
	20	E-OS3	1.70	0.08	24.3	0.1	2.6	0.3															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS3 FLOWS TOWARDS COTTONWOOD CREEK AT DP 20
	21	HC-E1	12.39	0.09	18.8	1.1	3.0	3.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E1 FLOWS TOWARDS SURREY TRIBUTARY AT DP 21
	22	HC-E2	9.33	0.08	26.9	0.7	2.4	1.7															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E2 FLOWS TOWARDS SURREY TRIBUTARY CREEK AT DP 22
	23	HC-E3	13.89	0.08	27.7	1.1	2.4	2.5															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E3 FLOWS TOWARDS SURREY TRIBUTARY AT DP 23
	24	E-OS4	3.74	0.10	25.0	0.4	2.5	1.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS4 FLOWS TOWARDS HC-E3 AT DP 24
	25	HC-E4	66.76	0.08	38.5	5.1	2.0	10.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E4 FLOWS TOWARDS SURREY TRIBUTARY AT DP 25
	26.1								38.5	5.46	1.97	10.8											SUM OF FLOWS FROM DP'S 24 & 25 FLOWS TOWARDS SURREY TRIBUTARY AT DP 26.1
	27	HC-E5	8.00	0.08	25.4	0.6	2.5	1.5															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E5 FLOWS TOWARDS SURREY TRIBUTARY AT DP 27
	28	HC-E6	2.61	0.08	21.9	0.2	2.7	0.5															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E6 FLOWS TOWARDS SURREY TRIBUTARY AT DP 28
	29	HC-E7	2.37	0.08	16.9	0.2	3.1	0.6															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E7 FLOWS TOWARDS SURREY TRIBUTARY AT DP 29
	30	HC-E8	3.71	0.08	23.1	0.3	2.7	0.7															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E8 FLOWS TOWARDS SURREY TRIBUTARY AT DP 30
	31	E-UD2	23.37	0.08	28.6	1.8	2.4	4.2															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-UD2 FLOWS TOWARDS DP 32.1
	32.1								38.5	10.28	1.97	20.3											SUM OF FLOWS FROM DP'S; 22, 23, 26.1, 27, 28, 29, 30, AND 31 FLOWS TOWARDS HAPPY CANYON CREEK AT DP 32.1
	33	E-UD3	10.60	0.08	21.4	0.8	2.8	2.2															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-UD3 FLOWS TOWARDS HAPPY CANYON CREEK AT DP 33
	34	HC-E9	8.70	0.08	27.1	0.7	2.4	1.6															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E9 FLOWS TOWARDS HAPPY CANYON CREEK AT DP 34
	35	HC-E10	4.35	0.08	21.4	0.4	2.8	1.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E10 FLOWS TOWARDS EXISTING RURAL RESIDENTIAL DEVELOPMENT TO SOUTH AT DP 35
	36	HC-E11	10.34	0.08	23.9	0.8	2.6	2.1															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E11 FLOWS TOWARDS EXISTING RURAL RESIDENTIAL DEVELOPMENT TO SOUTH AT DP 36

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Hillcamp Existing
Location: Lone Tree
Design Storm: 100-Year P1 = 2.6 in/hr

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/12/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE				TRAVEL TIME			REMARKS	
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	CFA (Ac)	I (in/hr)	Q (cfs)	t _c (min)	CFA (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	CFA (ac)	Slope (%)	Q _{pipe} (cfs)	CFA (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		t _r (min)
	1	DC-E1	17.36	0.50	19.2	8.8	5.2	45.8															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E1 FLOWS TO LOCAL UNNAMED CREEK ALONG DEER MEADOW LANE AT DP 1
	2	DC-E2	19.50	0.50	19.3	9.8	5.2	51.2															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E2 FLOWS TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 2
	3	DC-E3	59.92	0.51	29.7	30.3	4.1	124.3															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E3 FLOWS TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 3
	4	DC-E4	4.77	0.50	17.6	2.4	5.5	13.1															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E4 FLOWS TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 4
	5	DC-E5	35.57	0.50	37.0	17.9	3.6	64.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E5 FLOWS TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 5
	6	E-OS1	20.86	0.55	27.0	11.5	4.3	50.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS1 FLOWS TO LOCAL UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP 6
	7	DC-E6	17.18	0.50	31.3	8.7	4.0	34.5															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E6 FLOWS TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 7
	8.1								31.3	20.17	3.98	80.3											SUM OF FLOWS FROM DP 6 & 7 FLOWS TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 8.1
	9	DC-E7	5.51	0.50	17.7	2.8	5.5	15.2															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E7 FLOWS TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 9
	10	DC-E8	7.98	0.50	27.4	4.0	4.3	17.3															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E8 FLOWS TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 10
	11	DC-E9	17.27	0.50	31.2	8.7	4.0	34.7															TOTAL UNDEVELOPED RUNOFF FROM BASIN DC-E9 FLOWS TOWARDS EX RURAL RESIDENTIAL DEVELOPMENT AT DP 11
	12	E-OS2	41.99	0.50	41.1	21.2	3.4	71.3															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS2 FLOWS TOWARDS UNNAMED CREEK ALONG VALLEY ROAD AT DP 12
	13	E-UD1	3.60	0.52	19.9	1.9	5.1	9.5															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-UD1 FLOWS TOWARDS LOCAL LOW AT DP 13. LEAVES UNDETAINED
	14	W-E1	9.49	0.52	27.0	4.9	4.3	21.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN W-E1 FLOWS TOWARDS WILLOW CREEK AT DP 14
	15	CW-E1	22.00	0.51	23.1	11.3	4.7	53.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E1 FLOWS TOWARDS COTTONWOOD CREEK AT DP 15
	16	CW-E2	37.79	0.51	28.6	19.2	4.2	80.8															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E2 FLOWS TOWARDS COTTONWOOD CREEK AT DP 16
	17	CW-E3	40.22	0.51	33.2	20.5	3.8	78.8															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E3 FLOWS TOWARDS COTTONWOOD CREEK AT DP 17

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q _i (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q _i (cfs)	Q _{divert} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _c (min)	
	18	CW-E4	9.84	0.52	18.2	5.1	5.4	27.2															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E4
																							FLOWS TOWARDS COTTONWOOD CREEK AT DP 18
	19	CW-E5	5.56	0.52	14.6	2.9	6.0	17.2															TOTAL UNDEVELOPED RUNOFF FROM BASIN CW-E5
																							FLOWS TOWARDS COTTONWOOD CREEK AT DP 19
	20	E-OS3	1.70	0.50	24.3	0.9	4.6	4.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS3
																							FLOWS TOWARDS COTTONWOOD CREEK AT DP 20
	21	HC-E1	12.39	0.51	18.8	6.3	5.3	33.5															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E1
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 21
	22	HC-E2	9.33	0.50	26.9	4.7	4.4	20.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E2
																							FLOWS TOWARDS SURREY TRIBUTARY CREEK AT DP 22
	23	HC-E3	13.89	0.50	27.7	7.0	4.3	30.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E3
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 23
	24	E-OS4	3.74	0.52	25.0	1.9	4.5	8.8															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-OS4
																							FLOWS TOWARDS HC-E3 AT DP 24
	25	HC-E4	66.76	0.50	38.5	33.7	3.5	118.1															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E4
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 25
	26.1								38.5	35.59	3.51	124.9											SUM OF FLOWS FROM DP'S 24 & 25
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 26.1
	27	HC-E5	8.00	0.50	25.4	4.0	4.5	18.1															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E5
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 27
	28	HC-E6	2.61	0.50	21.9	1.3	4.9	6.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E6
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 28
	29	HC-E7	2.37	0.50	16.9	1.2	5.6	6.6															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E7
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 29
	30	HC-E8	3.71	0.50	23.1	1.9	4.7	8.8															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E8
																							FLOWS TOWARDS SURREY TRIBUTARY AT DP 30
	31	E-UD2	23.37	0.50	28.6	11.8	4.2	49.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-UD2
																							FLOWS TOWARDS DP 32.1
	32.1								35.6	67.48	3.68	248.3											SUM OF FLOWS FROM DP'S; 22, 23, 26.1, 27, 28, 29, 30, AND 31
																							FLOWS TOWARDS HAPPY CANYON CREEK AT DP 32.1
	33	E-UD3	10.60	0.50	21.4	5.3	4.9	26.4															TOTAL UNDEVELOPED RUNOFF FROM BASIN E-UD3
																							FLOWS TOWARDS HAPPY CANYON CREEK AT DP 33
	34	HC-E9	8.70	0.50	27.1	4.4	4.3	19.0															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E9
																							FLOWS TOWARDS HAPPY CANYON CREEK AT DP 34
	35	HC-E10	4.35	0.51	21.4	2.2	4.9	10.9															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E10
																							FLOWS TOWARDS EXISTING RURAL RESIDENTIAL DEVELOPMENT TO SOUTH AT DP 35
	36	HC-E11	10.34	0.50	23.9	5.2	4.7	24.2															TOTAL UNDEVELOPED RUNOFF FROM BASIN HC-E11
																							FLOWS TOWARDS EXISTING RURAL RESIDENTIAL DEVELOPMENT TO SOUTH AT DP 36

Subdivision:

Hillcamp Proposed

Project No. 15950.12

Location:

Lone Tree

Date: 12/10/25

PROPOSED SUB-BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
DC-P1	4.78	40.3%	0.37	0.65	14.4	5.9	18.7
DC-P2	7.44	35.9%	0.33	0.63	24.4	6.3	21.5
DC-P3	10.74	33.6%	0.31	0.62	24.1	8.7	30.9
DC-P4	27.71	45.2%	0.41	0.67	26.6	27.6	81.0
DC-P5	6.60	38.8%	0.35	0.64	22.9	6.2	20.2
PROPOSED BIG DRY CREEK TRIBUTARY	57.27	40.7%	---	---	---	48.8	153.6
CW-P1	6.48	42.2%	0.38	0.66	27.0	6.0	18.4
CW-P2	23.86	40.5%	0.37	0.65	28.2	20.8	65.6
CW-P3	3.59	22.9%	0.22	0.58	8.0	3.4	15.8
CW-P4	6.28	35.1%	0.32	0.63	14.6	6.8	23.6
PROPOSED COTTONWOOD CREEK TRIBUTARY	40.21	38.4%	---	---	---	31.1	105.0
HC-P1	11.72	45.8%	0.41	0.67	22.3	13.1	38.0
HC-P2	24.18	45.8%	0.41	0.67	23.2	26.3	76.7
HC-P3	12.78	48.2%	0.43	0.68	20.7	15.5	43.8
HC-P4	3.97	39.0%	0.35	0.64	8.2	6.0	19.4
HC-P5	7.86	52.1%	0.46	0.70	24.0	9.5	25.5
HC-P6	0.88	56.0%	0.49	0.71	7.9	1.9	4.8
HC-P7	6.50	44.2%	0.40	0.67	13.6	9.0	26.7
HC-P8	5.27	41.7%	0.38	0.65	13.9	6.8	21.1
PROPOSED HAPPY CANYON CREEK TRIBUTARY	73.16	46.2%	---	---	---	88.0	255.8
P-AS	2.81	65.0%	0.57	0.75	9.5	6.4	15.2
PROPOSED AMENITY CENTER	2.81	65.0%	---	---	---	6.4	15.2
DC-E1	16.72	8.1%	0.10	0.52	23.3	4.5	40.8
DC-E2	13.96	16.4%	0.17	0.55	17.0	7.4	42.7
DC-E3	34.07	12.9%	0.14	0.54	28.1	11.4	77.6
DC-E4	3.75	21.2%	0.21	0.57	5.0	3.9	18.9
DC-E5	9.47	7.2%	0.09	0.51	19.2	2.6	25.4
DC-E6	7.71	5.7%	0.08	0.51	30.7	1.4	15.7
DC-E7	4.05	10.8%	0.12	0.53	7.7	2.2	16.6
DC-E8	3.59	10.7%	0.12	0.53	21.5	1.2	9.3
DC-E8.1	4.43	7.3%	0.09	0.51	15.9	1.4	13.1
DC-E9	5.53	5.0%	0.08	0.50	28.2	1.0	11.8
DC-E9.1	9.68	10.4%	0.12	0.53	21.6	3.2	25.0
MODIFIED EXISTING BIG DRY CREEK TRIBUTARY	112.96	10.9%	---	---	---	40.1	296.8
W-E1	9.48	8.6%	0.10	0.52	26.6	2.4	21.6
MODIFIED EXISTING WILLOW CREEK TRIBUTARY	9.48	8.6%	---	---	---	2.4	21.6
CW-E1	21.46	5.9%	0.08	0.51	11.2	6.8	73.3
CW-E2	20.57	8.2%	0.10	0.52	24.0	5.5	49.3
CW-E3	34.33	14.3%	0.15	0.54	29.5	12.1	76.8
CW-E4	8.09	6.8%	0.09	0.51	17.6	2.2	22.6
CW-E5	5.56	6.5%	0.09	0.51	18.0	1.5	15.3
MODIFIED EXISTING COTTONWOOD CREEK TRIUBTARY	90.01	9.8%	---	---	---	28.2	237.4
HC-E1	12.92	6.5%	0.09	0.51	18.8	3.4	34.9
HC-E2	5.90	5.0%	0.08	0.50	15.6	1.5	17.2
HC-E3	5.91	19.0%	0.19	0.56	19.9	3.2	17.0
HC-E4	21.85	25.7%	0.25	0.59	26.7	13.2	56.2
HC-E5	3.28	18.0%	0.18	0.56	21.1	1.7	9.1
HC-E6	1.27	22.1%	0.22	0.57	5.0	1.4	6.4
HC-E7	1.80	21.5%	0.21	0.57	5.0	1.9	9.1
HC-E8	3.01	8.1%	0.10	0.52	5.0	1.5	13.7
HC-E9	6.82	28.3%	0.27	0.60	8.5	7.6	30.6
HC-E10	1.93	23.1%	0.22	0.58	13.0	1.5	7.1
MODIFIED EXISTING HAPPY CANYON CREEK TRIUBTARY	64.69	18.2%	---	---	---	36.8	201.3
E-OS1	26.90	8.1%	0.10	0.52	27.7	6.6	59.4
E-OS2	39.78	5.0%	0.08	0.50	41.1	5.7	67.6
E-OS3	1.70	5.0%	0.08	0.50	24.3	0.3	3.9
E-OS4	4.18	7.9%	0.10	0.52	35.5	0.9	8.0
MODIFIED OFFSITE TOTAL	72.56	6.3%	---	---	---	13.5	138.9
E-UD1	3.60	8.1%	0.10	0.52	20.7	1.0	9.4
E-UD2	23.35	5.0%	0.08	0.50	28.8	4.2	49.2
E-UD3	10.17	9.8%	0.12	0.52	14.7	3.9	31.8
MODIFIED UNDETAINED TOTAL	37.12	6.6%	---	---	---	9.1	90.3
SITE Total	560.27	20.6%	---	---	---	298.0	1500.7

DESIGN POINT TABLE

Design Point	Q ₅ (cfs)	Q ₁₀₀ (cfs)
P1	4.5	40.8
P2	7.4	42.7
P13	1.0	9.4
P14	2.5	21.5
A1	5.9	18.7
A2	6.0	18.4
A3.1	10.2	31.9
A	0.3	8.4
P15	6.8	73.2
P15.1	7.1	81.6
B1	20.8	65.6
B2	3.4	15.9
B3.1	22.8	74.4
B	0.6	3.8
P16	5.5	49.4
P16.1	6.1	53.2
P17	12.1	76.8
P18	2.2	22.6
P19	1.5	15.3
P20	0.3	4.0
P21	3.4	34.8
P33	3.9	31.8
P34	7.6	30.6
P35	1.5	7.1
G1	13.1	38.0
G2	6.8	23.6
G3.1	18.6	57.0
G	0.5	22.8
P23	3.2	17.0
P23.1	3.7	39.8
H1	26.3	76.7
H	0.6	23.1
P24	0.9	8.0
E2	1.9	4.8
E3.1	1.8	10.3
E4	15.5	43.8
E4.1	13.1	42.4
E5	6.0	19.4
E6.1	16.1	51.8
E	0.5	24.1
P25	13.2	56.2
P26.1	13.8	79.3
D1	9.5	25.5
D	2.2	4.9
P27	1.7	9.1
DE	2.7	29.0
P27.1	4.4	38.1
P30	1.5	13.8
P22	1.5	17.2
P28	1.3	6.4
P29	1.9	9.1
P31	4.2	49.2
P32.1	27.9	225.8
K1	6.8	21.1
K2	9.0	26.7
K3.1	15.7	47.5
K	0.3	20.0
P36.1	0.3	20.0
J1	6.3	21.5
J	0.3	15.8
P3	11.4	77.6
P3.1	11.7	93.4
P4	3.9	18.9
F1	8.7	30.9
F1.1	3.0	3.0
F2	27.6	81.0
F2.1	23.9	23.9
F3.1	26.9	26.9
P5	2.6	25.4
P5.1	29.5	52.3
P6	6.6	59.4
P7	1.4	15.7
P8.1	7.6	71.6
P10	1.2	9.3
P11	1.0	11.8
I1	6.2	20.2
I2.1	7.6	37.8
I	17.8	17.8
P11.2	23.5	85.4
P12	5.7	67.6
P9	2.2	16.6
P10.1	1.4	13.1
P11.1	3.2	25.0

Subdivision: Hillcamp Proposed
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/10/25

		Total Area (ac)	SFH-RURAL				SFH-LOW				Asphalt				Receiving Porous Area				Undisturbed Native Grasses				Extended Detention Basin				Basins Total Weighted % Imp.
Basin ID	% Imp.		Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.					
		4.78	35%	2.98	23.8%	55%	0.00	55%	0.00	95%	0.78	15.5%	20%	0.61	2.5%	5%	0.42	0.4%	25%	0.00	0.0%	40.3%					
		7.44	35%	2.38	11.2%	55%	1.29	9.5%	95%	0.89	11.3%	20%	0.54	1.5%	5%	2.02	1.4%	25%	0.32	1.1%	35.9%						
		10.74	35%	1.14	3.7%	55%	3.09	15.8%	95%	1.14	10.1%	20%	1.05	2.0%	5%	4.32	2.0%	25%	0.00	0.0%	33.6%						
		27.71	35%	0.00	0.0%	55%	15.43	30.6%	95%	3.30	11.3%	20%	2.16	1.6%	5%	6.13	1.1%	25%	0.69	0.6%	45.2%						
		6.60	35%	2.73	14.5%	55%	0.00	0.0%	95%	1.34	19.3%	20%	1.08	3.1%	5%	1.23	0.9%	25%	0.22	0.8%	38.8%						
PROPOSED BIG DRY CREEK TRIBUTARY		17.27																				40.68%					
		CW-P1	6.48	35%	3.79	20.5%	55%	0.00	0.0%	95%	1.26	18.5%	20%	0.94	2.9%	5%	0.49	0.4%	25%	0.00	0.0%	42.2%					
		CW-P2	23.86	35%	1.80	2.6%	55%	8.15	38.8%	95%	3.78	25.1%	20%	3.03	2.5%	5%	7.10	1.5%	25%	0.00	0.0%	40.5%					
		CW-F3	3.59	35%	0.00	0.0%	55%	0.33	5.1%	95%	0.53	14.0%	20%	0.00	0.0%	5%	2.73	3.8%	25%	0.00	0.0%	22.9%					
		CW-P4	6.28	35%	0.00	0.0%	55%	2.42	21.2%	95%	0.45	6.8%	20%	0.41	1.3%	5%	1.92	1.5%	25%	1.08	4.3%	35.1%					
PROPOSED COTTONWOOD CREEK TRIBUTARY		40.21																				38.37%					
		HC-P1	13.72	35%	0.00	0.0%	55%	5.28	24.8%	95%	2.20	17.8%	20%	1.32	1.9%	5%	1.32	1.3%	25%	0.00	0.0%	45.8%					
		HC-H3	34.18	35%	0.00	0.0%	55%	15.13	34.3%	95%	2.78	9.9%	20%	1.67	1.4%	5%	5.09	1.1%	25%	0.00	0.0%	45.8%					
		HC-F3	12.78	35%	0.00	0.0%	55%	7.62	32.8%	95%	1.62	12.1%	20%	1.62	2.5%	5%	1.92	0.8%	25%	0.00	0.0%	48.2%					
		HC-P4	3.97	35%	0.00	0.0%	55%	1.50	20.8%	95%	0.42	10.1%	20%	0.24	1.2%	5%	0.89	1.1%	25%	0.93	5.8%	39.0%					
		HC-F5	7.86	35%	0.00	0.0%	55%	4.18	29.2%	95%	1.52	18.4%	20%	1.04	2.6%	5%	0.66	0.4%	25%	0.46	1.5%	52.1%					
		HC-P6	0.88	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.44	47.8%	20%	0.34	7.6%	5%	0.10	0.6%	25%	0.00	0.0%	56.0%					
		HC-P7	6.50	35%	0.00	0.0%	55%	3.89	32.9%	95%	0.54	7.8%	20%	0.37	1.1%	5%	1.38	1.1%	25%	0.32	1.2%	44.2%					
		HC-P8	5.27	35%	0.00	0.0%	55%	2.51	26.2%	95%	0.67	12.1%	20%	0.49	1.9%	5%	1.60	1.5%	25%	0.00	0.0%	41.7%					
PROPOSED HAPPI CANYON CREEK TRIBUTARY		73.16																				46.23%					
Basin ID		Total Area (ac)																			COMMERCIAL-LOW DENSITY			Basins Total Weighted % Imp.			
																					% Imp.	Area (ac)	Weighted % Imp.				
P-A5		2.81																			65%	2.81	65.0%	65.0%			
PROPOSED AMENITY CENTER		2.81																						65.00%			
Basin ID	Total Area (ac)	SFH-RURAL				SFH-LOW				Asphalt				Gravel-LOW Traffic/Substations				Undisturbed Native Grasses				Extended Detention Basin				Basins Total Weighted % Imp.	
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.					
		16.72	35%	1.72	3.6%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	15.00	4.5%	25%	0.00	0.0%	8.1%						
		13.96	35%	5.30	13.3%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	8.66	3.1%	25%	0.00	0.0%	16.4%						
		DC-E3	34.07	35%	6.24	6.4%	55%	1.27	2.1%	95%	0.00	0.0%	60%	0.32	0.6%	5%	26.24	3.9%	25%	0.00	0.0%	12.9%					
		DC-E4	3.75	35%	2.03	18.9%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	1.72	2.3%	25%	0.00	0.0%	21.2%					
		DC-E5	9.47	35%	0.70	2.6%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	8.77	4.6%	25%	0.00	0.0%	7.2%					
		DC-E6	1.71	35%	0.18	0.8%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	7.53	4.9%	25%	0.00	0.0%	5.7%					
		DC-E7	4.95	35%	0.78	4.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	2.27	4.9%	25%	0.00	0.0%	10.8%					
		DC-E8	3.58	35%	0.68	6.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	2.91	4.1%	25%	0.00	0.0%	10.7%					
		DC-E8.1	4.43	35%	0.35	2.7%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	4.08	4.6%	25%	0.00	0.0%	7.3%					
		DC-E9	5.53	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	5.53	5.0%	25%	0.00	0.0%	5.9%					
		DC-E9.1	9.68	35%	1.73	6.3%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	7.95	4.1%	25%	0.00	0.0%	10.4%					
MODIFIED EXISTING BIG DRY CREEK TRIBUTARY		112.56																				10.95%					
		WE1	9.48	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.62	3.8%	5%	8.86	4.7%	25%	0.00	0.0%	8.6%					
MODIFIED EXISTING WILLOW CREEK TRIBUTARY		9.48																				8.60%					
		CW-E1	21.46	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.36	1.0%	5%	21.10	4.9%	25%	0.00	0.0%	5.9%					
		CW-E2	20.57	35%	0.00	0.0%	55%	0.62	1.7%	95%	0.00	0.0%	60%	0.43	1.3%	5%	18.91	4.6%	25%	0.61	0.7%	8.2%					
		CW-E3	34.33	35%	0.00	0.0%	55%	5.31	8.5%	95%	0.00	0.0%	60%	0.72	1.3%	5%	27.53	4.0%	25%	0.77	0.6%	14.3%					
		CW-E4	8.09	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.26	1.9%	5%	7.83	4.8%	25%	0.00	0.0%	6.8%					
		CW-E5	5.56	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.15	1.6%	5%	5.41	4.9%	25%	0.00	0.0%	6.5%					
MODIFIED EXISTING COTTONWOOD CREEK TRIBUTARY		90.01																				9.97%					
		HC-E1	12.83	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.36	1.7%	5%	12.56	4.9%	25%	0.00	0.0%	4.5%					
		HC-E2	5.90	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	5.90	5.0%	25%	0.00	0.0%	5.0%					
		HC-E3	5.91	35%	0.00	0.0%	55%	1.65	15.4%	95%	0.00	0.0%	60%	0.00	0.0%	5%	4.26	3.6%	25%	0.00	0.0%	19.0%					
		HC-E4	21.85	35%	0.00	0.0%	55%	8.67	21.8%	95%	0.00	0.0%	60%	0.00	0.0%	5%	12.20	2.8%	25%	0.58	1.1%	25.7%					
		HC-E5	3.28	35%	0.00	0.0%	55%	0.85	14.3%	95%	0.00	0.0%	60%	0.00	0.0%	5%	2.43	3.7%	25%	0.00	0.0%	18.0%					
		HC-E6	1.27	35%	0.00	0.0%	55%	0.44	18.8%	95%	0.00	0.0%	60%	0.00	0.0%	5%	0.84	3.3%	25%	0.00	0.0%	22.1%					
		HC-E7	1.80	35%	0.00	0.0%	55%	0.60	18.2%	95%	0.00	0.0%	60%	0.00	0.0%	5%	1.20	3.3%	25%	0.00	0.0%	21.5%					
		HC-E8	3.01	35%	0.0%	0.0%	55%	0.19	3.4%	95%	0.00	0.0%	60%	0.00	0.0%	5%	2.82	4.7%	25%	0.00	0.0%	8.1%					
		HC-E9	6.82	35%	0.00	0.0%	55%	3.18	25.6%	95%	0.00	0.0%	60%	0.00	0.0%	5%	3.64	2.7%	25%	0.00	0.0%	28.3%					
		HC-E10	1.93	35%	0.00	0.0%	55%	0.61	17.4%	95%	0.00	0.0%	60%	0.08	2.5%	5%	1.24	3.2%	25%	0.00	0.0%	23.1%					
MODIFIED EXISTING HAPPI CANYON CREEK TRIBUTARY		64.69																				18.18%					
		E-OS1	26.90	35%	0.00	0.0%	55%	1.68	3.4%	95%	0.00	0.0%	60%	0.00	0.0%	5%	25.22	4.7%	25%	0.00	0.0%	8.1%					
		E-OS2	39.78	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	39.78	5.0%	25%	0.00	0.0%	5.0%					
		E-OS3	1.70	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	1.70	5.0%	25%	0.00	0.0%	5.0%					
		E-OS4	4.18	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.23	3.2%	5%	3.96	4.7%	25%	0.00	0.0%	7.9%					
MODIFIED EXISTING OFFSITE TOTAL		72.56																				6.32%					
		E-U01	3.60	35%	0.00	0.0%	55%	0.00	0.0%	95%	0.00	0.0%	60%	0.20	3.3%	5%	3.40	4.7%	25%	0.00	0.0%	8.1%					
		E-U02	23.35	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	95%	0.00	0.0%	60%	0.00	0.0%	5%	23.35	5.0%	25%	0.00	0.0%	5.0%					
		E-U03	10.17	35%	0.00	0.0%	55%	0.98	5.3%	95%	0.00	0.0%	60%	0.00	0.0%	5%	9.19	4.5%	25%	0.00	0.0%	9.8%					
MODIFIED UNDISTAINED TOTAL		374.13																				44.61%					
SITE TOTAL		560.27																				20.55%					

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Hillcamp Proposed
 Location: Lone Tree

Project Name: Hillcamp
 Project No.: 15950.12
 Calculated By: BMP
 Checked By: KAC
 Date: 12/10/25

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Hydrologic Soil Group			Minor Coefficients			Major Coefficients			Basins Total Weighted C _s	Basins Total Weighted C ₁₀₀
			Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	C _{s,A}	C _{s,B}	C _{s,C/D}	C _{100,A}	C _{100,B}	C _{100,C/D}		
DC-P1	4.78	40.3%	0.00	0.00	4.78	0%	0%	100%	0.27	0.32	0.37	0.42	0.62	0.65	0.37	0.65
DC-P2	7.44	35.9%	0.00	0.00	7.44	0%	0%	100%	0.23	0.28	0.33	0.39	0.60	0.63	0.33	0.63
DC-P3	10.74	33.6%	0.00	0.00	10.74	0%	0%	100%	0.21	0.26	0.31	0.37	0.58	0.62	0.31	0.62
DC-P4	27.71	45.2%	0.00	0.00	27.71	0%	0%	100%	0.31	0.36	0.41	0.46	0.64	0.67	0.41	0.67
DC-P5	6.60	38.8%	0.00	0.00	6.60	0%	0%	100%	0.26	0.31	0.35	0.41	0.61	0.64	0.35	0.64
CW-P1	6.48	42.2%	0.00	0.00	6.48	0%	0%	100%	0.29	0.34	0.38	0.44	0.62	0.66	0.38	0.66
CW-P2	23.86	40.5%	0.00	0.00	23.86	0%	0%	100%	0.27	0.32	0.37	0.43	0.62	0.65	0.37	0.65
CW-P3	3.59	22.9%	0.00	0.00	3.59	0%	0%	100%	0.13	0.17	0.22	0.29	0.53	0.58	0.22	0.58
CW-P4	6.28	35.1%	0.00	0.00	6.28	0%	0%	100%	0.23	0.28	0.32	0.38	0.59	0.63	0.32	0.63
HC-P1	11.72	45.8%	0.00	0.00	11.72	0%	0%	100%	0.32	0.37	0.41	0.47	0.64	0.67	0.41	0.67
HC-P2	24.18	45.8%	0.00	0.00	24.18	0%	0%	100%	0.32	0.37	0.41	0.47	0.64	0.67	0.41	0.67
HC-P3	12.78	48.2%	0.00	0.00	12.78	0%	0%	100%	0.34	0.39	0.43	0.49	0.65	0.68	0.43	0.68
HC-P4	3.97	39.0%	0.00	0.00	3.97	0%	0%	100%	0.26	0.31	0.35	0.41	0.61	0.64	0.35	0.64
HC-P5	7.86	52.1%	0.00	0.00	7.86	0%	0%	100%	0.38	0.42	0.46	0.52	0.67	0.70	0.46	0.70
HC-P6	0.88	56.0%	0.00	0.00	0.88	0%	0%	100%	0.41	0.46	0.49	0.55	0.69	0.71	0.49	0.71
HC-P7	6.50	44.2%	0.00	0.00	6.50	0%	0%	100%	0.30	0.35	0.40	0.46	0.63	0.67	0.40	0.67
HC-P8	5.27	41.7%	0.00	0.00	5.27	0%	0%	100%	0.28	0.33	0.38	0.44	0.62	0.65	0.38	0.65
P-AS	2.81	65.0%	0.00	0.00	2.81	0%	0%	100%	0.50	0.54	0.57	0.62	0.73	0.75	0.57	0.75
DC-E1	16.72	8.1%	0.00	0.00	16.72	0%	0%	100%	0.04	0.06	0.10	0.17	0.46	0.52	0.10	0.52
DC-E2	13.96	16.4%	0.00	0.00	13.96	0%	0%	100%	0.09	0.12	0.17	0.24	0.50	0.55	0.17	0.55
DC-E3	34.07	12.9%	0.00	0.00	34.07	0%	0%	100%	0.06	0.09	0.14	0.21	0.49	0.54	0.14	0.54
DC-E4	3.75	21.2%	0.00	0.00	3.75	0%	0%	100%	0.12	0.16	0.21	0.28	0.53	0.57	0.21	0.57
DC-E5	9.47	7.2%	0.00	0.00	9.47	0%	0%	100%	0.03	0.05	0.09	0.17	0.46	0.51	0.09	0.51
DC-E6	7.71	5.7%	0.00	0.00	7.71	0%	0%	100%	0.02	0.04	0.08	0.15	0.45	0.51	0.08	0.51
DC-E7	4.05	10.8%	0.00	0.00	4.05	0%	0%	100%	0.05	0.08	0.12	0.19	0.48	0.53	0.12	0.53

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Hydrologic Soil Group			Minor Coefficients			Major Coefficients			Basins Total Weighted C ₅	Basins Total Weighted C ₁₀₀
			Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	C _{5,A}	C _{5,B}	C _{5,C/D}	C _{100,A}	C _{100,B}	C _{100,C/D}		
DC-E8	3.59	10.7%	0.00	0.00	3.59	0%	0%	100%	0.05	0.08	0.12	0.19	0.48	0.53	0.12	0.53
DC-E8.1	4.43	7.3%	0.00	0.00	4.43	0%	0%	100%	0.03	0.05	0.09	0.17	0.46	0.51	0.09	0.51
DC-E9	5.53	5.0%	0.00	0.00	5.53	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
DC-E9.1	9.68	10.4%	0.00	0.00	9.68	0%	0%	100%	0.05	0.07	0.12	0.19	0.47	0.53	0.12	0.53
W-E1	9.48	8.6%	0.00	0.00	9.48	0%	0%	100%	0.04	0.06	0.10	0.18	0.47	0.52	0.10	0.52
CW-E1	21.46	5.9%	0.00	0.00	21.46	0%	0%	100%	0.02	0.04	0.08	0.16	0.45	0.51	0.08	0.51
CW-E2	20.57	8.2%	0.00	0.00	20.57	0%	0%	100%	0.04	0.06	0.10	0.17	0.47	0.52	0.10	0.52
CW-E3	34.33	14.3%	0.00	0.00	34.33	0%	0%	100%	0.07	0.10	0.15	0.22	0.49	0.54	0.15	0.54
CW-E4	8.09	6.8%	0.00	0.00	8.09	0%	0%	100%	0.03	0.05	0.09	0.16	0.46	0.51	0.09	0.51
CW-E5	5.56	6.5%	0.00	0.00	5.56	0%	0%	100%	0.03	0.04	0.09	0.16	0.46	0.51	0.09	0.51
HC-E1	12.92	6.5%	0.00	0.00	12.92	0%	0%	100%	0.03	0.04	0.09	0.16	0.46	0.51	0.09	0.51
HC-E2	5.90	5.0%	0.00	0.00	5.90	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
HC-E3	5.91	19.0%	0.00	0.00	5.91	0%	0%	100%	0.10	0.14	0.19	0.26	0.51	0.56	0.19	0.56
HC-E4	21.85	25.7%	0.00	0.00	21.85	0%	0%	100%	0.15	0.20	0.25	0.31	0.55	0.59	0.25	0.59
HC-E5	3.28	18.0%	0.00	0.00	3.28	0%	0%	100%	0.10	0.13	0.18	0.25	0.51	0.56	0.18	0.56
HC-E6	1.27	22.1%	0.00	0.00	1.27	0%	0%	100%	0.13	0.17	0.22	0.28	0.53	0.57	0.22	0.57
HC-E7	1.80	21.5%	0.00	0.00	1.80	0%	0%	100%	0.12	0.16	0.21	0.28	0.53	0.57	0.21	0.57
HC-E8	3.01	8.1%	0.00	0.00	3.01	0%	0%	100%	0.04	0.06	0.10	0.17	0.46	0.52	0.10	0.52
HC-E9	6.82	28.3%	0.00	0.00	6.82	0%	0%	100%	0.17	0.22	0.27	0.33	0.56	0.60	0.27	0.60
HC-E10	1.93	23.1%	0.00	0.00	1.93	0%	0%	100%	0.13	0.17	0.22	0.29	0.53	0.58	0.22	0.58
E-OS1	26.90	8.1%	0.00	0.00	26.90	0%	0%	100%	0.04	0.06	0.10	0.17	0.46	0.52	0.10	0.52
E-OS2	39.78	5.0%	0.00	0.00	39.78	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
E-OS3	1.70	5.0%	0.00	0.00	1.70	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
E-OS4	4.18	7.9%	0.00	0.00	4.18	0%	0%	100%	0.03	0.05	0.10	0.17	0.46	0.52	0.10	0.52
E-UD1	3.60	8.1%	0.00	0.00	3.60	0%	0%	100%	0.04	0.06	0.10	0.17	0.46	0.52	0.10	0.52
E-UD2	23.35	5.0%	0.00	0.00	23.35	0%	0%	100%	0.02	0.03	0.08	0.15	0.45	0.50	0.08	0.50
E-UD3	10.17	9.8%	0.00	0.00	10.17	0%	0%	100%	0.04	0.07	0.12	0.19	0.47	0.52	0.12	0.52

STANDARD FORM SF-2 **TIME OF CONCENTRATION**

Subdivision: Hillcamp Proposed
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/10/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C _s	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	
DC-P1	4.78	C/D	40.25%	0.37	0.65	45	5.78%	5.0	935	1.23%	15	1.7	9.4	14.4	980.0	28.8	14.36
DC-P2	7.44	C/D	35.92%	0.33	0.63	134	0.24%	25.8	670	3.06%	15	2.6	4.3	30.0	804.0	24.4	24.44
DC-P3	10.74	C/D	33.59%	0.31	0.62	139	3.42%	11.2	1492	1.65%	15	1.9	12.9	24.1	1631.0	34.4	24.11
DC-P4	27.71	C/D	45.23%	0.41	0.67	278	2.00%	16.6	1560	3.00%	15	2.6	10.0	26.6	1838.0	28.1	26.63
DC-P5	6.60	C/D	38.80%	0.35	0.64	85	2.00%	9.9	1845	2.50%	15	2.4	13.0	22.9	1930.0	32.9	22.86
CW-P1	6.48	C/D	42.22%	0.38	0.66	214	2.20%	14.6	1485	1.77%	15	2.0	12.4	27.0	1699.0	31.3	27.04
CW-P2	23.86	C/D	40.51%	0.37	0.65	62	3.40%	7.0	2700	2.00%	15	2.1	21.2	28.2	2762.0	40.8	28.17
CW-P3	3.59	C/D	22.86%	0.22	0.58	10	3.32%	3.4	592	2.00%	15	2.1	4.7	8.0	602.0	27.8	8.02
CW-P4	6.28	C/D	35.13%	0.32	0.63	104	2.00%	11.4	340	1.40%	15	1.8	3.2	14.6	444.0	23.5	14.57
HC-P1	11.72	C/D	45.84%	0.41	0.67	99	5.94%	6.9	1732	1.55%	15	1.9	15.5	22.3	1831.0	33.2	22.33
HC-P2	24.18	C/D	45.85%	0.41	0.67	132	2.58%	10.5	2003	3.05%	15	2.6	12.7	23.2	2135.0	30.6	23.20
HC-P3	12.78	C/D	48.15%	0.43	0.68	73.7	3.40%	6.9	2182	3.12%	15	2.6	13.7	20.7	2255.7	30.9	20.66
HC-P4	3.97	C/D	38.97%	0.35	0.64	46	5.50%	5.2	691	6.50%	15	3.8	3.0	8.2	737.0	22.5	8.21
HC-P5	7.86	C/D	52.15%	0.46	0.70	75.5	3.80%	6.4	1944	1.52%	15	1.8	17.5	24.0	2019.5	33.3	23.95
HC-P6	0.88	C/D	56.02%	0.49	0.71	30	8.66%	2.9	516	1.35%	15	1.7	4.9	7.9	546.0	20.9	7.87
HC-P7	6.50	C/D	44.20%	0.40	0.67	163	3.02%	11.3	448	4.46%	15	3.2	2.4	13.6	611.0	20.8	13.61

STANDARD FORM SF-2 **TIME OF CONCENTRATION**

Subdivision: Hillcamp Proposed
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/10/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C _s	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	
HC-P8	5.27	C/D	41.65%	0.38	0.65	156	2.80%	11.6	507	6.00%	15	3.7	2.3	13.9	663.0	21.2	13.91
P-AS	2.81	C/D	65.00%	0.57	0.75	76	2.50%	6.2	420	2.00%	15	2.1	3.3	9.5	496.0	17.7	9.49
DC-E1	16.72	C/D	8.09%	0.10	0.52	500	7.17%	21.1	355	14.69%	7	2.7	2.2	23.3	855.0	26.1	23.26
DC-E2	13.96	C/D	16.39%	0.17	0.55	500	15.34%	15.3	250	11.67%	7	2.4	1.7	17.0	750.0	24.3	17.01
DC-E3	34.07	C/D	12.87%	0.14	0.54	500	8.21%	19.3	1184	10.35%	7	2.3	8.8	28.1	1684.0	29.5	28.11
DC-E4	3.75	C/D	21.24%	0.21	0.57	10	30.00%	1.7	20	30.00%	7	3.8	0.1	1.7	30.0	22.4	5.00
DC-E5	9.47	C/D	7.22%	0.09	0.51	135	5.50%	12.0	875	8.40%	7	2.0	7.2	19.2	1010.0	29.8	19.21
DC-E6	7.71	C/D	5.69%	0.08	0.51	280	2.00%	24.5	1276	14.50%	7	2.7	8.0	32.4	1556.0	30.7	30.73
DC-E7	4.05	C/D	10.80%	0.12	0.53	70	13.39%	6.3	220	13.00%	7	2.5	1.5	7.7	290.0	25.1	7.72
DC-E8	3.59	C/D	10.68%	0.12	0.53	370	4.06%	21.4	10	4.06%	7	1.4	0.1	21.5	380.0	24.3	21.49
DC-E8.1	4.43	C/D	7.34%	0.09	0.51	126	3.80%	13.1	420	13.25%	7	2.5	2.7	15.9	546.0	26.7	15.86
DC-E9	5.53	C/D	5.00%	0.08	0.50	500	4.00%	26.2	376	4.46%	7	1.5	4.2	30.4	876.0	28.2	28.21
DC-E9.1	9.68	C/D	10.36%	0.12	0.53	500	7.33%	20.5	196	19.57%	7	3.1	1.1	21.6	696.0	24.9	21.56
W-E1	9.48	C/D	8.60%	0.10	0.52	217	0.76%	29.0	495	15.79%	7	2.8	3.0	31.9	712.0	26.6	26.57
CW-E1	21.46	C/D	5.92%	0.08	0.51	58	6.38%	7.6	437	8.36%	7	2.0	3.6	11.2	495.0	27.6	11.18
CW-E2	20.57	C/D	8.24%	0.10	0.52	500	6.88%	21.3	360	9.87%	7	2.2	2.7	24.0	860.0	26.5	24.03
CW-E3	34.33	C/D	14.34%	0.15	0.54	500	5.95%	21.2	1106	7.99%	7	2.0	9.3	30.5	1606.0	29.5	29.49
CW-E4	8.09	C/D	6.77%	0.09	0.51	300	10.00%	14.8	345	8.46%	7	2.0	2.8	17.6	645.0	26.8	17.60

STANDARD FORM SF-2 **TIME OF CONCENTRATION**

Subdivision: Hillcamp Proposed
Location: Lone Tree

Project Name: Hillcamp
Project No.: 15950.12
Calculated By: BMP
Checked By: KAC
Date: 12/10/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C ₅	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
CW-E5	5.56	C/D	6.48%	0.09	0.51	500	12.55%	17.7	39	11.44%	7	2.4	0.3	18.0	539.0	25.1	18.00
HC-E1	12.92	C/D	6.53%	0.09	0.51	500	13.92%	17.1	263	13.65%	7	2.6	1.7	18.8	763.0	26.1	18.81
HC-E2	5.90	C/D	5.00%	0.08	0.50	170	6.21%	13.2	429	18.33%	7	3.0	2.4	15.6	599.0	26.9	15.58
HC-E3	5.91	C/D	18.96%	0.19	0.56	351	7.47%	15.9	536	10.13%	7	2.2	4.0	19.9	887.0	25.2	19.86
HC-E4	21.85	C/D	25.74%	0.25	0.59	500	5.48%	19.7	1015	6.89%	7	1.8	9.2	28.9	1515.0	26.7	26.74
HC-E5	3.28	C/D	17.96%	0.18	0.56	400	5.62%	18.8	347	12.30%	7	2.5	2.4	21.1	747.0	24.4	21.11
HC-E6	1.27	C/D	22.13%	0.22	0.57	10	15.96%	2.0	156	23.50%	7	3.4	0.8	2.8	166.0	22.7	5.00
HC-E7	1.80	C/D	21.54%	0.21	0.57	10	24.80%	1.8	125	29.59%	7	3.8	0.5	2.3	135.0	22.7	5.00
HC-E8	3.01	C/D	8.10%	0.10	0.52	10	12.26%	2.5	340	26.90%	7	3.6	1.6	4.1	350.0	25.7	5.00
HC-E9	6.82	C/D	28.31%	0.27	0.60	102	14.58%	6.3	433	20.74%	7	3.2	2.3	8.5	535.0	22.4	8.54
HC-E10	1.93	C/D	23.08%	0.22	0.58	150	5.00%	11.4	150	5.00%	7	1.6	1.6	13.0	300.0	23.0	12.99
E-OS1	26.90	C/D	8.12%	0.10	0.52	500	6.77%	21.4	688	6.77%	7	1.8	6.3	27.7	1188.0	29.0	27.73
E-OS2	39.78	C/D	5.00%	0.08	0.50	500	7.67%	21.1	2564	7.67%	7	1.9	22.0	43.1	3064.0	41.1	41.06
E-OS3	1.70	C/D	5.00%	0.08	0.50	300	2.72%	23.0	150	7.94%	7	2.0	1.3	24.3	450.0	26.1	24.28
E-OS4	4.18	C/D	7.89%	0.10	0.52	300	2.35%	23.6	607	0.86%	7	0.6	15.6	39.2	907.0	35.5	35.45
E-UD1	3.60	C/D	8.06%	0.10	0.52	300	4.33%	19.3	148	6.21%	7	1.7	1.4	20.7	448.0	25.6	20.68
E-UD2	23.35	C/D	5.00%	0.08	0.50	311	27.86%	10.9	1375	3.33%	7	1.3	17.9	28.8	1686.0	38.1	28.82
E-UD3	10.17	C/D	9.80%	0.12	0.52	300	16.70%	12.2	520	23.72%	7	3.4	2.5	14.7	820.0	26.1	14.71

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Hillcamp Proposed

Location: Lone Tree

Design Storm: 5-Year P1 = 1.46 in/hr

12/10/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	P1	DC-E1	16.72	0.10	23.3	1.7	2.7	4.5					
	P2	DC-E2	13.96	0.17	17.0	2.4	3.1	7.4					
	P13	E-UD1	3.60	0.10	20.7	0.4	2.8	1.0					
	P14	W-E1	9.48	0.10	26.6	1.0	2.5	2.5					
	A1	DC-P1	4.78	0.37	14.4	1.7	3.4	5.9					TOTAL DEVELOPED RUNOFF FROM BASIN DC-P1 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP A1. ENTERS POND A
	A2	CW-P1	6.48	0.38	27.0	2.5	2.4	6.0					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P1 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP A2. ENTERS POND A
													POND A CUMULATIVE TRIBUTARY FLOWS
	A3.1								27.0	4.21	2.43	10.2	ENTERS POND A
													PROPOSED POND A
	A											0.3	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P15
	P15	CW-E1	21.46	0.08	11.2	1.8	3.8	6.8					MODIFIED EXISTING SUB- BASIN CW-E1 RUNOFF FLOWS TO DP P15.1
	P15.1								11.2	1.80	3.78	7.1	SUM OF FLOWS FROM PROPOSED POND A AND MODIFIED EXISTING SUB-BASIN CW-E1 ENTERS COTTONWOOD CREEK
	B1	CW-P2	23.86	0.37	28.2	8.8	2.4	20.8					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P2 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP B2. ENTERS POND B
	B2	CW-P3	3.59	0.22	8.0	0.8	4.3	3.4					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P3 FLOWS VIA SWALE TO DP B2, ENTERS HILLCAMP DRIVE SYSTEM AT DP B2
													POND B CUMULATIVE TRIBUTARY FLOWS
	B3.1								28.2	9.56	2.38	22.8	ENTERS POND B
													PROPOSED POND B
	B											0.6	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P16
	P16	CW-E2	20.57	0.10	24.0	2.1	2.6	5.5					MODIFIED EXISTING SUB- BASIN CW-E2 RUNOFF FLOWS TO DP P16.1
	P16.1								24.0	2.12	2.60	6.1	SUM OF FLOWS FROM DP P16 AND POND B RELEASE RATE ENTERS COTTONWOOD CREEK AT DP B3.2
	P17	CW-E3	34.33	0.15	29.5	5.3	2.3	12.1					
	P18	CW-E4	8.09	0.09	17.6	0.7	3.1	2.2					
	P19	CW-E5	5.56	0.09	18.0	0.5	3.0	1.5					
	P20	E-OS3	1.70	0.08	24.3	0.1	2.6	0.3					

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	P21	HC-E1	12.92	0.09	18.8	1.2	3.0	3.4					
	P33	E-UD3	10.17	0.12	14.7	1.2	3.4	3.9					
	P34	HC-E9	6.82	0.27	8.5	1.8	4.2	7.6					
	P35	HC-E10	1.93	0.22	13.0	0.4	3.5	1.5					
	G1	HC-P1	11.72	0.41	22.3	4.8	2.7	13.1					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P1 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP G1. ENTERS POND G
	G2	CW-P4	6.28	0.32	14.6	2.0	3.4	6.8					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P4 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP G2.
	G3.1								22.3	6.85	2.71	18.6	POND G CUMULATIVE TRIBUTARY FLOWS ENTERS POND G
	G												PROPOSED POND G 0.5 CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P23
	P23	HC-E3	5.91	0.19	19.9	1.1	2.9	3.2					MODIFIED EXISTING SUB- BASIN HC-E3 RUNOFF FLOWS TO DP G3.2
	P23.1								19.9	1.12	2.88	3.7	SUM OF FLOWS FROM DP P23 AND POND G RELEASE RATE ENTERS SURREY TRIBUTARY AT DP P23.1
	H1	HC-P2	24.18	0.41	23.2	9.9	2.7	26.3					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P2 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP H1. ENTERS POND H
	H												POND H 0.6 CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP 25
	P24	E-OS4	4.18	0.10	35.5	0.4	2.1	0.9					MODIFIED EXISTING SUB- BASIN E-OS4 RUNOFF CAPTURED BY ONSITE SWALE AND TYPE C INLET, PIPED TO DP E3.1
	E2	HC-P6	0.88	0.49	7.9	0.4	4.3	1.9					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P6 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP E2. PIPED TO DP E3.1
	E3.1								35.5	0.85	2.07	1.8	SUM OF FLOWS FROM DP 24 AND E2 PIPED TO DP E4.1
	E4	HC-P3	12.78	0.43	20.7	5.5	2.8	15.5					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P3 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP E4. PIPED TO DP E4.1
	E4.1								35.5	6.35	2.07	13.1	SUM OF FLOWS FROM DP E3.1 AND E4 ENTERS POND E
	E5	HC-P4	3.97	0.35	8.2	1.4	4.3	6.0					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P4 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP E5. ENTERS POND E
	E6.1								35.5	7.76	2.07	16.1	POND E CUMULATIVE TRIBUTARY FLOWS CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P25
	E												POND E 0.5 CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P25
	P25	HC-E4	21.85	0.25	26.7	5.4	2.5	13.2					MODIFIED EXISTING SUB- BASIN HC-E4 RUNOFF CARRIED WITHIN SURREY TRIBUTARY TO DP P26.1
	P26.1								26.7	5.38	2.45	13.8	SUM OF FLOWS FROM PONDS H RELEASE RATE AND DP P25 RUNOFF ENTERS SURREY TRIBUTARY AT DP P26.1
	D1	HC-P5	7.86	0.46	24.0	3.6	2.6	9.5					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P5 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP D1. ENTERS POND D
	D												POND D 2.2 CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P32.1
													MODIFIED EXISTING SUB- BASIN HC-E25 RUNOFF

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	P27	HC-E5	3.28	0.18	21.1	0.6	2.8	1.7					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P27
	DE											2.7	POND D AND E COMBINED RELEASE RATES ENTER LOW TAILWATER BASIN, FLOW TO DP P27.1
	P27.1								21.1	0.60	2.79	4.4	SUM OF FLOWS FROM PONDS D AND E RELEASE RATES AND EXISTING MODIFIED SUB-BASIN HC-E5 RUNOFF ENTERS SURREY TRIBUTARY, FLOWS TO DP P32.1
	P30	HC-E8	3.01	0.10	5.0	0.3	5.0	1.5					MODIFIED EXISTING SUB- BASIN HC-E8 RUNOFF CARRIED WITHIN NATURAL CHANNEL TO DP P32.1
													MODIFIED EXISTING SUB- BASIN HC-E2 RUNOFF
	P22	HC-E2	5.90	0.08	15.6	0.5	3.3	1.5					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P22
													MODIFIED EXISTING SUB- BASIN HC-E26 RUNOFF
	P28	HC-E6	1.27	0.22	5.0	0.3	5.0	1.3					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P28
													MODIFIED EXISTING SUB- BASIN HC-E7 RUNOFF
	P29	HC-E7	1.80	0.21	5.0	0.4	5.0	1.9					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P29
													MODIFIED EXISTING SUB- BASIN E-UD2 RUNOFF
	P31	E-UD2	23.35	0.08	28.8	1.8	2.4	4.2					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P31
													SUM OF FLOWS FROM DP'S P22, P23.1, P26.1, P27.1, P28, P29, P30, AND P31
	P32.1								28.8	10.27	2.35	27.9	CONTINUES ALONG SURREY TRIUBTARY AT DP 32.1
	K1	HC-P8	5.27	0.38	13.9	2.0	3.4	6.8					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P8 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP K1. ENTERS POND K
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P7
	K2	HC-P7	6.50	0.40	13.6	2.6	3.5	9.0					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP K2. ENTERS POND K
													POND K CUMULATIVE TRIBUTARY FLOWS
	K3.1								13.9	4.57	3.43	15.7	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P36.1
													POND K
	K											0.3	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P36.1, OUTFALLS OFFSITE
													FLOWS RELEASED FROM POND K
	P36.1											0.3	OUTFALLS OFFSITE AT DP P36.1
	J1	DC-P2	7.44	0.33	24.4	2.5	2.6	6.3					TOTAL DEVELOPED RUNOFF FROM BASIN DC-P2 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP J1. ENTERS POND J
													POND J
	J											0.3	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P3.1
													MODIFIED EXISTING SUB- BASIN DC-E3 RUNOFF
	P3	DC-E3	34.07	0.14	28.1	4.8	2.4	11.4					FOLLOWS EXISTING UNNAMED CREEK ALONG MACARTHUR DRIVE TO DP P3.1
													SUM OF FLOWS FROM POND J RELEASE RATE AND DP 3 RUNOFF
	P3.1								28.1	4.77	2.38	11.7	CONTINUES ALONG UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP P3.1
	P4	DC-E4	3.75	0.21	5.0	0.8	5.0	3.9					TOTAL RUNOFF FROM MODIFIED EXISTING SUB-BASIN DC-E4 FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P4
	F1	DC-P3	10.74	0.31	24.1	3.3	2.6	8.7					TOTAL DEVELOPED RUNOFF FROM BASIN DC-P3 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP F1. ENTERS POND F1
													POND F1
	F1.1											3.0	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P5.1
													TOTAL DEVELOPED RUNOFF FROM BASIN DC-P4
	F2	DC-P4	27.71	0.41	26.6	11.3	2.5	27.6					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP F2. ENTERS POND F2
													POND F2
	F2.1											23.9	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P5.1
													COMBINED POND F1 AND F2 RELEASE RATES
	F3.1											26.9	CONTINUES DOWN DRAINAGE WAY TO DP P5.1

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	P5	DC-E5	9.47	0.09	19.2	0.9	2.9	2.6					MODIFIED EXISTING SUB- BASIN DC-E5 RUNOFF
													FLows VIA NATURAL CHANNEL TO DP P5.1
	P5.1								19.2	0.89	2.93	29.5	SUM OF FLOWS FROM POND F RELEASE RATE AND DP 5 RUNOFF
													CONTINUES ALONG UNNAMED CREEK ALONG VALLEY ROAD AT DP F3.2
	P6	E-OS1	26.90	0.10	27.7	2.7	2.4	6.6					MODIFIED EXISTING SUB- BASIN E-OS1 RUNOFF
													FLows VIA NATURAL CHANNEL TO DP P8.1
	P7	DC-E6	7.71	0.08	30.7	0.6	2.3	1.4					MODIFIED EXISTING SUB- BASIN DC-E6 RUNOFF
													FLows VIA NATURAL CHANNEL TO DP P8.1
	P8.1								30.7	3.37	2.26	7.6	SUM OF FLOWS FROM DP'S P6 AND P7
													FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P8.1
	P10	DC-E8	3.59	0.12	21.5	0.4	2.8	1.2					MODIFIED EXISTING SUB- BASIN DC-E8 RUNOFF
													ENTERS PROP SUB-BASIN DC-P6 AT DP 10
	P11	DC-E9	5.53	0.08	28.2	0.4	2.4	1.0					MODIFIED EXISTING SUB- BASIN DC-E9 RUNOFF
													ENTERS PROP SUB-BASIN DC-P6 AT DP 11
	I1	DC-P5	6.60	0.35	22.9	2.3	2.7	6.2					TOTAL DEVELOPED RUNOFF FROM BASIN DC-P5
													CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP I1. ENTERS POND I
	I2.1								28.2	3.19	2.37	7.6	SUM OF FLOWS FROM DP P10, P11, AND I1
													ENTERS POND I
	I											17.8	POND I
													CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P11.1
	P11.2								41.1	3.02	1.89	23.5	SUM OF FLOWS FROM POND I RELEASE RATE AND DP P11.1 RUNOFF
													FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P11.2
	P12	E-OS2	39.78	0.08	41.1	3.0	1.9	5.7					MODIFIED EXISTING SUB- BASIN E-OS2 RUNOFF
													FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P12
	P9	DC-E7	4.05	0.12	7.7	0.5	4.4	2.2					MODIFIED EXISTING SUB- BASIN DC-E7 RUNOFF
													FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P9
	P10.1	DC-E8.1	4.43	0.09	15.9	0.4	3.2	1.4					MODIFIED EXISTING SUB- BASIN DC-E8.1 RUNOFF
													FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P10.1
	P11.1	DC-E9.1	9.68	0.12	21.6	1.2	2.8	3.2					MODIFIED EXISTING SUB- BASIN DC-E9.1 RUNOFF
													FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P11.1

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Hillcamp Proposed
Location: Lone Tree
Design Storm: 100-Year P1 = 2.60 in/hr

12/10/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	P1	DC-E1	16.72	0.52	23.3	8.6	4.7	40.8					
	P2	DC-E2	13.96	0.55	17.0	7.7	5.6	42.7					
	P13	E-UD1	3.60	0.52	20.7	1.9	5.0	9.4					
	P14	W-E1	9.48	0.52	26.6	4.9	4.4	21.5					
	A1	DC-P1	4.78	0.65	14.4	3.1	6.0	18.7					TOTAL DEVELOPED RUNOFF FROM BASIN DC-P1 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP A1. ENTERS POND A
	A2	CW-P1	6.48	0.66	27.0	4.3	4.3	18.4					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P1 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP A2. ENTERS POND A
	A3.1								27.0	7.36	4.33	31.9	POND A CUMULATIVE TRIBUTARY FLOWS ENTERS POND A
	A												PROPOSED POND A
	P15	CW-E1	21.46	0.51	11.2	10.9	6.7	73.2					8.4 CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P15 MODIFIED EXISTING SUB- BASIN CW-E1 RUNOFF FLOWS TO DP P15.1
	P15.1								11.2	10.90	6.72	81.6	SUM OF FLOWS FROM PROPOSED POND A AND MODIFIED EXISTING SUB-BASIN CW-E1 ENTERS COTTONWOOD CREEK
	B1	CW-P2	23.86	0.65	28.2	15.5	4.2	65.6					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P2 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP B2. ENTERS POND B
	B2	CW-P3	3.59	0.58	8.0	2.1	7.6	15.9					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P3 FLOWS VIA SWALE TO DP B2, ENTERS HILLCAMP DRIVE SYSTEM AT DP B2
	B3.1								28.2	17.59	4.23	74.4	POND B CUMULATIVE TRIBUTARY FLOWS ENTERS POND B
	B												PROPOSED POND B
	P16	CW-E2	20.57	0.52	24.0	10.7	4.6	49.4					3.8 CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P16 MODIFIED EXISTING SUB- BASIN CW-E2 RUNOFF FLOWS TO DP P16.1
	P16.1								24.0	10.66	4.63	53.2	SUM OF FLOWS FROM DP P16 AND POND B RELEASE RATE ENTERS COTTONWOOD CREEK AT DP B3.2
	P17	CW-E3	34.33	0.54	29.5	18.6	4.1	76.8					
	P18	CW-E4	8.09	0.51	17.6	4.1	5.5	22.6					
	P19	CW-E5	5.56	0.51	18.0	2.8	5.4	15.3					
	P20	E-OS3	1.70	0.50	24.3	0.9	4.6	4.0					

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	P21	HC-E1	12.92	0.51	18.8	6.6	5.3	34.8					
	P33	E-UD3	10.17	0.52	14.7	5.3	6.0	31.8					
	P34	HC-E9	6.82	0.60	8.5	4.1	7.5	30.6					
	P35	HC-E10	1.93	0.58	13.0	1.1	6.3	7.1					
	G1	HC-P1	11.72	0.67	22.3	7.9	4.8	38.0					TOTAL DEVELOPED RUNOFF FROM BASIN HC-P1 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP G1. ENTERS POND G
	G2	CW-P4	6.28	0.63	14.6	3.9	6.0	23.6					TOTAL DEVELOPED RUNOFF FROM BASIN CW-P4 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP G2.
													POND G CUMULATIVE TRIBUTARY FLOWS
	G3.1								22.3	11.82	4.82	57.0	ENTERS POND G
													PROPOSED POND G
	G											22.8	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P23
													MODIFIED EXISTING SUB- BASIN HC-E3 RUNOFF
	P23	HC-E3	5.91	0.56	19.9	3.3	5.1	17.0					FLOWS TO DP G3.2
													SUM OF FLOWS FROM DP P23 AND POND G RELEASE RATE
	P23.1								19.9	3.32	5.13	39.8	ENTERS SURREY TRIBUTARY AT DP P23.1
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P2
	H1	HC-P2	24.18	0.67	23.2	16.3	4.7	76.7					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP H1. ENTERS POND H
													POND H
	H											23.1	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP 25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	
													MODIFIED EXISTING SUB- BASIN E-OS4 RUNOFF
	P24	E-OS4	4.18	0.52	35.5	2.2	3.7	8.0					CAPTURED BY ONSITE SWALE AND TYPE C INLET, PIPED TO DP E3.1
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P6
	E2	HC-P6	0.88	0.71	7.9	0.6	7.7	4.8					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP E2. PIPED TO DP E3.1
													SUM OF FLOWS FROM DP 24 AND E2
	E3.1								35.5	2.79	3.69	10.3	PIPED TO DP E4.1
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P3
	E4	HC-P3	12.78	0.68	20.7	8.7	5.0	43.8					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP E4. PIPED TO DP E4.1
													SUM OF FLOWS FROM DP E3.1 AND E4
	E4.1								35.5	11.49	3.69	42.4	ENTERS POND E
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P4
	E5	HC-P4	3.97	0.64	8.2	2.6	7.6	19.4					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP E5. ENTERS POND E
													POND E CUMULATIVE TRIBUTARY FLOWS
	E6.1								35.5	14.05	3.69	51.8	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P25
													POND E
	E											24.1	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P25
													MODIFIED EXISTING SUB- BASIN HC-E4 RUNOFF
	P25	HC-E4	21.85	0.59	26.7	12.9	4.4	56.2					CARRIED WITHIN SURREY TRIBUTARY TO DP P26.1
													SUM OF FLOWS FROM PONDS H RELEASE RATE AND DP P25 RUNOFF
	P26.1								26.7	12.89	4.36	79.3	ENTERS SURREY TRIBUTARY AT DP P26.1
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P5
	D1	HC-P5	7.86	0.70	24.0	5.5	4.6	25.5					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP D1. ENTERS POND D
													POND D
	D											4.9	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P32.1
													MODIFIED EXISTING SUB- BASIN HC-E25 RUNOFF
	P27	HC-E5	3.28	0.56	21.1	1.8	5.0	9.1					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P27
													POND D AND E COMBINED RELEASE RATES
	DE											29.0	ENTER LOW TAILWATER BASIN, FLOW TO DP P27.1
													SUM OF FLOWS FROM PONDS D AND E RELEASE RATES AND EXISTING MODIFIED SUB-BASIN HC-E5 RUNOFF
	P27.1								21.1	1.83	4.97	38.1	ENTERS SURREY TRIBUTARY, FLOWS TO DP P32.1
													MODIFIED EXISTING SUB- BASIN HC-E8 RUNOFF
	P30	HC-E8	3.01	0.52	5.0	1.6	8.8	13.8					CARRIED WITHIN NATURAL CHANNEL TO DP P32.1
													MODIFIED EXISTING SUB- BASIN HC-E2 RUNOFF
	P22	HC-E2	5.90	0.50	15.6	3.0	5.8	17.2					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P22
													MODIFIED EXISTING SUB- BASIN HC-E26 RUNOFF
	P28	HC-E6	1.27	0.57	5.0	0.7	8.8	6.4					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P28
													MODIFIED EXISTING SUB- BASIN HC-E7 RUNOFF
	P29	HC-E7	1.80	0.57	5.0	1.0	8.8	9.1					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P29
													MODIFIED EXISTING SUB- BASIN E-UD2 RUNOFF
	P31	E-UD2	23.35	0.50	28.8	11.8	4.2	49.2					CARRIED WITHIN NATURAL CHANNEL INTO SURREY TRIBUTARY AT DP P31
													SUM OF FLOWS FROM DP'S P22, P23.1, P26.1, P27.1, P28, P29, P30, AND P31
	P32.1								28.8	36.10	4.18	225.8	CONTINUES ALONG SURREY TRIUBTARY AT DP 32.1
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P8
	K1	HC-P8	5.27	0.65	13.9	3.5	6.1	21.1					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP K1. ENTERS POND K
													TOTAL DEVELOPED RUNOFF FROM BASIN HC-P7
	K2	HC-P7	6.50	0.67	13.6	4.3	6.2	26.7					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP K2. ENTERS POND K
													POND K CUMULATIVE TRIBUTARY FLOWS
	K3.1								13.9	7.77	6.11	47.5	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P36.1
													POND K
	K											20.0	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P36.1, OUTFALLS OFFSITE
													FLOWS RELEASED FROM POND K
	P36.1											20.0	OUTFALLS OFFSITE AT DP P36.1

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	J1	DC-P2	7.44	0.63	24.4	4.7	4.6	21.5					TOTAL DEVELOPED RUNOFF FROM BASIN DC-P2
													CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP J1. ENTERS POND J
	J											15.8	POND J
													CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P3.1
													MODIFIED EXISTING SUB- BASIN DC-E3 RUNOFF
	P3	DC-E3	34.07	0.54	28.1	18.3	4.2	77.6					FOLLOWS EXISTING UNNAMED CREEK ALONG MACARTHUR DRIVE TO DP P3.1
													SUM OF FLOWS FROM POND J RELEASE RATE AND DP 3 RUNOFF
	P3.1								28.1	18.30	4.24	93.4	CONTINUES ALONG UNNAMED CREEK ALONG MACARTHUR DRIVE AT DP P3.1
													TOTAL RUNOFF FROM MODIFIED EXISTING SUB-BASIN DC-E4
	P4	DC-E4	3.75	0.57	5.0	2.1	8.8	18.9					FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P4
													TOTAL DEVELOPED RUNOFF FROM BASIN DC-P3
	F1	DC-P3	10.74	0.62	24.1	6.7	4.6	30.9					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP F1. ENTERS POND F1
													POND F1
	F1.1											3.0	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P5.1
													TOTAL DEVELOPED RUNOFF FROM BASIN DC-P4
	F2	DC-P4	27.71	0.67	26.6	18.5	4.4	81.0					CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP F2. ENTERS POND F2
													POND F2
	F2.1											23.9	CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P5.1
													COMBINED POND F1 AND F2 RELEASE RATES
	F3.1											26.9	CONTINUES DOWN DRAINAGE WAY TO DP P5.1
													MODIFIED EXISTING SUB- BASIN DC-E5 RUNOFF
	P5	DC-E5	9.47	0.51	19.2	4.9	5.2	25.4					FLOWS VIA NATURAL CHANNEL TO DP P5.1
													SUM OF FLOWS FROM POND F RELEASE RATE AND DP 5 RUNOFF
	P5.1								19.2	4.87	5.22	52.3	CONTINUES ALONG UNNAMED CREEK ALONG VALLEY ROAD AT DP F3.2
													MODIFIED EXISTING SUB- BASIN E-OS1 RUNOFF
	P6	E-OS1	26.90	0.52	27.7	13.9	4.3	59.4					FLOWS VIA NATURAL CHANNEL TO DP P8.1
													MODIFIED EXISTING SUB- BASIN DC-E6 RUNOFF
	P7	DC-E6	7.71	0.51	30.7	3.9	4.0	15.7					FLOWS VIA NATURAL CHANNEL TO DP P8.1
													SUM OF FLOWS FROM DP'S P6 AND P7
	P8.1								30.7	17.82	4.02	71.6	FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P8.1

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	
	P10	DC-E8	3.59	0.53	21.5	1.9	4.9	9.3					MODIFIED EXISTING SUB- BASIN DC-E8 RUNOFF ENTERS PROP SUB-BASIN DC-P6 AT DP 10
	P11	DC-E9	5.53	0.50	28.2	2.8	4.2	11.8					MODIFIED EXISTING SUB- BASIN DC-E9 RUNOFF ENTERS PROP SUB-BASIN DC-P6 AT DP 11
	I1	DC-P5	6.60	0.64	22.9	4.2	4.8	20.2					TOTAL DEVELOPED RUNOFF FROM BASIN DC-P5 CONVEYED VIA SWALE TO 15" RCP CULVERT AT DP I1. ENTERS POND I
	I2.1								28.2	8.93	4.23	37.8	SUM OF FLOWS FROM DP P10, P11, AND I1 ENTERS POND I
	I											17.8	POND I CONTROLLED RELEASE TO MEET 90% OF HISTORIC RUNOFF AT DOWNSTREAM DP P11.1
	P11.2								41.1	20.05	3.37	85.4	SUM OF FLOWS FROM POND I RELEASE RATE AND DP P11.1 RUNOFF FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P11.2
	P12	E-OS2	39.78	0.50	41.1	20.1	3.4	67.6					MODIFIED EXISTING SUB- BASIN E-OS2 RUNOFF FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P12
	P9	DC-E7	4.05	0.53	7.7	2.1	7.7	16.6					MODIFIED EXISTING SUB- BASIN DC-E7 RUNOFF FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P9
	P10.1	DC-E8.1	4.43	0.51	15.9	2.3	5.8	13.1					MODIFIED EXISTING SUB- BASIN DC-E8.1 RUNOFF FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P10.1
	P11.1	DC-E9.1	9.68	0.53	21.6	5.1	4.9	25.0					MODIFIED EXISTING SUB- BASIN DC-E9.1 RUNOFF FOLLOWS HISTORICAL PATTERN, LEAVES SITE AT DP P11.1

DESIGN POINT COMPARISON TABLE BY MAJOR DRAINAGE BASIN					
MAJOR DRAINAGE BASIN	EX DOWNSTREAM DESIGN POINT	EX FLOW (CFS)	PROPOSED DESIGN POINT	PROP FLOW (CFS)	DELTA FLOW RATE (CFS)
BIG DRY CREEK	1	45.8	P1	40.8	-5.0
	2	51.2	P2	42.7	-8.5
	3	124.3	P3.1	93.4	-30.9
	4	13.1	P4	18.9	5.7
	5	64.4	P5.1	52.3	-12.0
	6	50.0	P6	59.4	9.4
	7	34.5	P7	15.7	-18.7
	8.1	80.3	P8.1	71.6	-8.6
	9	15.2	P9	16.6	1.4
	10	17.3	P10.1	13.1	-4.2
	11	34.7	P11.2	85.4	50.7
	12	71.3	P12	67.6	-3.7
	SUM	601.9	SUM	577.4	
WILLOW CREEK	13	9.5	P13	9.4	-0.2
	14	21.4	P14	21.5	0.2
	SUM	30.9	SUM	30.9	
COTTONWOOD CREEK	15	53.4	P15.1	81.6	28.3
	16	80.8	P16.1	53.2	-27.7
	17	78.8	P17	76.8	-2.0
	18	27.2	P18	22.6	-4.6
	19	17.2	P19	15.3	-1.8
	20	4.0	P20	4.0	0.0
	SUM	261.3	SUM	253.5	
HAPPY CANYON CREEK	21	33.5	P21	34.8	1.4
	22	20.4	P22	17.2	-3.2
	23	30.0	P23.1	39.8	9.9
	24	8.8	P24	8.0	-0.8
	25	118.1	P25	56.2	-61.9
	26.1	124.9	P26.1	79.3	-45.6
	27	18.1	P27.1	38.1	20.0
	28	6.4	P28	6.4	0.0
	29	6.6	P29	9.1	2.5
	30	8.8	P30	13.8	4.9
	31	49.4	P31	49.2	-0.2
	32.1	248.3	P32.1	225.8	-22.5
	33	26.4	P33	31.8	5.4
	34	19.0	P34	30.6	11.6
	35	10.9	P35	7.1	-3.8
	36	24.2	P36.1	20.0	-4.2
	SUM	753.8	SUM	632.3	
EX SITE TOTAL		1648.0	PROP SITE TOTAL	1494.1	*RATIO 91%
*RATIO CALCULATED AS PROPOSED SITE TOTAL DIVIDED BY EXISTING SITE TOTAL					

APPENDIX C
HYDRAULIC CALCULATIONS

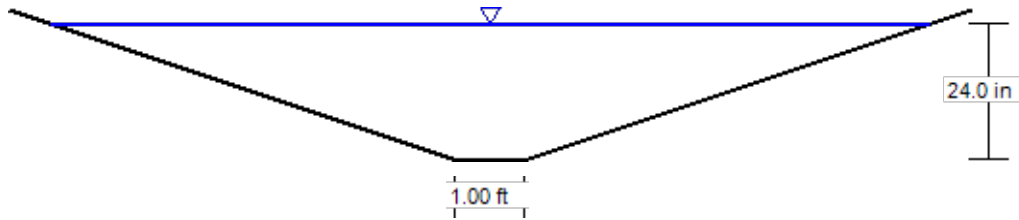
Cross Section for MIN SLOPE CAP ROADSIDE DITCH

Project Description

Friction Method	Manning
Solve For	Formula
	Discharge

Input Data

Roughness Coefficient	0.030
Channel Slope	0.010 ft/ft
Normal Depth	24.0 in
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	1.00 ft
Discharge	70.53 cfs



V: 1
H: 1

Worksheet : MIN SLOPE CAP ROADSIDE DITCH

Uniform Flow
Gradually Varied Flow
Messages

Solve For: Discharge

Friction Method: Manning Formula

<table style="width: 100%; border-collapse: collapse;"> <tr><td>Roughness Coefficient</td><td>0.030 ... </td></tr> <tr><td>Channel Slope:</td><td>0.010 ft/ft</td></tr> <tr><td>Normal Depth:</td><td>24.0 in</td></tr> <tr><td>Left Side Slope:</td><td>3.000 H:V</td></tr> <tr><td>Right Side Slope:</td><td>3.000 H:V</td></tr> <tr><td>Bottom Width:</td><td>1.00 ft</td></tr> <tr><td>Discharge:</td><td>70.53 cfs</td></tr> </table>	Roughness Coefficient	0.030 ...	Channel Slope:	0.010 ft/ft	Normal Depth:	24.0 in	Left Side Slope:	3.000 H:V	Right Side Slope:	3.000 H:V	Bottom Width:	1.00 ft	Discharge:	70.53 cfs	<table style="width: 100%; border-collapse: collapse;"> <tr><td>Flow Area:</td><td>14.0 ft²</td></tr> <tr><td>Wetted Perimeter:</td><td>13.6 ft</td></tr> <tr><td>Hydraulic Radius:</td><td>12.3 in</td></tr> <tr><td>Top Width:</td><td>13.00 ft</td></tr> <tr><td>Critical Depth:</td><td>22.4 in</td></tr> <tr><td>Critical Slope:</td><td>0.014 ft/ft</td></tr> <tr><td>Velocity:</td><td>5.04 ft/s</td></tr> <tr><td>Velocity Head:</td><td>0.39 ft</td></tr> <tr><td>Specific Energy:</td><td>2.39 ft</td></tr> <tr><td>Froude Number:</td><td>0.856</td></tr> <tr><td>Flow Type:</td><td>Subcritical</td></tr> </table>	Flow Area:	14.0 ft²	Wetted Perimeter:	13.6 ft	Hydraulic Radius:	12.3 in	Top Width:	13.00 ft	Critical Depth:	22.4 in	Critical Slope:	0.014 ft/ft	Velocity:	5.04 ft/s	Velocity Head:	0.39 ft	Specific Energy:	2.39 ft	Froude Number:	0.856	Flow Type:	Subcritical
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Flow Type:	Subcritical																																				

i Calculation Successful.

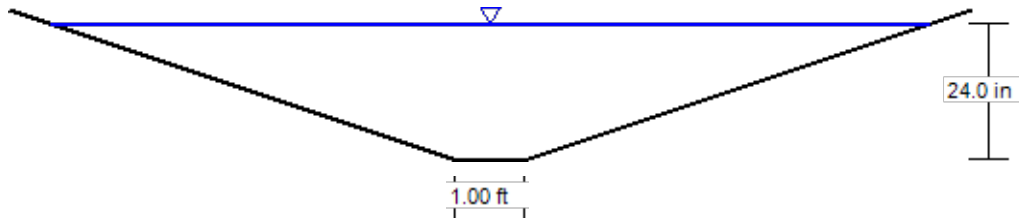
Cross Section for MAX SLOPE CAP ROADSIDE DITCH

Project Description

Friction Method	Manning
	Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030
Channel Slope	0.060 ft/ft
Normal Depth	24.0 in
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	1.00 ft
Discharge	172.75 cfs



V: 1
H: 1

Worksheet : MAX SLOPE CAP ROADSIDE DITCH

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Discharge Friction Method: Manning Formula

Roughness Coefficient	0.030	...	Flow Area:	14.0	ft ²
Channel Slope:	0.060	ft/ft	Wetted Perimeter:	13.6	ft
Normal Depth:	24.0	in	Hydraulic Radius:	12.3	in
Left Side Slope:	3.000	H:V	Top Width:	13.00	ft
Right Side Slope:	3.000	H:V	Critical Depth:	32.9	in
Bottom Width:	1.00	ft	Critical Slope:	0.012	ft/ft
Discharge:	172.75	cfs	Velocity:	12.34	ft/s
			Velocity Head:	2.37	ft
			Specific Energy:	4.37	ft
			Froude Number:	2.096	
			Flow Type:	Supercritical	

Calculation Successful.

Cross Section for MIN SLOPE CAP 15" RCP

Project Description

Friction Method

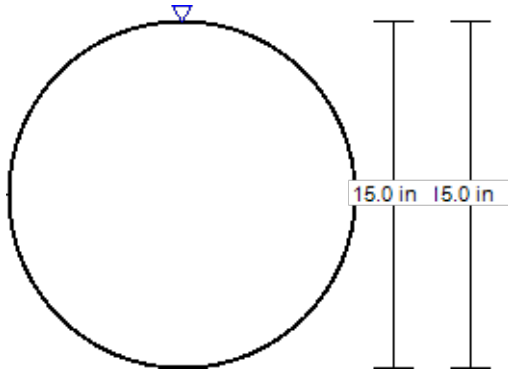
Manning
Formula

Solve For

Discharge

Input Data

Roughness Coefficient	0.013
Channel Slope	0.060 ft/ft
Normal Depth	15.0 in
Diameter	15.0 in
Discharge	15.82 cfs



V: 1
H: 1

Worksheet : MIN SLOPE CAP 15" RCP

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Discharge Friction Method: Manning Formula

Roughness Coefficient	0.013	Flow Area:	1.2	ft ²
Channel Slope:	0.060 ft/ft	Wetted Perimeter:	3.9	ft
Normal Depth:	15.0 in	Hydraulic Radius:	3.8	in
Diameter:	15.0 in	Top Width:	0.00	ft
Discharge:	15.82 cfs	Critical Depth:	14.9	in
		Percent Full:	100.0	%
		Critical Slope:	0.055	ft/ft
		Velocity:	12.89	ft/s
		Velocity Head:	2.58	ft
		Specific Energy:	3.83	ft
		Froude Number:	(N/A)	
		Maximum Discharge:	17.02	cfs
		Discharge Full:	15.82	cfs
		Slope Full:	0.060	ft/ft
		Flow Type:	Undefined	

Calculation Successful.

Cross Section for MAX SLOPE CAP 15" RCP

Project Description

Friction Method

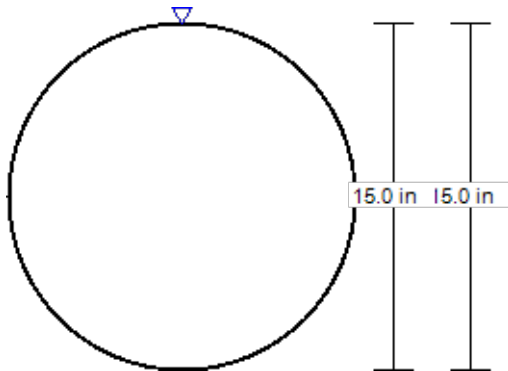
Manning
Formula

Solve For

Discharge

Input Data

Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	15.0 in
Diameter	15.0 in
Discharge	4.57 cfs



V: 1
H: 1

Worksheet : MAX SLOPE CAP 15" RCP

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Discharge Friction Method: Manning Formula

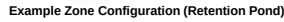
Roughness Coefficient	0.013	Flow Area:	1.2	ft²
Channel Slope:	0.005 ft/ft	Wetted Perimeter:	3.9	ft
Normal Depth:	15.0 in	Hydraulic Radius:	3.8	in
Diameter:	15.0 in	Top Width:	0.00	ft
Discharge:	4.57 cfs	Critical Depth:	10.4	in
		Percent Full:	100.0	%
		Critical Slope:	0.007	ft/ft
		Velocity:	3.72	ft/s
		Velocity Head:	0.22	ft
		Specific Energy:	1.47	ft
		Froude Number:	(N/A)	
		Maximum Discharge:	4.91	cfs
		Discharge Full:	4.57	cfs
		Slope Full:	0.005	ft/ft
		Flow Type:	Undefined	

Calculation Successful.

APPENDIX D
DETENTION POND CACLULATIONS

Pond Summary Table												
Pond	Major Drainage Basin Outfalling To	Major Drainage Basin	Tributary Proposed Basin(s)	Proposed Basin Area (AC)	%I	Cumulative Area (AC)	Total %I	WQCV Requirements (AC-FT)	Required EURV/5YR (AC-FT)	Required TOTAL Detention Volume (AC-FT)	Provided Volume (AC-FT)	100 YEAR OUTFLOW
A	Cottonwood Creek	Cottonwood Creek	CW-P1	6.48	42.2%	11.56	40.4%	0.174	0.26	0.821	1.227	8.4
			INCIDENTAL RUNOFF	0.3	5.0%							
			DC-P1	4.78	40.3%							
B	Cottonwood Creek	Cottonwood Creek	CW-P2	23.86	40.5%	23.86	40.5%	0.36	0.539	1.697	3.44	3.8
D	Happy Canyon Creek	Happy Canyon Creek	HC-P5	7.86	52.1%	7.86	52.1%	0.139	0.234	0.662	0.45	4.9
E	Happy Canyon Creek	Happy Canyon Creek	HC-P3	12.78	48.2%	21.81	39.1%	0.323	0.469	1.517	2.185	24.1
			HC-P4	3.97	39.0%							
			HC-P6	0.88	56.0%							
			E-OS4	4.18	7.9%							
F2	Big Dry Creek	Big Dry Creek	DC-P4	27.71	45.2%	27.71	45.2%	0.41	0.61	1.94	2.86	23.9
		Big Dry Creek										
F1	Big Dry Creek	Big Dry Creek	DC-P3	10.74	33.6%	10.74	33.6%	0.15	0.19	0.68	0.818	3
		Big Dry Creek										
G	Happy Canyon Creek	Happy Canyon Creek	HC-P1	11.72	45.8%	18	42.1%	0.278	0.429	1.313	2.86	22.8
		Cottonwood Creek	CW-P4	6.28	35.1%							
H	Happy Canyon Creek	Happy Canyon Creek	HC-P2	24.18	45.8%	24.18	45.8%	0.393	0.624	1.864	2.51	23.1
I	Big Dry Creek	Big Dry Creek	DC-P5	6.6	38.8%	15.72	20.5%	0.15	0.13	0.759	0.856	17.8
		Big Dry Creek	DC-E8	3.59	10.7%							
		Big Dry Creek	DC-E9	5.53	5.0%							
J	Big Dry Creek	Big Dry Creek	P-AS	2.81	65.0%	10.25	43.9%	0.162	0.259	0.768	1.069	15.8
		Big Dry Creek	DC-P2	7.44	35.9%							
K	Happy Canyon Creek	Happy Canyon Creek	HC-P7	6.5	44.2%	11.77	43.1%	0.184	0.29	0.872	1.566	20
		Happy Canyon Creek	HC-P8	5.27	41.7%							

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Basin ID: POND A

6280

Note: L / W Ratio > 9.04
L / W Ratio = 9.04

Optional User Overrides

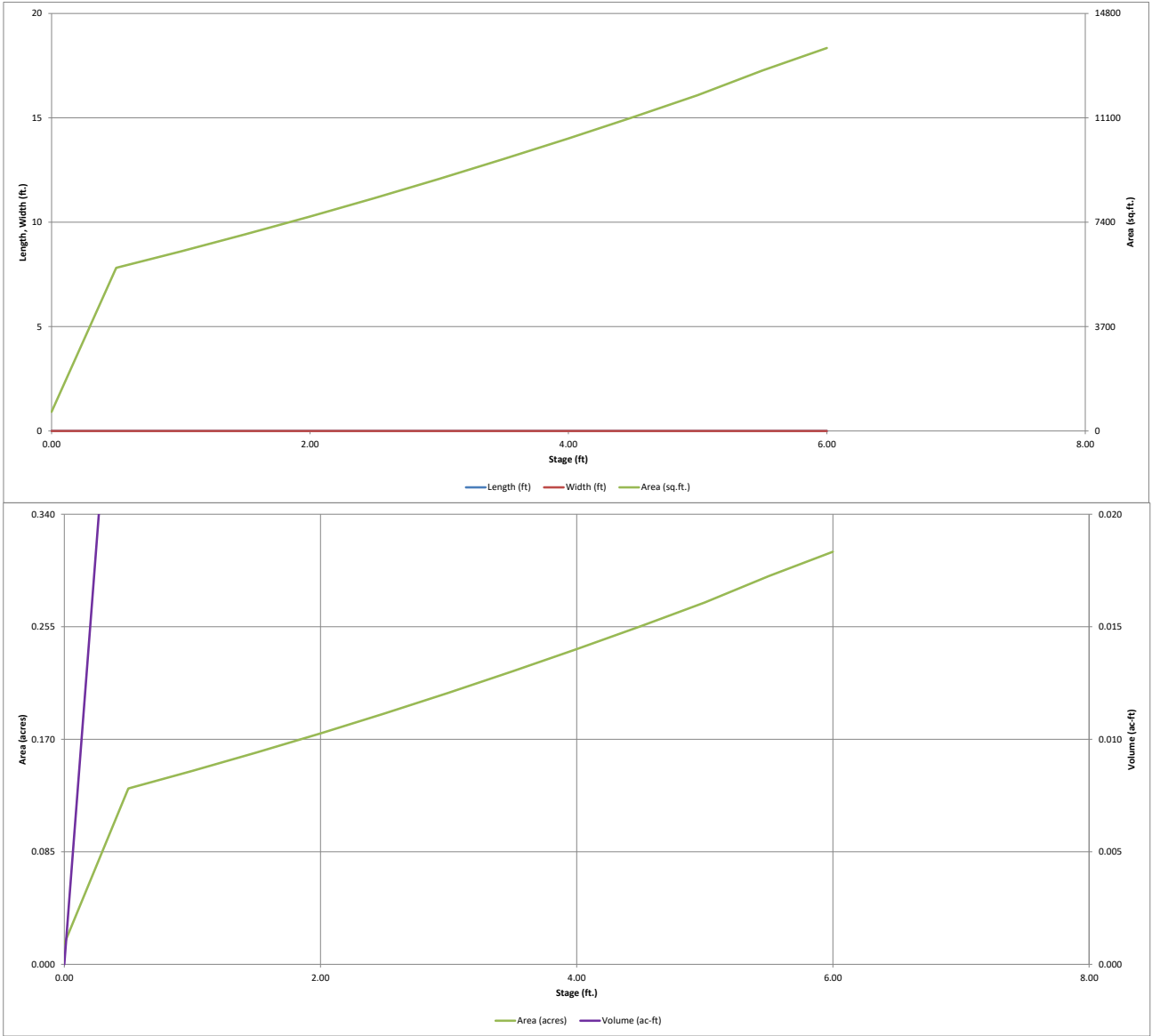
[illegible]

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

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

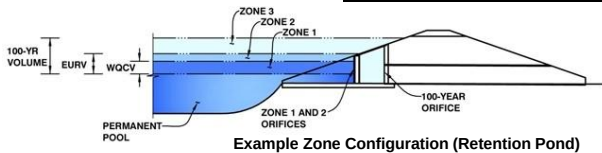


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: POND A



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.45	0.174	
Zone 2 (EURV)	2.90	0.260	
Zone 3 (100-year)	4.58	0.387	
Total (all zones)		0.821	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area = N/A ft²
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 SCM)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 1.49 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 6.00 inches
Orifice Plate: Orifice Area per Row = 1.35 sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row = 9.375E-03 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	0.99					
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 = 1.45 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 2.90 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter or Height = 2.00 inches
Vertical Orifice Width = 1.16 inches

Calculated Parameters for Vertical Orifice

Not Selected	Not Selected
Vertical Orifice Area = 0.02 ft ²	Vertical Orifice Centroid = N/A feet

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

Not Selected	Not Selected
Overflow Weir Front Edge Height, H _o = 2.86 ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H _g = 4.86 feet
Overflow Weir Front Edge Length = 1.00 feet	Overflow Weir Slope Length = 8.25 feet
Overflow Weir Grate Slope = 4.00 H:V	Grate Open Area / 100-yr Orifice Area = 9.18
Horiz. Length of Weir Sides = 8.00 feet	Overflow Grate Open Area w/o Debris = 5.74 ft ²
Overflow Grate Type = Type C Grate	Overflow Grate Open Area w/ Debris = 2.87 ft ²
Debris Clogging % = 50%	

Calculated Parameters for Overflow Weir

Not Selected	Not Selected
Height of Grate Upper Edge, H _g = 4.86 feet	Overflow Weir Slope Length = 8.25 feet
Overflow Weir Slope Length = 8.25 feet	Grate Open Area / 100-yr Orifice Area = 9.18
Grate Open Area / 100-yr Orifice Area = 9.18	Overflow Grate Open Area w/o Debris = 5.74 ft ²
Overflow Grate Open Area w/o Debris = 5.74 ft ²	Overflow Grate Open Area w/ Debris = 2.87 ft ²

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

Not Selected	Not Selected
Depth to Invert of Outlet Pipe = 3.00 ft (distance below basin bottom at Stage = 0 ft)	Circular Orifice Diameter = 18.00 inches
Circular Orifice Diameter = 18.00 inches	
	5.00

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Not Selected	Not Selected
Outlet Orifice Area = 0.63 ft ²	Outlet Orifice Centroid = 0.21 feet
Outlet Orifice Centroid = 0.21 feet	Half-Central Angle of Restrictor Plate on Pipe = N/A radians
Half-Central Angle of Restrictor Plate on Pipe = N/A radians	

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 5.50 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 10.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = 0.70 feet	Stage at Top of Freeboard = 7.20 feet
Stage at Top of Freeboard = 7.20 feet	Basin Area at Top of Freeboard = 0.31 acres
Basin Area at Top of Freeboard = 0.31 acres	Basin Volume at Top of Freeboard = 1.23 acre-ft

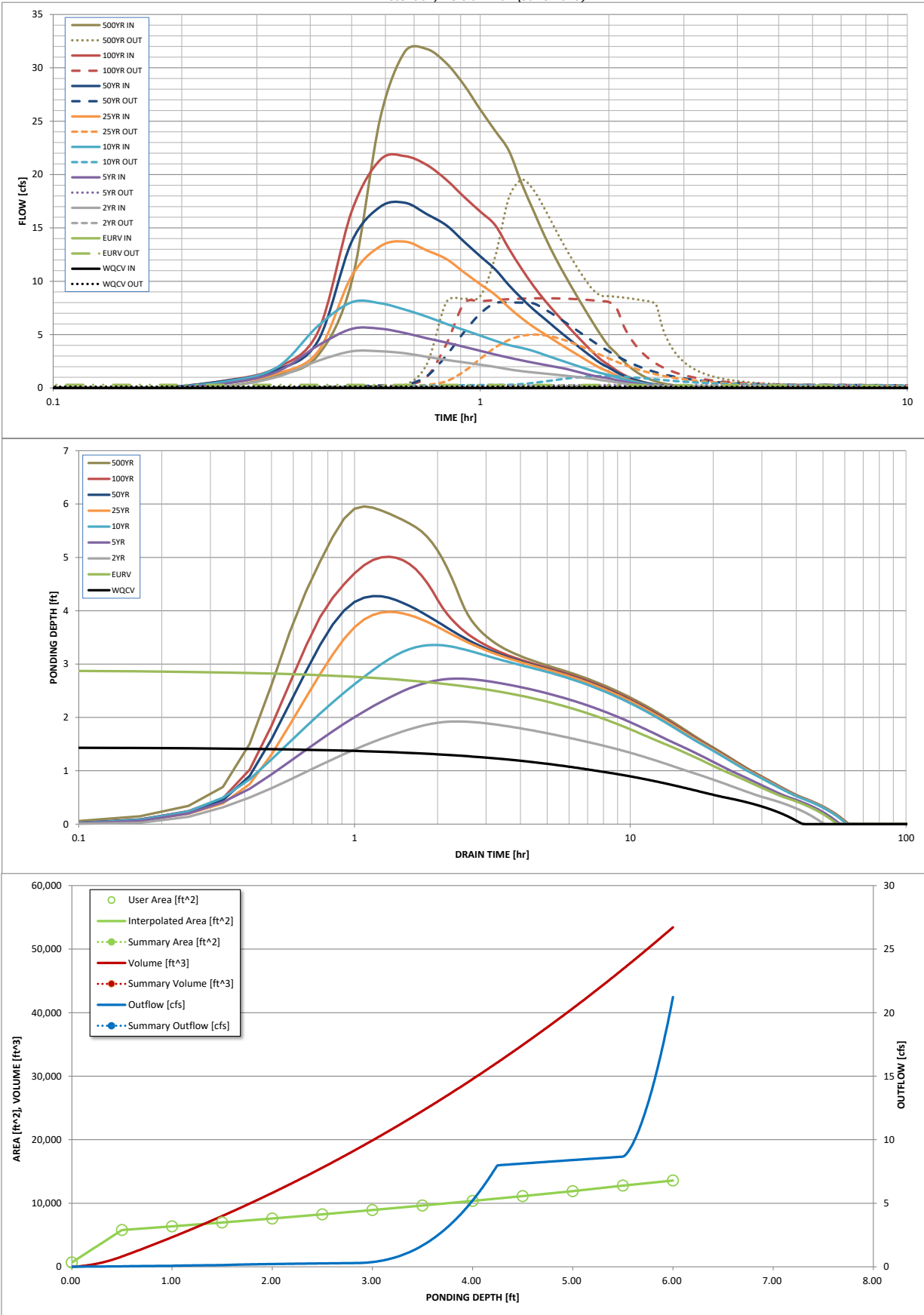
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	N/A	N/A	0.84	1.10	1.33	1.68	1.97	2.28	3.07
CUHP Runoff Volume (acre-ft) =	0.174	0.434	0.285	0.446	0.631	1.011	1.287	1.630	2.421
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.285	0.446	0.631	1.011	1.287	1.630	2.421
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.3	1.2	2.9	7.0	9.5	12.8	19.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.11	0.25	0.60	0.82	1.11	1.73
Peak Inflow Q (cfs) =	N/A	N/A	3.4	5.6	8.0	13.7	17.4	21.7	31.8
Peak Outflow Q (cfs) =	0.1	0.3	0.2	0.3	1.1	5.0	8.0	8.4	19.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.4	0.7	0.8	0.7	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	N/A	0.1	0.8	1.3	1.4	1.5
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) =	37	47	43	48	49	44	41	38	34
Time to Drain 99% of Inflow Volume (hours) =	40	52	47	53	55	53	52	51	47
Maximum Ponding Depth (ft) =	1.45	2.89	1.92	2.73	3.36	3.98	4.28	5.01	5.96
Area at Maximum Ponding Depth (acres) =	0.16	0.20	0.17	0.20	0.22	0.24	0.25	0.27	0.31
Maximum Volume Stored (acre-ft) =	0.175	0.434	0.253	0.400	0.530	0.671	0.744	0.936	1.211

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
	0:15:00	0	0.00	0.14	0.40	0.58	0.44	0.64	0.66	1.13
	0:20:00	0	0.00	1.02	1.51	1.90	1.34	1.69	1.88	3.04
	0:25:00	0	0.00	2.54	3.97	5.80	3.40	4.39	5.24	9.96
	0:30:00	0	0.00	3.44	5.54	8.04	10.48	13.71	16.55	25.29
	0:35:00	0	0.00	3.44	5.56	7.94	13.28	16.98	21.38	31.53
	0:40:00	0	0.00	3.25	5.15	7.34	13.71	17.35	21.72	31.76
	0:45:00	0	0.00	2.92	4.66	6.69	12.89	16.29	20.90	30.42
	0:50:00	0	0.00	2.63	4.26	6.00	12.08	15.24	19.50	28.39
	0:55:00	0	0.00	2.40	3.86	5.43	10.84	13.71	17.91	26.10
	1:00:00	0	0.00	2.18	3.49	4.91	9.73	12.35	16.54	24.11
	1:05:00	0	0.00	1.98	3.14	4.43	8.74	11.13	15.27	22.25
	1:10:00	0	0.00	1.75	2.85	4.02	7.55	9.65	13.07	19.17
	1:15:00	0	0.00	1.58	2.59	3.76	6.55	8.41	11.17	16.59
	1:20:00	0	0.00	1.46	2.37	3.46	5.72	7.35	9.55	14.20
	1:25:00	0	0.00	1.35	2.17	3.10	5.04	6.47	8.20	12.19
	1:30:00	0	0.00	1.25	1.98	2.76	4.40	5.62	7.06	10.47
	1:35:00	0	0.00	1.15	1.80	2.45	3.80	4.85	6.03	8.92
	1:40:00	0	0.00	1.06	1.58	2.15	3.26	4.14	5.07	7.49
	1:45:00	0	0.00	0.96	1.36	1.87	2.75	3.47	4.19	6.17
	1:50:00	0	0.00	0.87	1.17	1.61	2.27	2.85	3.38	4.96
	1:55:00	0	0.00	0.74	1.02	1.40	1.84	2.30	2.66	3.93
	2:00:00	0	0.00	0.65	0.91	1.23	1.53	1.91	2.16	3.25
	2:05:00	0	0.00	0.53	0.74	1.01	1.18	1.49	1.65	2.50
	2:10:00	0	0.00	0.43	0.60	0.81	0.91	1.15	1.25	1.91
	2:15:00	0	0.00	0.35	0.48	0.66	0.71	0.89	0.95	1.45
	2:20:00	0	0.00	0.28	0.39	0.53	0.55	0.69	0.71	1.09
	2:25:00	0	0.00	0.23	0.31	0.42	0.43	0.54	0.53	0.81
	2:30:00	0	0.00	0.18	0.24	0.33	0.33	0.41	0.39	0.60
	2:35:00	0	0.00	0.14	0.19	0.25	0.25	0.31	0.29	0.45
	2:40:00	0	0.00	0.11	0.15	0.19	0.19	0.24	0.23	0.34
	2:45:00	0	0.00	0.09	0.11	0.15	0.15	0.18	0.18	0.27
	2:50:00	0	0.00	0.07	0.09	0.12	0.12	0.14	0.14	0.21
	2:55:00	0	0.00	0.05	0.07	0.09	0.09	0.11	0.11	0.16
	3:00:00	0	0.00	0.04	0.05	0.06	0.07	0.08	0.08	0.12
	3:05:00	0	0.00	0.03	0.03	0.04	0.05	0.05	0.05	0.08
	3:10:00	0	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.05
	3:15:00	0	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03
	3:20:00	0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MHFD-Detention, Version 4.07 (June 2025)

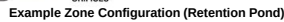
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

Station	Stage	Elevation	Area	Area	Volume	Volume	Total
---------	-------	-----------	------	------	--------	--------	-------

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

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

MHFD-Detention, Version 4.06 (July 2022)

Basin ID: POND B

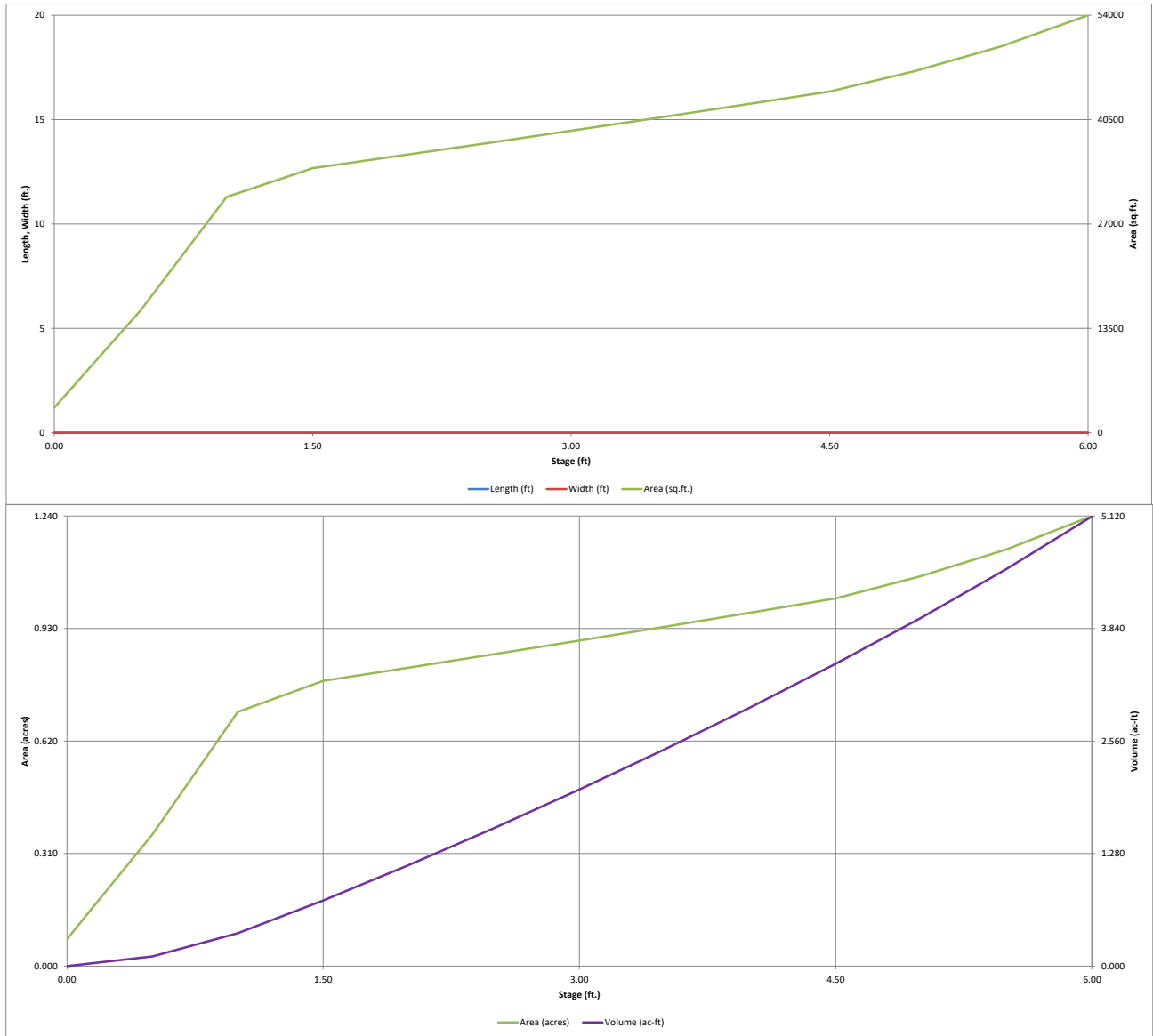
Optional User Overrides

Depth Increment =	0.50	ft
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12/11/2025, 11:58 AM

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

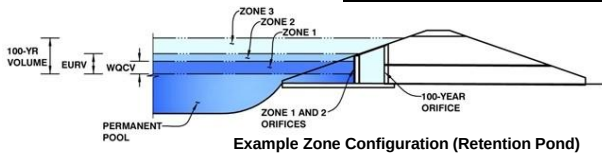


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.06 (July 2022)

Project:

Basin ID: POND B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.98	0.360	Orifice Plate
Zone 2 (EURV)	1.70	0.539	Rectangular Orifice
Zone 3 (100-year)	2.65	0.798	Weir&Pipe (Restrict)
Total (all zones)		1.697	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = N/A ft²
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)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 0.98 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 3.90 inches
Orifice Plate: Orifice Area per Row = 2.98 sq. inches (diameter = 1-15/16 inches)

Calculated Parameters for Plate
WQ Orifice Area per Row = 2.069E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	0.33	0.65					
Orifice Area (sq. inches)	2.98	2.98	2.98					

	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 = 0.98 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 1.70 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height = 2.00 inches
Vertical Orifice Width = 5.99 inches

Calculated Parameters for Vertical Orifice
Zone 2 Rectangular Not Selected
Vertical Orifice Area = 0.08 ft²
Vertical Orifice Centroid = 0.08 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_o = 1.70 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 14.00 feet
Overflow Weir Grate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 8.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
Height of Grate Upper Edge, H_u = 3.70 feet
Overflow Weir Slope Length = 8.25 feet
Grate Open Area / 100-yr Orifice Area = 251.62
Overflow Grate Open Area w/o Debris = 80.35 ft²
Overflow Grate Open Area w/ Debris = 40.18 ft²

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

Depth to Invert of Outlet Pipe = 2.50 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 21.00 inches
Restrictor Plate Height Above Pipe Invert = 4.00 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Zone 3 Restrictor Not Selected
Outlet Orifice Area = 0.32 ft²
Outlet Orifice Centroid = 0.20 feet
Half-Central Angle of Restrictor Plate on Pipe = 0.90 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 4.50 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 12.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.86 feet
Stage at Top of Freeboard = 6.36 feet
Basin Area at Top of Freeboard = 1.24 acres
Basin Volume at Top of Freeboard = 5.11 acre-ft

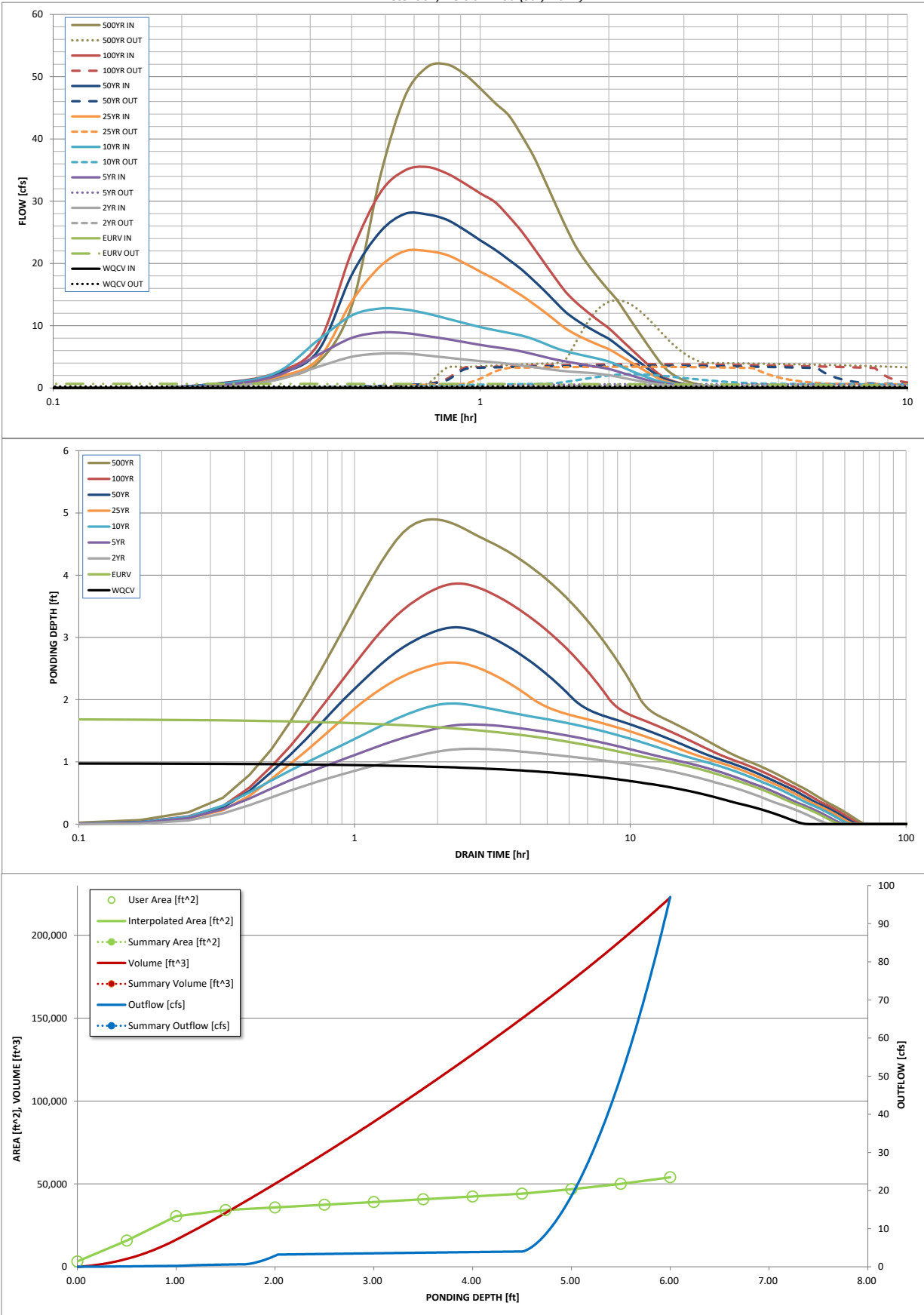
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.360	0.899	0.596	0.933	1.318	2.112	2.689	3.407	5.061
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.596	0.933	1.318	2.112	2.689	3.407	5.061
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.2	1.5	4.0	10.5	14.4	19.8	31.1
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.06	0.17	0.44	0.60	0.83	1.30
Peak Inflow Q (cfs) =	N/A	N/A	5.5	8.9	12.8	22.0	28.0	35.5	52.0
Peak Outflow Q (cfs) =	0.2	0.7	0.4	0.6	2.2	3.4	3.6	3.8	14.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.3	0.2	0.2	0.5
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	46	44	48	48	45	44	44	41
Time to Drain 99% of Inflow Volume (hours) =	40	52	48	54	55	55	55	55	54
Maximum Ponding Depth (ft) =	0.98	1.70	1.21	1.60	1.94	2.60	3.16	3.87	4.90
Area at Maximum Ponding Depth (acres) =	0.69	0.80	0.74	0.79	0.82	0.87	0.91	0.96	1.06
Maximum Volume Stored (acre-ft) =	0.361	0.905	0.526	0.826	1.091	1.647	2.152	2.807	3.844

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
	0:15:00	0.00	0.00	0.16	0.48	0.70	0.54	0.78	0.81	1.42
	0:20:00	0.00	0.00	1.28	1.95	2.48	1.75	2.23	2.48	4.04
	0:25:00	0.00	0.00	3.38	5.29	7.66	4.57	5.90	6.99	13.13
	0:30:00	0.00	0.00	5.01	8.04	11.64	13.89	18.15	21.86	33.98
	0:35:00	0.00	0.00	5.52	8.90	12.76	19.54	25.09	31.35	46.85
	0:40:00	0.00	0.00	5.53	8.82	12.60	21.99	27.97	34.95	51.51
	0:45:00	0.00	0.00	5.22	8.34	11.96	22.00	27.88	35.50	51.99
	0:50:00	0.00	0.00	4.88	7.87	11.17	21.39	27.05	34.50	50.47
	0:55:00	0.00	0.00	4.58	7.37	10.43	20.08	25.44	32.90	48.13
	1:00:00	0.00	0.00	4.31	6.92	9.78	18.69	23.72	31.27	45.77
	1:05:00	0.00	0.00	4.11	6.55	9.28	17.45	22.21	29.85	43.77
	1:10:00	0.00	0.00	3.86	6.24	8.84	16.12	20.59	27.55	40.56
	1:15:00	0.00	0.00	3.61	5.86	8.41	14.86	19.03	25.16	37.21
	1:20:00	0.00	0.00	3.35	5.41	7.83	13.50	17.28	22.54	33.34
	1:25:00	0.00	0.00	3.10	4.97	7.12	12.16	15.56	19.99	29.55
	1:30:00	0.00	0.00	2.87	4.57	6.43	10.83	13.82	17.61	26.02
	1:35:00	0.00	0.00	2.69	4.27	5.91	9.58	12.22	15.48	22.97
	1:40:00	0.00	0.00	2.57	3.99	5.53	8.67	11.06	13.92	20.69
	1:45:00	0.00	0.00	2.47	3.74	5.20	7.95	10.13	12.66	18.83
	1:50:00	0.00	0.00	2.38	3.50	4.90	7.33	9.32	11.54	17.18
	1:55:00	0.00	0.00	2.23	3.28	4.59	6.76	8.58	10.54	15.67
	2:00:00	0.00	0.00	2.06	3.06	4.25	6.24	7.90	9.60	14.27
	2:05:00	0.00	0.00	1.84	2.72	3.76	5.54	7.01	8.48	12.58
	2:10:00	0.00	0.00	1.60	2.36	3.26	4.83	6.09	7.37	10.90
	2:15:00	0.00	0.00	1.38	2.03	2.78	4.15	5.22	6.32	9.31
	2:20:00	0.00	0.00	1.18	1.71	2.34	3.49	4.39	5.31	7.78
	2:25:00	0.00	0.00	0.99	1.41	1.92	2.88	3.60	4.35	6.34
	2:30:00	0.00	0.00	0.81	1.14	1.54	2.29	2.85	3.42	4.96
	2:35:00	0.00	0.00	0.64	0.90	1.21	1.74	2.16	2.57	3.72
	2:40:00	0.00	0.00	0.52	0.72	0.97	1.29	1.61	1.88	2.78
	2:45:00	0.00	0.00	0.43	0.60	0.81	0.99	1.24	1.42	2.12
	2:50:00	0.00	0.00	0.36	0.50	0.67	0.77	0.97	1.09	1.63
	2:55:00	0.00	0.00	0.30	0.41	0.56	0.61	0.77	0.83	1.25
	3:00:00	0.00	0.00	0.25	0.34	0.46	0.48	0.60	0.63	0.95
	3:05:00	0.00	0.00	0.21	0.28	0.38	0.39	0.48	0.47	0.72
	3:10:00	0.00	0.00	0.18	0.23	0.31	0.31	0.38	0.36	0.55
	3:15:00	0.00	0.00	0.15	0.19	0.25	0.25	0.31	0.28	0.44
	3:20:00	0.00	0.00	0.12	0.15	0.20	0.20	0.24	0.23	0.35
	3:25:00	0.00	0.00	0.10	0.12	0.16	0.16	0.19	0.18	0.28
	3:30:00	0.00	0.00	0.08	0.10	0.12	0.12	0.15	0.15	0.22
	3:35:00	0.00	0.00	0.06	0.07	0.09	0.10	0.11	0.11	0.17
	3:40:00	0.00	0.00	0.04	0.05	0.07	0.07	0.08	0.08	0.12
	3:45:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.08
	3:50:00	0.00	0.00	0.02	0.02	0.03	0.03	0.04	0.04	0.05
	3:55:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	4:00:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	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 4.06 (July 2022)

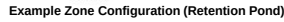
Summary Stage-Area-Volume-Discharge Relationships

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

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

[illegible]

MHFD-Detention, Version 4.07 (June 2025)

Basin ID: POND D

6292.5

Note: L / W Ratio >
L / W Ratio = 10.48

Optional User Overrides

[illegible]

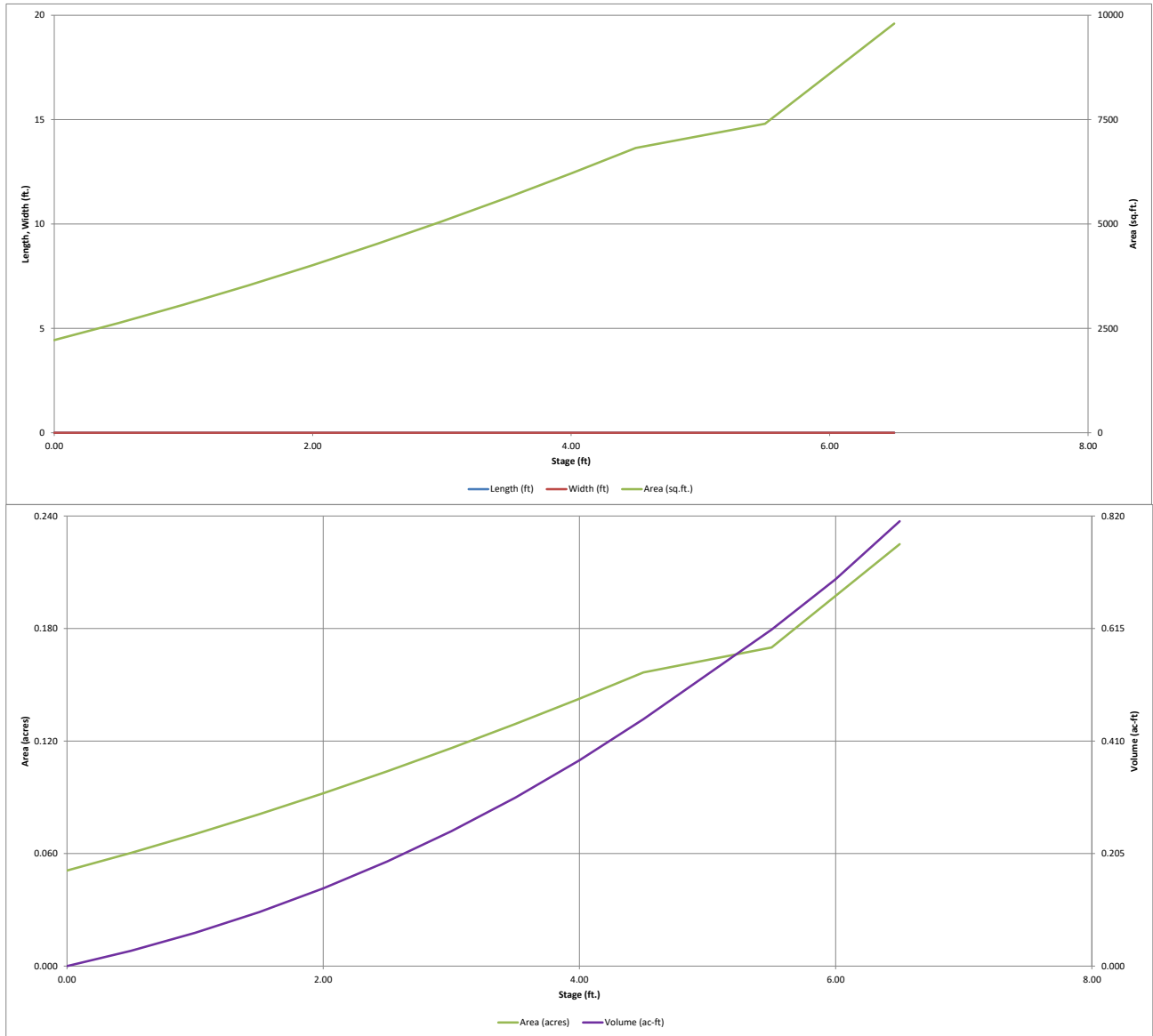
Total detention volume is less than 100-year volume.

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

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

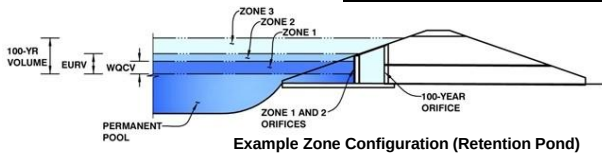


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project: **HILLCAMP - RIDGEGATE**

Basin ID: **POND D**



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.97	0.139	Orifice Plate
Zone 2 (EURV)	4.10	0.250	Circular Orifice
Zone 3			
Total (all zones)		0.389	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = ft²
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 SCM)

Centroid 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 = 1-1/8 inches)

Calculated Parameters for Plate
WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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	0.43	0.85					
Orifice Area (sq. inches)	0.98	0.98	0.98					

	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 = ft²
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_o = 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
Not Selected Not Selected
Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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
Not Selected Not Selected
Outlet Orifice Area = ft²
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

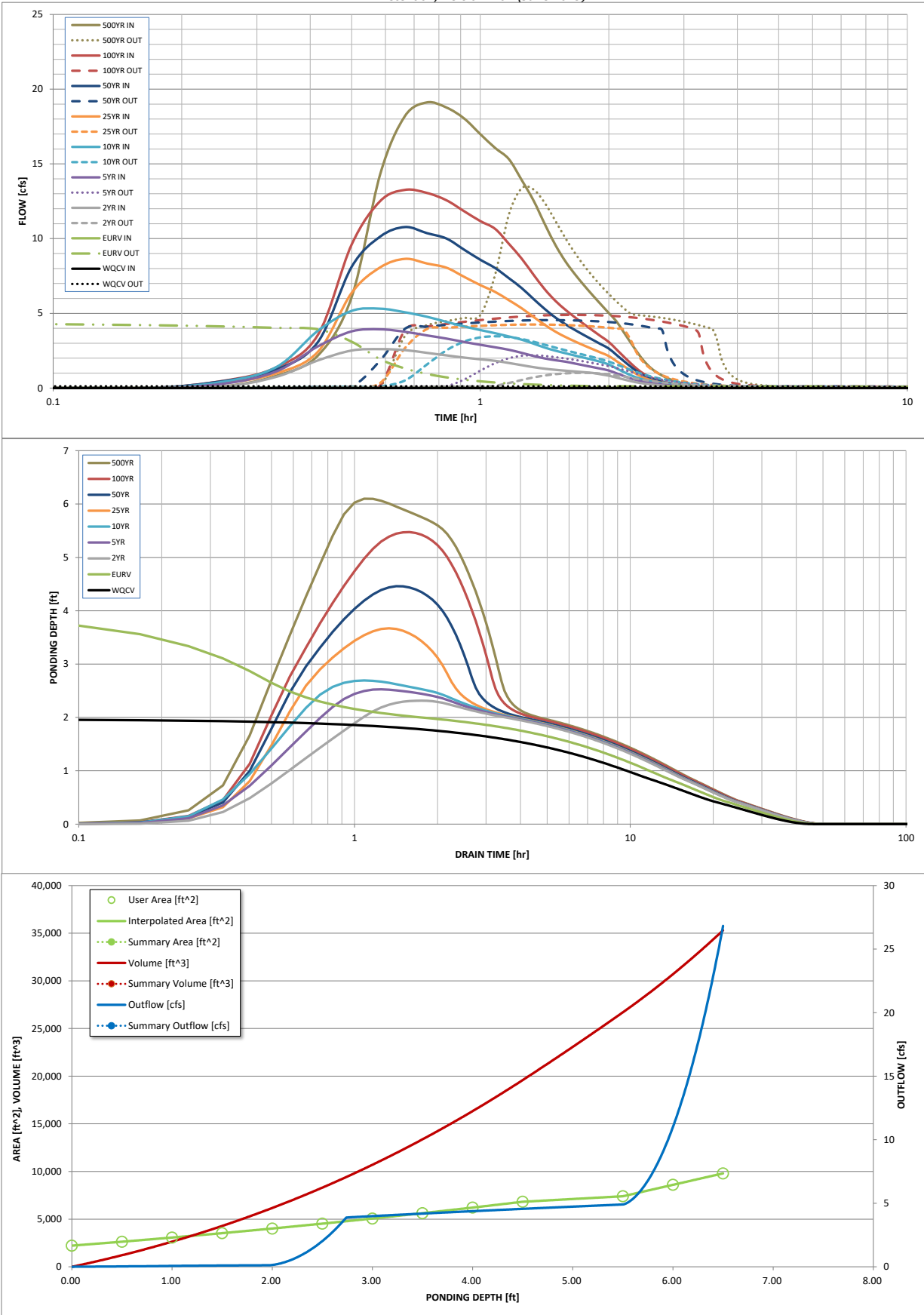
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.139	0.389	0.259	0.386	0.521	0.779	0.972	1.204	1.752
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.259	0.386	0.521	0.779	0.972	1.204	1.752
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.6	1.3	3.4	4.6	6.2	9.7
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.07	0.17	0.43	0.58	0.79	1.23
Peak Inflow Q (cfs) =	N/A	N/A	2.6	3.9	5.3	8.6	10.8	13.3	19.1
Peak Outflow Q (cfs) =	0.1	4.4	1.0	2.2	3.5	4.3	4.5	4.9	13.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	4.0	2.6	1.3	1.0	0.8	1.4
Structure Controlling Flow =	Vertical Orifice 1	Outlet Plate 1	N/A	N/A	N/A	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	0.00	0.37	0.08	0.2	0.3	0.4	0.4	0.4	0.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	35	30	35	32	29	24	22	20	16
Time to Drain 99% of Inflow Volume (hours) =	40	38	41	40	38	35	34	32	29
Maximum Ponding Depth (ft) =	1.98	4.10	2.31	2.53	2.69	3.67	4.46	5.47	6.10
Area at Maximum Ponding Depth (acres) =	0.09	0.15	0.10	0.10	0.11	0.13	0.16	0.17	0.20
Maximum Volume Stored (acre-ft) =	0.140	0.389	0.171	0.193	0.211	0.329	0.442	0.608	0.725

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
	0:15:00	0	0.00	0.10	0.29	0.42	0.32	0.47	0.48	0.82
	0:20:00	0	0.00	0.75	1.12	1.41	0.99	1.25	1.39	2.17
	0:25:00	0	0.00	1.85	2.79	3.83	2.42	3.07	3.55	6.09
	0:30:00	0	0.00	2.51	3.79	5.16	6.37	8.11	9.61	14.32
	0:35:00	0	0.00	2.60	3.93	5.31	8.08	10.14	12.52	18.21
	0:40:00	0	0.00	2.54	3.76	5.07	8.65	10.77	13.26	19.11
	0:45:00	0	0.00	2.36	3.52	4.77	8.34	10.37	13.06	18.77
	0:50:00	0	0.00	2.19	3.31	4.43	8.05	10.01	12.57	18.04
	0:55:00	0	0.00	2.04	3.08	4.13	7.44	9.26	11.83	17.00
	1:00:00	0	0.00	1.92	2.90	3.88	6.89	8.59	11.18	16.07
	1:05:00	0	0.00	1.82	2.73	3.67	6.44	8.03	10.66	15.32
	1:10:00	0	0.00	1.68	2.56	3.45	5.88	7.36	9.66	13.93
	1:15:00	0	0.00	1.53	2.36	3.24	5.34	6.69	8.67	12.54
	1:20:00	0	0.00	1.40	2.15	2.97	4.76	5.96	7.58	10.97
	1:25:00	0	0.00	1.29	1.98	2.71	4.23	5.29	6.60	9.57
	1:30:00	0	0.00	1.22	1.86	2.50	3.77	4.72	5.83	8.47
	1:35:00	0	0.00	1.16	1.77	2.33	3.42	4.27	5.24	7.61
	1:40:00	0	0.00	1.11	1.64	2.18	3.12	3.89	4.73	6.88
	1:45:00	0	0.00	1.06	1.52	2.03	2.85	3.54	4.27	6.21
	1:50:00	0	0.00	1.01	1.40	1.89	2.60	3.23	3.86	5.60
	1:55:00	0	0.00	0.92	1.29	1.75	2.37	2.93	3.46	5.02
	2:00:00	0	0.00	0.83	1.17	1.58	2.14	2.64	3.09	4.47
	2:05:00	0	0.00	0.70	0.99	1.32	1.81	2.23	2.59	3.75
	2:10:00	0	0.00	0.58	0.81	1.08	1.48	1.82	2.12	3.05
	2:15:00	0	0.00	0.47	0.65	0.86	1.17	1.44	1.67	2.39
	2:20:00	0	0.00	0.37	0.52	0.69	0.90	1.10	1.26	1.82
	2:25:00	0	0.00	0.30	0.42	0.56	0.69	0.84	0.95	1.38
	2:30:00	0	0.00	0.25	0.35	0.47	0.54	0.66	0.73	1.07
	2:35:00	0	0.00	0.21	0.29	0.39	0.43	0.53	0.57	0.84
	2:40:00	0	0.00	0.17	0.24	0.32	0.34	0.42	0.44	0.65
	2:45:00	0	0.00	0.14	0.20	0.26	0.27	0.33	0.34	0.50
	2:50:00	0	0.00	0.12	0.16	0.21	0.22	0.26	0.26	0.38
	2:55:00	0	0.00	0.10	0.13	0.17	0.17	0.21	0.20	0.29
	3:00:00	0	0.00	0.08	0.10	0.14	0.14	0.17	0.16	0.23
	3:05:00	0	0.00	0.07	0.08	0.11	0.11	0.13	0.13	0.19
	3:10:00	0	0.00	0.05	0.07	0.09	0.09	0.11	0.10	0.15
	3:15:00	0	0.00	0.04	0.05	0.07	0.07	0.08	0.08	0.12
	3:20:00	0	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.09
	3:25:00	0	0.00	0.02	0.03	0.04	0.04	0.05	0.05	0.07
	3:30:00	0	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.05
	3:35:00	0	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	3:40:00	0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

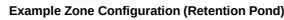
Summary Stage-Area-Volume-Discharge Relationships

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 4.07 (June 2025)

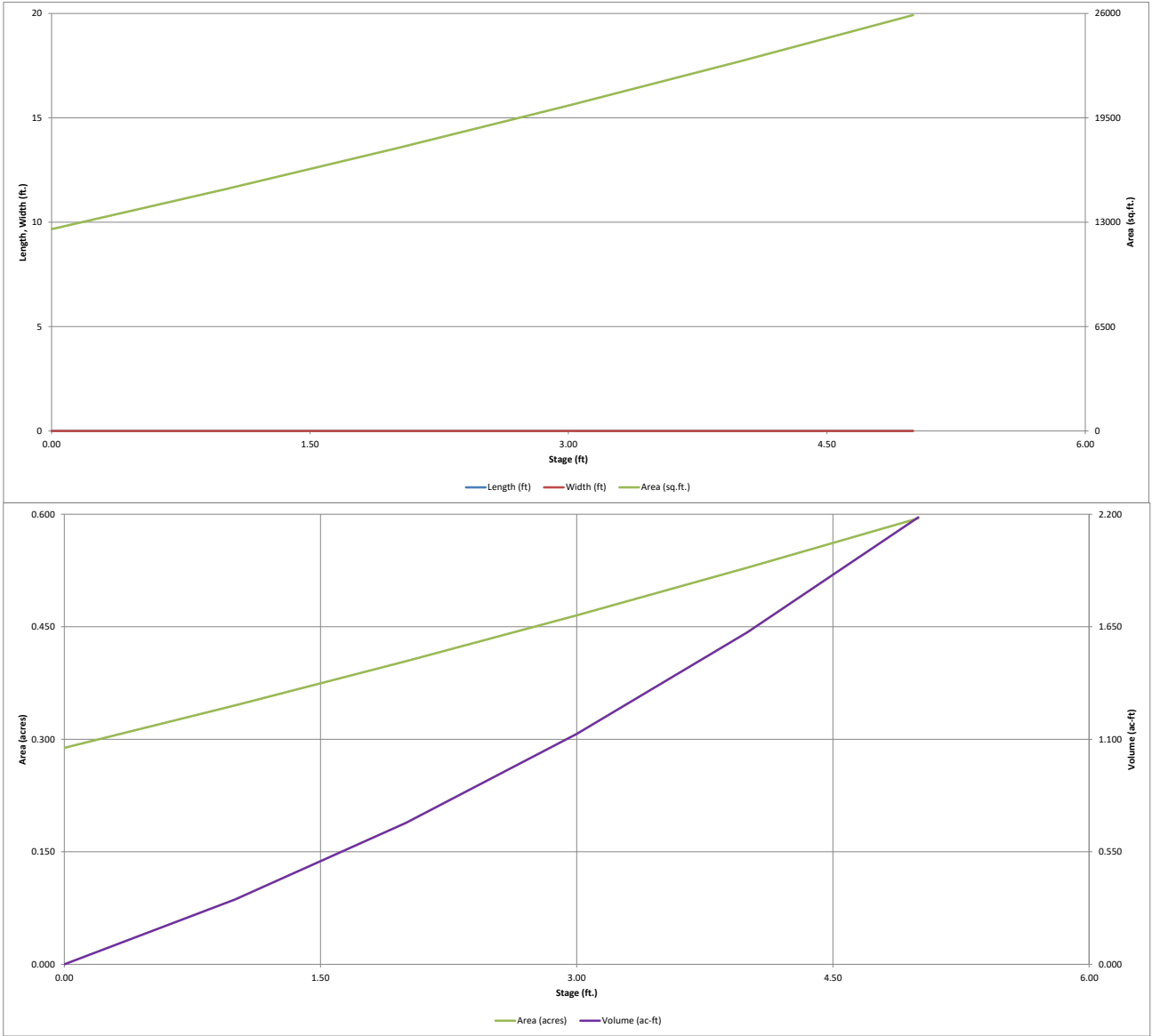
Basin ID: POND E[illegible]

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

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

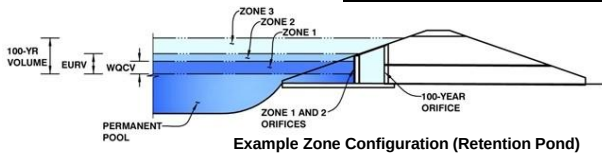


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: **POND E**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.02	0.323	Orifice Plate
Zone 2 (EURV)	2.25	0.469	Circular Orifice
Zone 3 (100-year)	3.80	0.726	Weir&Pipe (Restrict)
Total (all zones)		1.517	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = ft²
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 SCM)

Centroid 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 = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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	0.34	0.68					
Orifice Area (sq. inches)	4.01	4.01	4.01					

	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 = ft²
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_o = 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_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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 = ft²
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

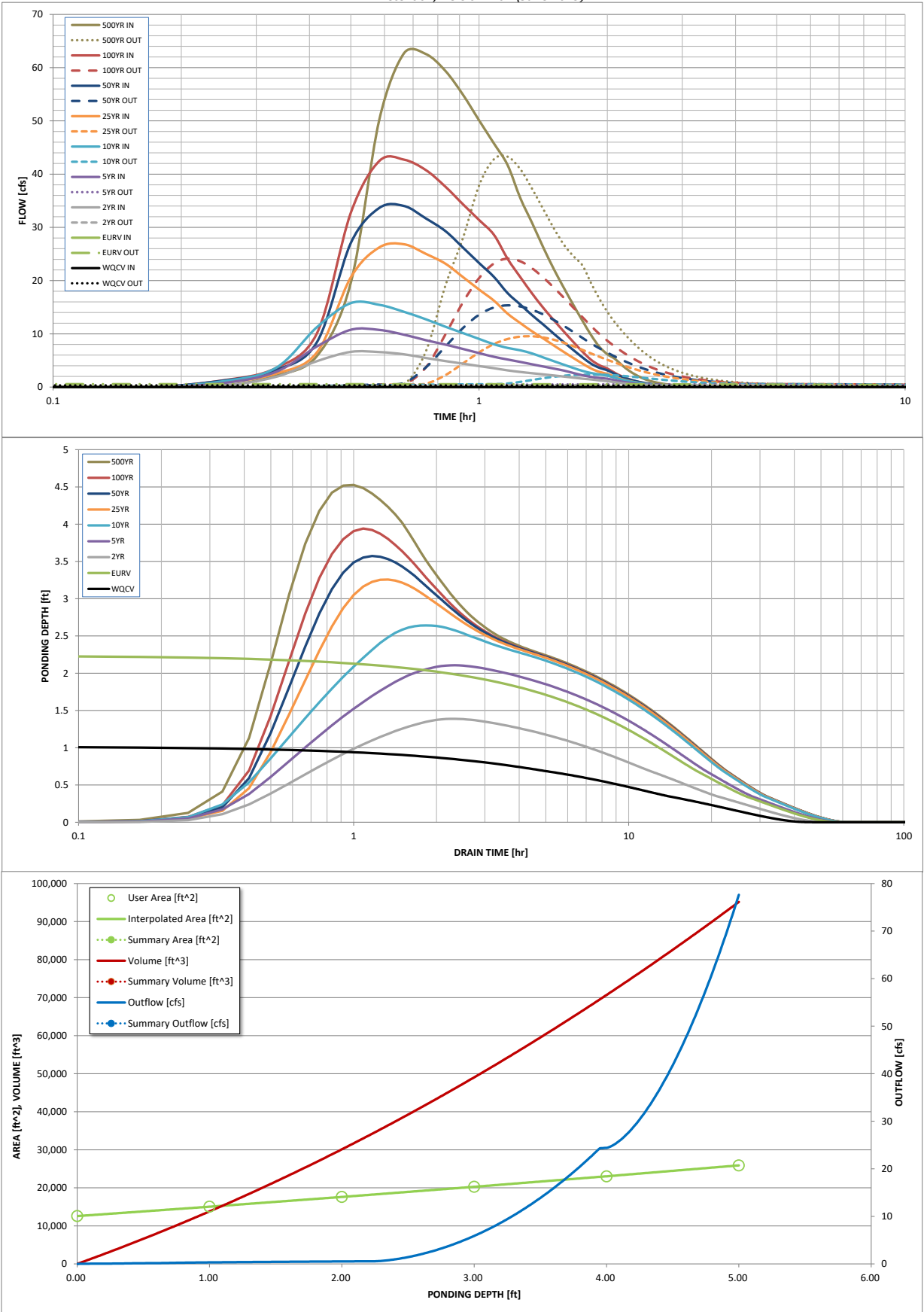
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.323	0.791	0.517	0.819	1.165	1.883	2.406	3.056	4.551
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.517	0.819	1.165	1.883	2.406	3.056	4.551
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.6	2.5	5.8	14.2	19.3	26.1	40.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.03	0.12	0.27	0.65	0.89	1.20	1.86
Peak Inflow Q (cfs) =	N/A	N/A	6.6	10.8	15.8	26.8	34.0	42.7	62.7
Peak Outflow Q (cfs) =	0.3	0.6	0.4	0.5	2.3	9.5	15.4	24.1	43.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.4	0.7	0.8	0.9	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.4	0.6	0.6
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) =	36	43	40	44	44	40	37	34	28
Time to Drain 99% of Inflow Volume (hours) =	40	50	45	51	52	50	48	46	42
Maximum Ponding Depth (ft) =	1.02	2.25	1.39	2.11	2.64	3.26	3.57	3.94	4.53
Area at Maximum Ponding Depth (acres) =	0.35	0.42	0.37	0.41	0.44	0.48	0.50	0.52	0.56
Maximum Volume Stored (acre-ft) =	0.324	0.794	0.452	0.732	0.963	1.244	1.402	1.591	1.907

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
	0:15:00	0	0.00	0.25	0.74	1.08	0.83	1.20	1.25	2.13
	0:20:00	0	0.00	1.92	2.85	3.59	2.53	3.19	3.56	5.86
	0:25:00	0	0.00	4.87	7.65	11.28	6.55	8.48	10.15	19.59
	0:30:00	0	0.00	6.61	10.76	15.77	20.61	27.06	32.74	50.24
	0:35:00	0	0.00	6.58	10.73	15.45	26.24	33.65	42.47	62.71
	0:40:00	0	0.00	6.16	9.84	14.13	26.82	34.02	42.72	62.56
	0:45:00	0	0.00	5.47	8.80	12.73	25.03	31.68	40.76	59.41
	0:50:00	0	0.00	4.88	7.98	11.34	23.19	29.31	37.66	54.92
	0:55:00	0	0.00	4.40	7.16	10.15	20.67	26.21	34.34	50.11
	1:00:00	0	0.00	3.95	6.38	9.05	18.32	23.31	31.39	45.78
	1:05:00	0	0.00	3.54	5.69	8.04	16.24	20.71	28.62	41.71
	1:10:00	0	0.00	3.14	5.18	7.36	13.79	17.65	24.10	35.49
	1:15:00	0	0.00	2.84	4.72	6.90	12.02	15.50	20.64	30.76
	1:20:00	0	0.00	2.60	4.27	6.30	10.44	13.47	17.53	26.14
	1:25:00	0	0.00	2.38	3.85	5.55	9.10	11.71	14.83	22.07
	1:30:00	0	0.00	2.18	3.46	4.85	7.78	9.98	12.51	18.57
	1:35:00	0	0.00	1.97	3.09	4.19	6.57	8.39	10.39	15.37
	1:40:00	0	0.00	1.77	2.63	3.58	5.44	6.92	8.43	12.42
	1:45:00	0	0.00	1.58	2.22	3.03	4.39	5.56	6.63	9.73
	1:50:00	0	0.00	1.44	1.90	2.64	3.48	4.38	5.10	7.55
	1:55:00	0	0.00	1.25	1.71	2.38	2.85	3.61	4.10	6.18
	2:00:00	0	0.00	1.12	1.57	2.14	2.48	3.15	3.48	5.31
	2:05:00	0	0.00	0.91	1.28	1.74	1.94	2.47	2.67	4.09
	2:10:00	0	0.00	0.73	1.01	1.39	1.49	1.89	1.99	3.07
	2:15:00	0	0.00	0.59	0.81	1.10	1.15	1.46	1.49	2.29
	2:20:00	0	0.00	0.47	0.64	0.86	0.89	1.12	1.09	1.69
	2:25:00	0	0.00	0.37	0.50	0.67	0.68	0.85	0.80	1.24
	2:30:00	0	0.00	0.29	0.39	0.51	0.52	0.65	0.61	0.94
	2:35:00	0	0.00	0.23	0.30	0.39	0.39	0.49	0.46	0.70
	2:40:00	0	0.00	0.18	0.22	0.29	0.30	0.37	0.35	0.54
	2:45:00	0	0.00	0.14	0.17	0.23	0.23	0.28	0.28	0.42
	2:50:00	0	0.00	0.10	0.13	0.17	0.17	0.21	0.21	0.32
	2:55:00	0	0.00	0.07	0.09	0.12	0.13	0.15	0.15	0.23
	3:00:00	0	0.00	0.05	0.06	0.08	0.09	0.11	0.10	0.15
	3:05:00	0	0.00	0.03	0.04	0.05	0.05	0.07	0.06	0.09
	3:10:00	0	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.05
	3:15:00	0	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MHFD-Detention, Version 4.07 (June 2025)

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.

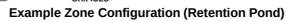
Station	Stage	Elevation	Area	Area	Volume	Volume	Total
---------	-------	-----------	------	------	--------	--------	-------

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

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

MHFD-Detention, Version 4.07 (June 2025)

Basin ID: POND F1

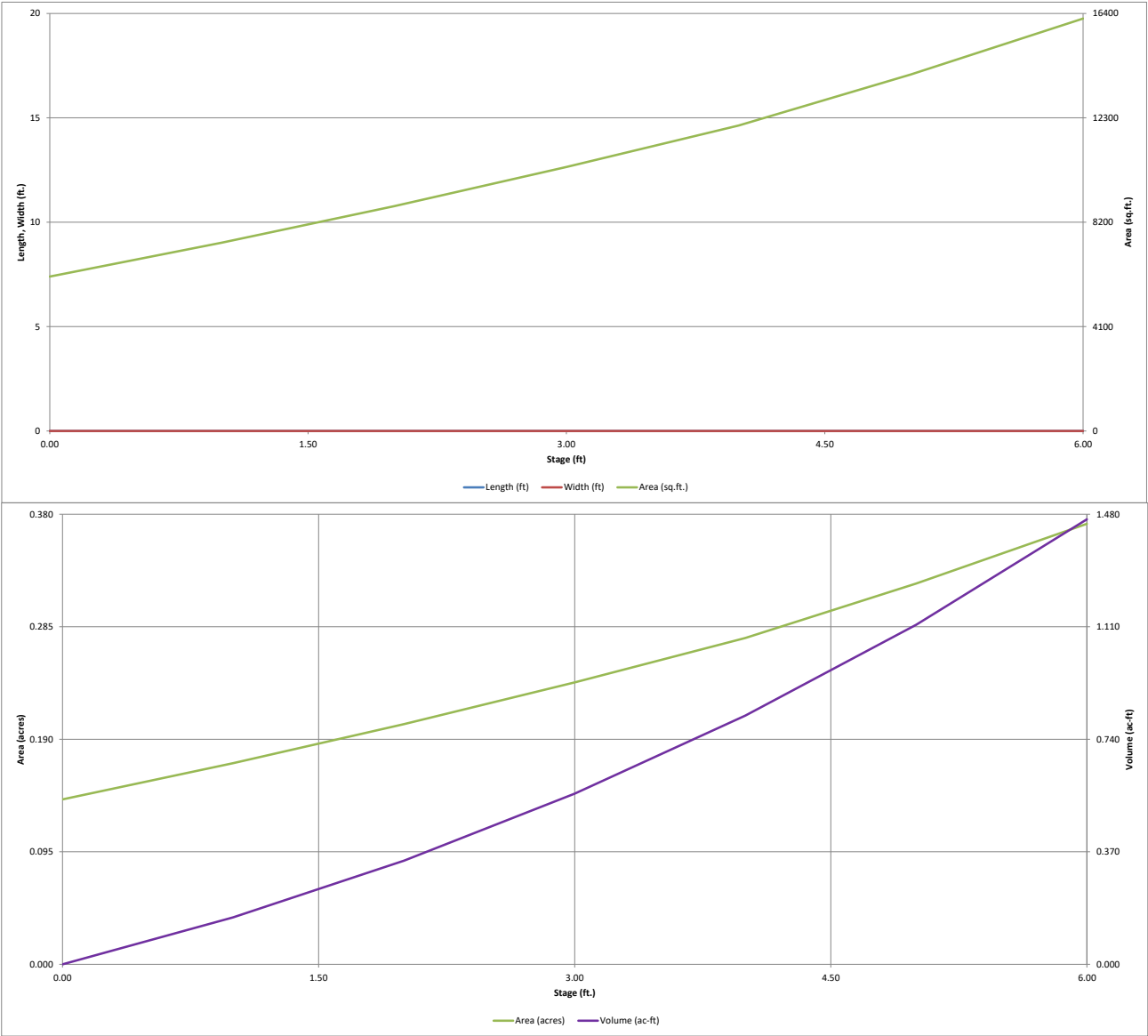
[illegible]

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

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

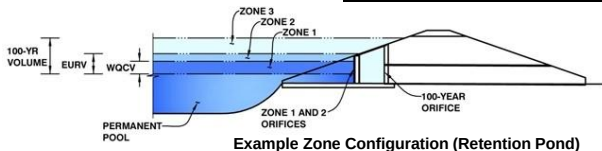


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: POND F1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.95	0.145	Orifice Plate
Zone 2 (EURV)	1.95	0.185	Circular Orifice
Zone 3 (100-year)	3.48	0.349	Weir&Pipe (Restrict)
Total (all zones)		0.679	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = N/A ft²
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 SCM)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 0.95 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 3.80 inches
Orifice Plate: Orifice Area per Row = 1.87 sq. inches (diameter = 1-1/2 inches)

Calculated Parameters for Plate
WQ Orifice Area per Row = 1.299E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	0.32	0.63					
Orifice Area (sq. inches)	1.87	1.87	1.87					

	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 = 0.95 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 1.95 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = 0.38 inches

Calculated Parameters for Vertical Orifice
Zone 2 Circular Not Selected
Vertical Orifice Area = 0.00 ft²
Vertical Orifice Centroid = 0.02 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_o = 1.95 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 1.00 feet
Overflow Weir Grate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 8.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
Height of Grate Upper Edge, H_u = 3.95 feet
Overflow Weir Slope Length = 8.25 feet
Grate Open Area / 100-yr Orifice Area = 19.63
Overflow Grate Open Area w/o Debris = 5.74 ft²
Overflow Grate Open Area w/ Debris = 2.87 ft²

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

Depth to Invert of Outlet Pipe = 0.50 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 18.00 inches
Restrictor Plate Height Above Pipe Invert = 4.00 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Zone 3 Restrictor Not Selected
Outlet Orifice Area = 0.29 ft²
Outlet Orifice Centroid = 0.20 feet
Half-Central Angle of Restrictor Plate on Pipe = 0.98 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 5.00 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 3.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.73 feet
Stage at Top of Freeboard = 6.73 feet
Basin Area at Top of Freeboard = 0.37 acres
Basin Volume at Top of Freeboard = 1.46 acre-ft

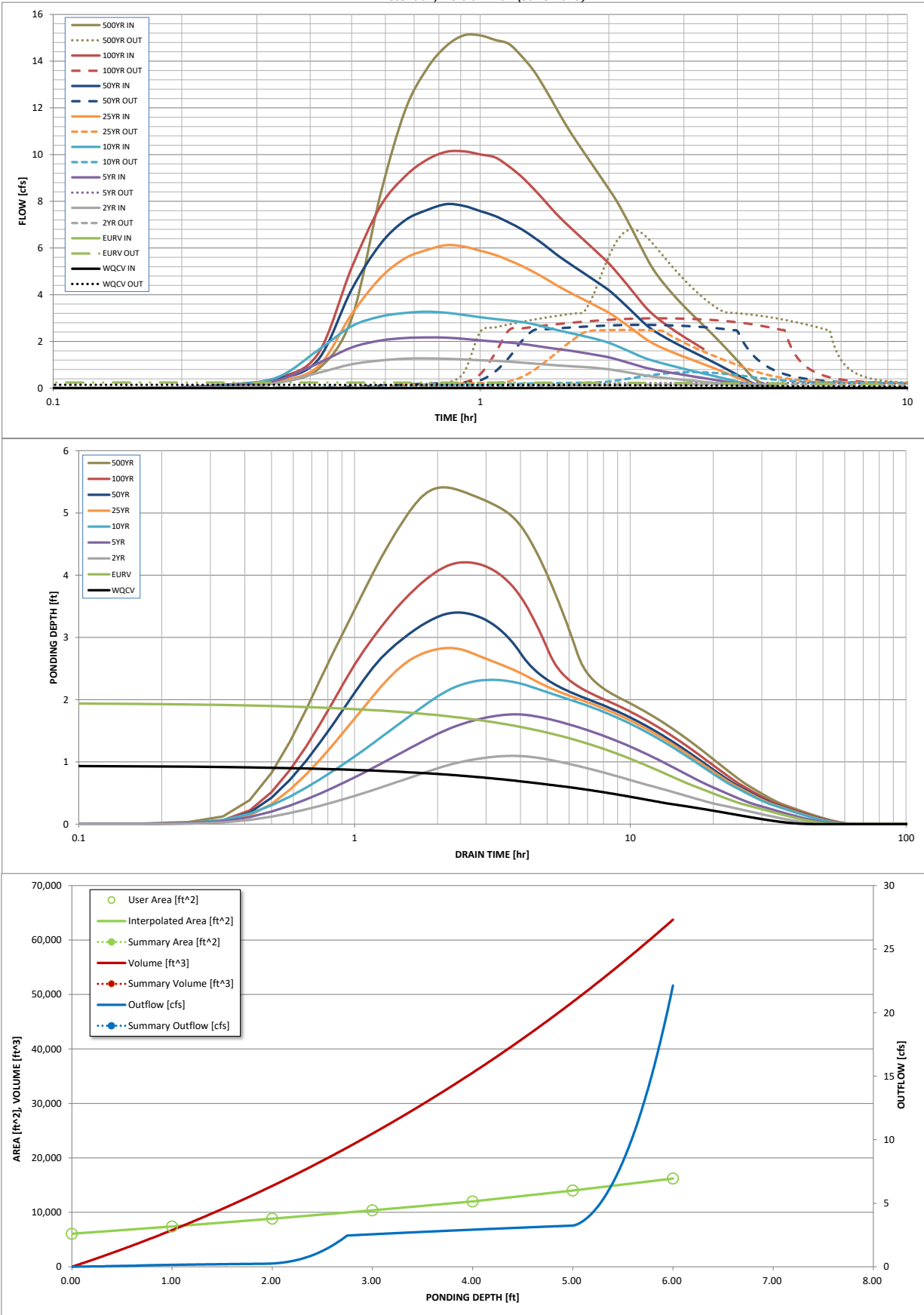
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.145	0.331	0.212	0.353	0.522	0.880	1.139	1.465	2.205
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.212	0.353	0.522	0.880	1.139	1.465	2.205
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.6	1.3	3.4	4.7	6.6	10.4
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.05	0.12	0.32	0.44	0.62	0.97
Peak Inflow Q (cfs) =	N/A	N/A	1.3	2.2	3.3	6.1	7.9	10.1	15.1
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.7	2.5	2.7	3.0	6.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.5	0.7	0.6	0.5	0.7
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	N/A	0.1	0.4	0.4	0.5	0.5
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) =	36	43	40	45	45	41	38	35	31
Time to Drain 99% of Inflow Volume (hours) =	40	49	45	51	53	51	49	48	45
Maximum Ponding Depth (ft) =	0.95	1.96	1.10	1.76	2.32	2.83	3.40	4.21	5.41
Area at Maximum Ponding Depth (acres) =	0.17	0.20	0.17	0.19	0.21	0.23	0.25	0.28	0.34
Maximum Volume Stored (acre-ft) =	0.146	0.333	0.170	0.293	0.405	0.519	0.659	0.874	1.253

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.07 (June 2025)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
	0:15:00	0	0.00	0.03	0.08	0.12	0.09	0.13	0.14	0.24
	0:20:00	0	0.00	0.21	0.33	0.45	0.30	0.38	0.43	0.80
	0:25:00	0	0.00	0.65	1.06	1.62	0.92	1.20	1.46	2.99
	0:30:00	0	0.00	1.02	1.74	2.65	3.17	4.22	5.16	8.26
	0:35:00	0	0.00	1.18	2.04	3.06	4.71	6.16	7.78	11.88
	0:40:00	0	0.00	1.26	2.15	3.22	5.56	7.18	9.07	13.67
	0:45:00	0	0.00	1.27	2.17	3.27	5.92	7.62	9.78	14.65
	0:50:00	0	0.00	1.26	2.16	3.23	6.12	7.88	10.12	15.11
	0:55:00	0	0.00	1.23	2.11	3.13	6.06	7.80	10.14	15.10
	1:00:00	0	0.00	1.20	2.05	3.04	5.88	7.58	10.01	14.91
	1:05:00	0	0.00	1.17	2.00	2.96	5.71	7.37	9.88	14.74
	1:10:00	0	0.00	1.13	1.95	2.90	5.48	7.09	9.50	14.21
	1:15:00	0	0.00	1.09	1.90	2.83	5.24	6.80	9.05	13.60
	1:20:00	0	0.00	1.06	1.82	2.74	4.97	6.46	8.54	12.84
	1:25:00	0	0.00	1.02	1.75	2.62	4.71	6.11	8.01	12.05
	1:30:00	0	0.00	0.98	1.69	2.50	4.43	5.76	7.51	11.31
	1:35:00	0	0.00	0.95	1.63	2.41	4.20	5.45	7.07	10.66
	1:40:00	0	0.00	0.93	1.57	2.31	3.98	5.18	6.69	10.09
	1:45:00	0	0.00	0.90	1.51	2.23	3.79	4.92	6.34	9.55
	1:50:00	0	0.00	0.88	1.45	2.14	3.60	4.67	6.00	9.03
	1:55:00	0	0.00	0.85	1.38	2.05	3.41	4.43	5.67	8.53
	2:00:00	0	0.00	0.81	1.32	1.94	3.23	4.20	5.34	8.04
	2:05:00	0	0.00	0.76	1.24	1.82	3.02	3.92	4.98	7.48
	2:10:00	0	0.00	0.71	1.15	1.68	2.80	3.63	4.61	6.91
	2:15:00	0	0.00	0.65	1.06	1.55	2.58	3.34	4.25	6.35
	2:20:00	0	0.00	0.60	0.97	1.42	2.37	3.06	3.89	5.81
	2:25:00	0	0.00	0.55	0.89	1.30	2.16	2.80	3.55	5.30
	2:30:00	0	0.00	0.51	0.83	1.21	1.98	2.57	3.26	4.90
	2:35:00	0	0.00	0.48	0.77	1.14	1.84	2.39	3.04	4.57
	2:40:00	0	0.00	0.45	0.73	1.07	1.73	2.24	2.84	4.27
	2:45:00	0	0.00	0.42	0.68	1.00	1.62	2.10	2.66	4.00
	2:50:00	0	0.00	0.40	0.64	0.94	1.52	1.97	2.49	3.74
	2:55:00	0	0.00	0.37	0.60	0.88	1.43	1.85	2.34	3.51
	3:00:00	0	0.00	0.35	0.57	0.83	1.34	1.74	2.19	3.29
	3:05:00	0	0.00	0.33	0.53	0.77	1.26	1.63	2.06	3.08
	3:10:00	0	0.00	0.31	0.50	0.72	1.18	1.53	1.93	2.88
	3:15:00	0	0.00	0.29	0.46	0.67	1.10	1.42	1.80	2.68
	3:20:00	0	0.00	0.27	0.43	0.63	1.03	1.33	1.68	2.49
	3:25:00	0	0.00	0.25	0.40	0.58	0.95	1.23	1.55	2.30
	3:30:00	0	0.00	0.23	0.37	0.53	0.88	1.13	1.43	2.11
	3:35:00	0	0.00	0.22	0.34	0.49	0.81	1.03	1.30	1.92
	3:40:00	0	0.00	0.20	0.31	0.45	0.73	0.94	1.18	1.73
	3:45:00	0	0.00	0.18	0.28	0.40	0.66	0.84	1.06	1.55
	3:50:00	0	0.00	0.16	0.25	0.36	0.59	0.75	0.94	1.36
	3:55:00	0	0.00	0.15	0.23	0.32	0.52	0.66	0.82	1.18
	4:00:00	0	0.00	0.13	0.20	0.28	0.45	0.57	0.70	1.00
	4:05:00	0	0.00	0.12	0.17	0.24	0.38	0.48	0.59	0.82
	4:10:00	0	0.00	0.10	0.15	0.20	0.31	0.39	0.47	0.65
	4:15:00	0	0.00	0.09	0.12	0.16	0.25	0.30	0.36	0.48
	4:20:00	0	0.00	0.07	0.10	0.13	0.18	0.22	0.25	0.36
	4:25:00	0	0.00	0.06	0.08	0.10	0.13	0.17	0.19	0.27
	4:30:00	0	0.00	0.05	0.06	0.08	0.10	0.13	0.14	0.21
	4:35:00	0	0.00	0.04	0.05	0.07	0.08	0.10	0.11	0.16
	4:40:00	0	0.00	0.03	0.04	0.06	0.06	0.08	0.08	0.12
	4:45:00	0	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.09
	4:50:00	0	0.00	0.02	0.03	0.04	0.04	0.05	0.05	0.07
	4:55:00	0	0.00	0.02	0.03	0.03	0.03	0.04	0.04	0.05
	5:00:00	0	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	5:05:00	0	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.03
	5:10:00	0	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	5:15:00	0	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	5:20:00	0	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	5:25:00	0	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	5:30:00	0	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

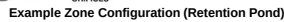
Summary Stage-Area-Volume-Discharge Relationships

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 4.06 (July 2022)

Basin ID: POND F2

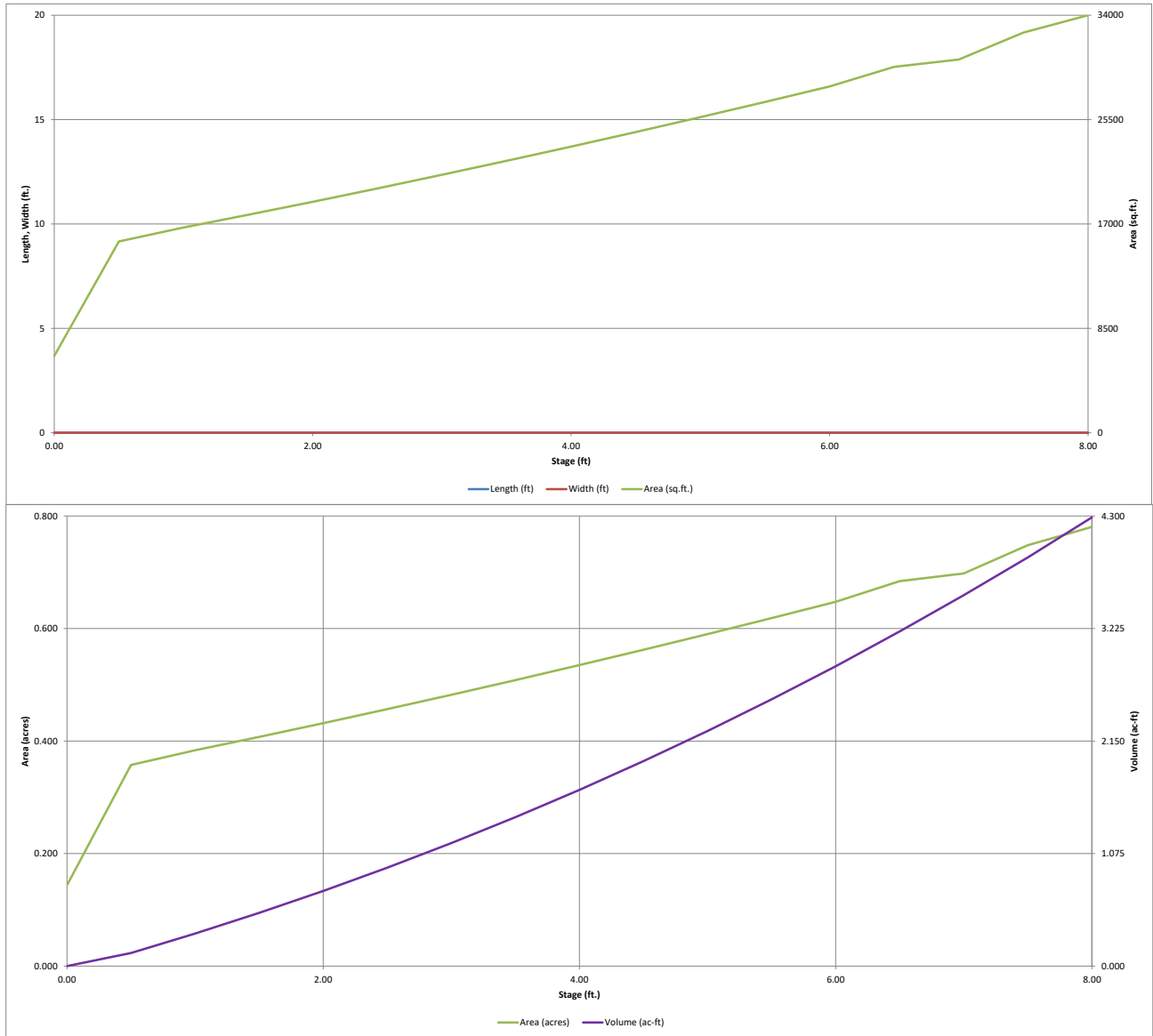
Optional User Overrides

Depth Increment =	0.50	ft
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12/11/2025, 1:12 PM

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

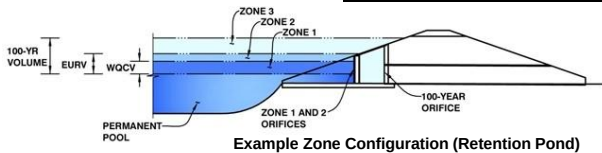


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project:

Basin ID: **POND F2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.31	0.430	Orifice Plate
Zone 2 (EURV)	2.77	0.633	Rectangular Orifice
Zone 3 (100-year)	4.63	0.962	Weir&Pipe (Restrict)
Total (all zones)		2.026	

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 = ft²
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)

Centroid 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 = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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	0.44	0.87					
Orifice Area (sq. inches)	3.89	3.89	3.89					

	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 ft²
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_o = 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_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area = ft²
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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 ft²
Outlet Orifice Area = feet
Outlet Orifice Centroid = radians
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

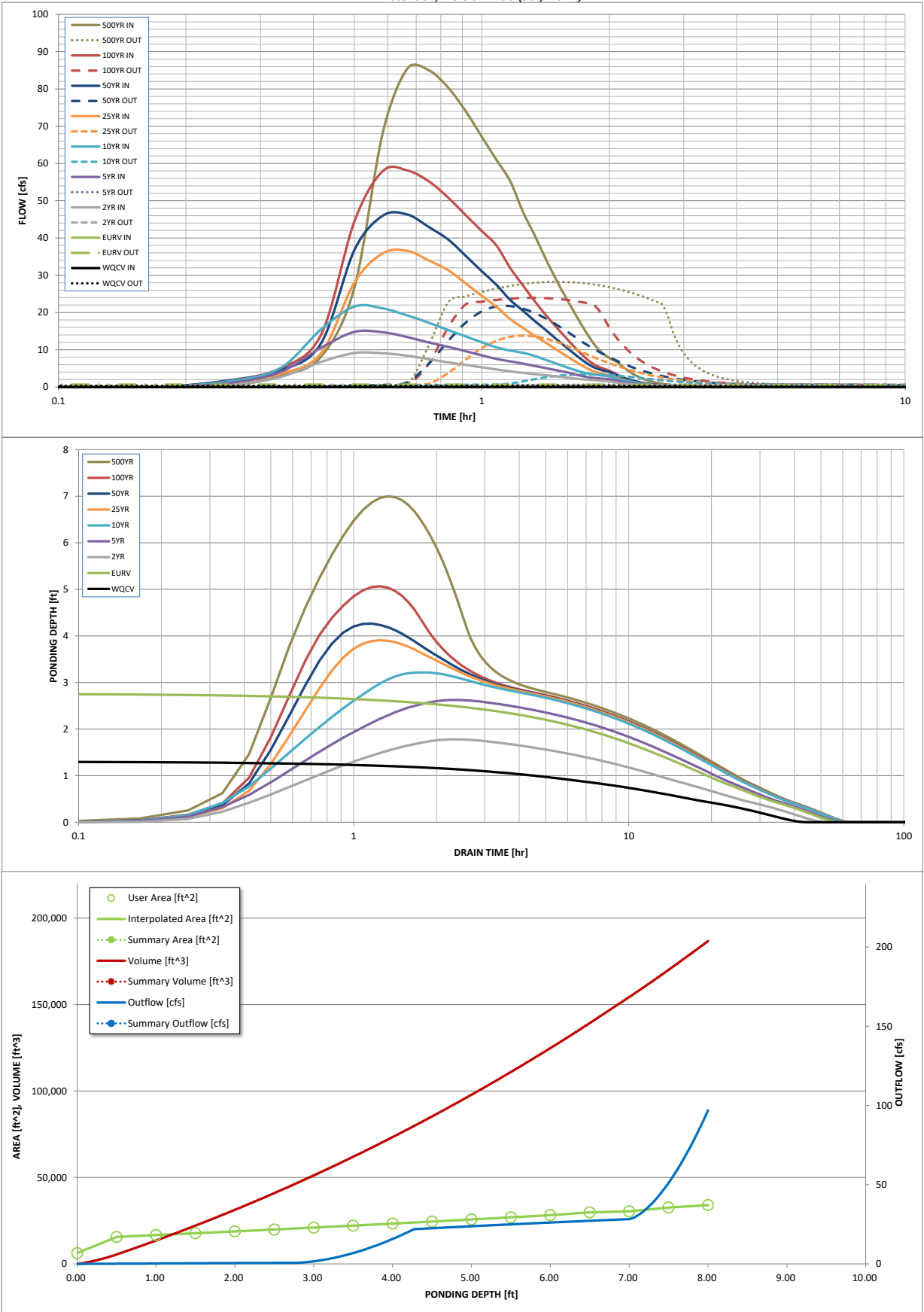
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.430	1.064	0.698	1.099	1.560	2.514	3.208	4.071	6.058
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.698	1.099	1.560	2.514	3.208	4.071	6.058
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.3	2.8	7.3	18.6	25.4	34.5	53.9
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.10	0.25	0.64	0.88	1.20	1.87
Peak Inflow Q (cfs) =	N/A	N/A	9.1	14.8	21.6	36.6	46.3	58.1	85.4
Peak Outflow Q (cfs) =	0.4	0.7	0.5	0.6	3.4	13.8	21.7	23.9	28.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.5	0.7	0.9	0.7	0.5
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.5	0.8	0.9	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	36	46	42	47	47	43	40	37	32
Time to Drain 99% of Inflow Volume (hours) =	40	52	47	53	55	52	51	49	46
Maximum Ponding Depth (ft) =	1.31	2.77	1.78	2.63	3.22	3.91	4.26	5.07	7.00
Area at Maximum Ponding Depth (acres) =	0.40	0.47	0.42	0.46	0.49	0.53	0.55	0.59	0.70
Maximum Volume Stored (acre-ft) =	0.432	1.065	0.620	0.995	1.277	1.630	1.824	2.281	3.536

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41
	0:15:00	0.00	0.00	0.35	1.03	1.51	1.16	1.67	1.73	2.96
	0:20:00	0.00	0.00	2.67	3.97	5.01	3.53	4.45	4.97	8.08
	0:25:00	0.00	0.00	6.73	10.52	15.44	9.02	11.65	13.92	26.67
	0:30:00	0.00	0.00	9.13	14.80	21.61	28.05	36.77	44.43	68.17
	0:35:00	0.00	0.00	9.06	14.72	21.12	35.88	45.98	57.94	85.44
	0:40:00	0.00	0.00	8.43	13.42	19.22	36.55	46.31	58.13	85.00
	0:45:00	0.00	0.00	7.46	11.96	17.25	33.96	42.93	55.19	80.32
	0:50:00	0.00	0.00	6.63	10.78	15.28	31.34	39.57	50.81	73.99
	0:55:00	0.00	0.00	5.95	9.61	13.58	27.79	35.20	46.10	67.16
	1:00:00	0.00	0.00	5.29	8.50	12.02	24.46	31.07	41.87	60.95
	1:05:00	0.00	0.00	4.73	7.55	10.66	21.52	27.42	37.96	55.29
	1:10:00	0.00	0.00	4.21	6.89	9.79	18.25	23.38	31.98	47.13
	1:15:00	0.00	0.00	3.81	6.30	9.19	15.90	20.52	27.33	40.71
	1:20:00	0.00	0.00	3.47	5.67	8.35	13.76	17.74	23.06	34.36
	1:25:00	0.00	0.00	3.16	5.08	7.29	11.90	15.30	19.32	28.72
	1:30:00	0.00	0.00	2.86	4.52	6.29	10.06	12.88	16.09	23.84
	1:35:00	0.00	0.00	2.56	3.99	5.36	8.37	10.66	13.13	19.39
	1:40:00	0.00	0.00	2.27	3.36	4.51	6.80	8.62	10.42	15.33
	1:45:00	0.00	0.00	2.03	2.81	3.82	5.38	6.78	8.02	11.84
	1:50:00	0.00	0.00	1.89	2.47	3.41	4.27	5.39	6.23	9.36
	1:55:00	0.00	0.00	1.68	2.27	3.14	3.62	4.58	5.14	7.81
	2:00:00	0.00	0.00	1.50	2.09	2.85	3.21	4.06	4.42	6.78
	2:05:00	0.00	0.00	1.22	1.70	2.31	2.52	3.19	3.39	5.22
	2:10:00	0.00	0.00	0.97	1.34	1.82	1.93	2.44	2.52	3.89
	2:15:00	0.00	0.00	0.77	1.05	1.43	1.49	1.87	1.86	2.88
	2:20:00	0.00	0.00	0.61	0.82	1.11	1.14	1.42	1.36	2.11
	2:25:00	0.00	0.00	0.48	0.64	0.85	0.87	1.08	1.02	1.57
	2:30:00	0.00	0.00	0.37	0.49	0.64	0.66	0.81	0.77	1.18
	2:35:00	0.00	0.00	0.29	0.37	0.48	0.49	0.61	0.58	0.89
	2:40:00	0.00	0.00	0.22	0.28	0.36	0.37	0.46	0.44	0.68
	2:45:00	0.00	0.00	0.17	0.21	0.28	0.28	0.35	0.34	0.52
	2:50:00	0.00	0.00	0.12	0.15	0.20	0.21	0.26	0.25	0.38
	2:55:00	0.00	0.00	0.08	0.11	0.14	0.15	0.18	0.18	0.27
	3:00:00	0.00	0.00	0.05	0.07	0.09	0.10	0.12	0.11	0.17
	3:05:00	0.00	0.00	0.03	0.04	0.05	0.06	0.07	0.06	0.10
	3:10:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.04
	3:15:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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 4.06 (July 2022)

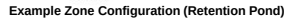
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[illegible]

MHFD-Detention, Version 4.07 (June 2025)

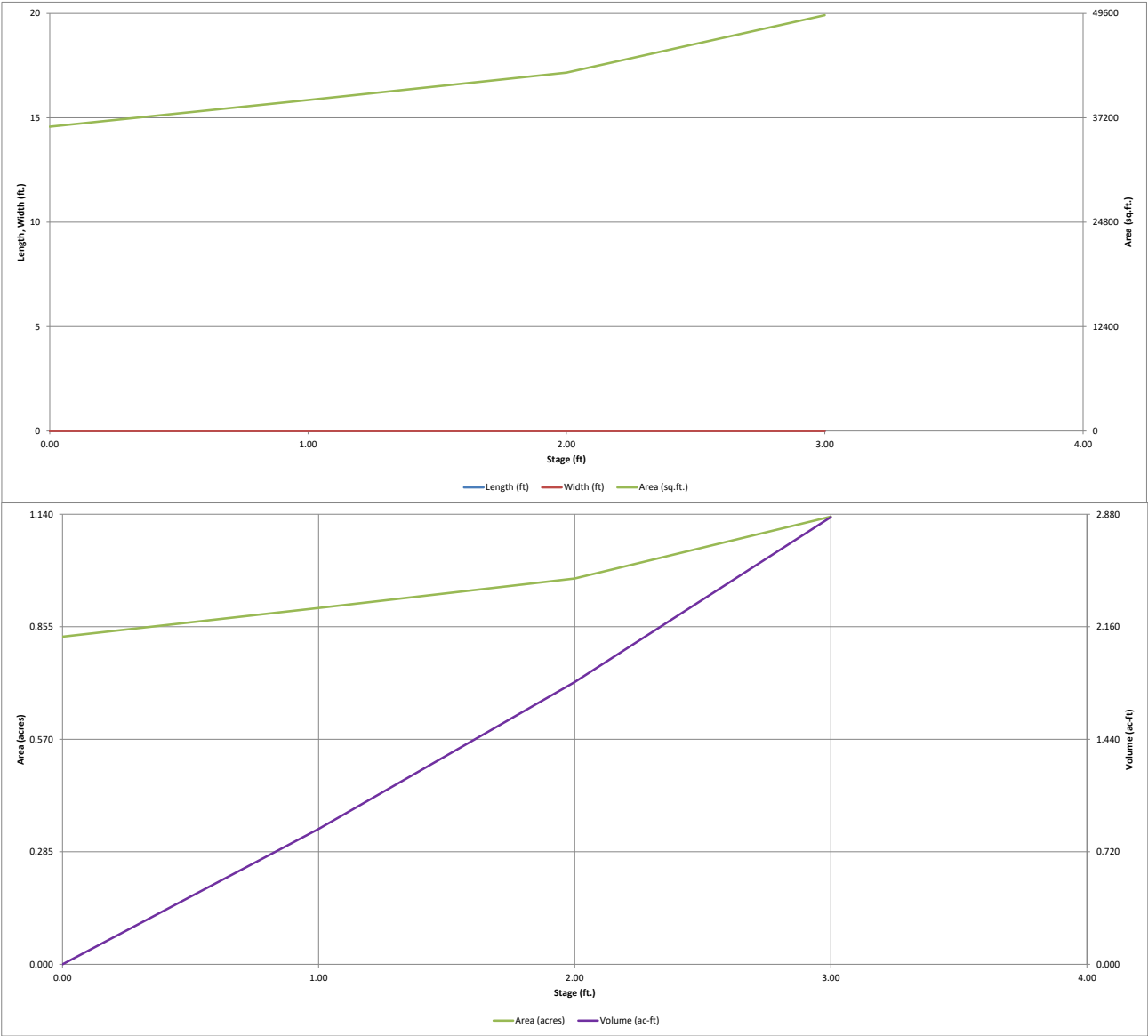
Basin ID: POND G

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

6287	Depth Increment =	1.00	ft							
	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
	Top of Micropool	--	0.00	--	--	--	36,146	0.830		
	6288	--	1.00	--	--	--	39,307	0.902	37,726	0.866
6288	6289	--	2.00	--	--	--	42,568	0.977	78,664	1.806
	6290	--	3.00	--	--	--	49,393	1.134	124,644	2.861
		--		--	--	--				
		--		--	--	--				
6289		--		--	--	--				
		--		--	--	--				
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

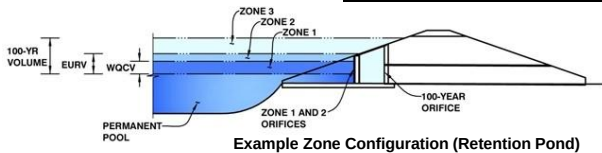


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: POND G



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.34	0.278	Orifice Plate
Zone 2 (EURV)	0.83	0.429	Circular Orifice
Zone 3 (100-year)	1.49	0.606	Weir&Pipe (Restrict)
Total (all zones)		1.313	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area = N/A ft²
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 SCM)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 0.34 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 1.40 inches
Orifice Plate: Orifice Area per Row = 6.51 sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row = 4.521E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	0.11	0.23					
Orifice Area (sq. inches)	6.51	6.51	6.51					

	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 = 0.34 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 0.83 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = 0.38 inches

Calculated Parameters for Vertical Orifice

Zone 2 Circular	Not Selected
Vertical Orifice Area = 0.00 ft ²	N/A
Vertical Orifice Centroid = 0.02 feet	N/A

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 _o = 0.83 ft (relative to basin bottom at Stage = 0 ft)	N/A
Overflow Weir Front Edge Length = 44.00 feet	N/A
Overflow Weir Grate Slope = 4.00 H:V	N/A
Horiz. Length of Weir Sides = 8.00 feet	N/A
Overflow Grate Type = Type C Grate	N/A
Debris Clogging % = 50%	N/A

Calculated Parameters for Overflow Weir

Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H _u = 2.83 feet	N/A
Overflow Weir Slope Length = 8.25 feet	N/A
Grate Open Area / 100-yr Orifice Area = 125.30	N/A
Overflow Grate Open Area w/o Debris = 252.53 ft ²	N/A
Overflow Grate Open Area w/ Debris = 126.27 ft ²	N/A

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 = 5.00 ft (distance below basin bottom at Stage = 0 ft)	N/A
Outlet Pipe Diameter = 21.00 inches	N/A
Restrictor Plate Height Above Pipe Invert = 16.40 inches	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Zone 3 Restrictor	Not Selected
Outlet Orifice Area = 2.02 ft ²	N/A
Outlet Orifice Centroid = 0.75 feet	N/A
Half-Central Angle of Restrictor Plate on Pipe = 2.17 radians	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 2.00 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 15.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = 0.87 feet
Stage at Top of Freeboard = 3.87 feet
Basin Area at Top of Freeboard = 1.13 acres
Basin Volume at Top of Freeboard = 2.86 acre-ft

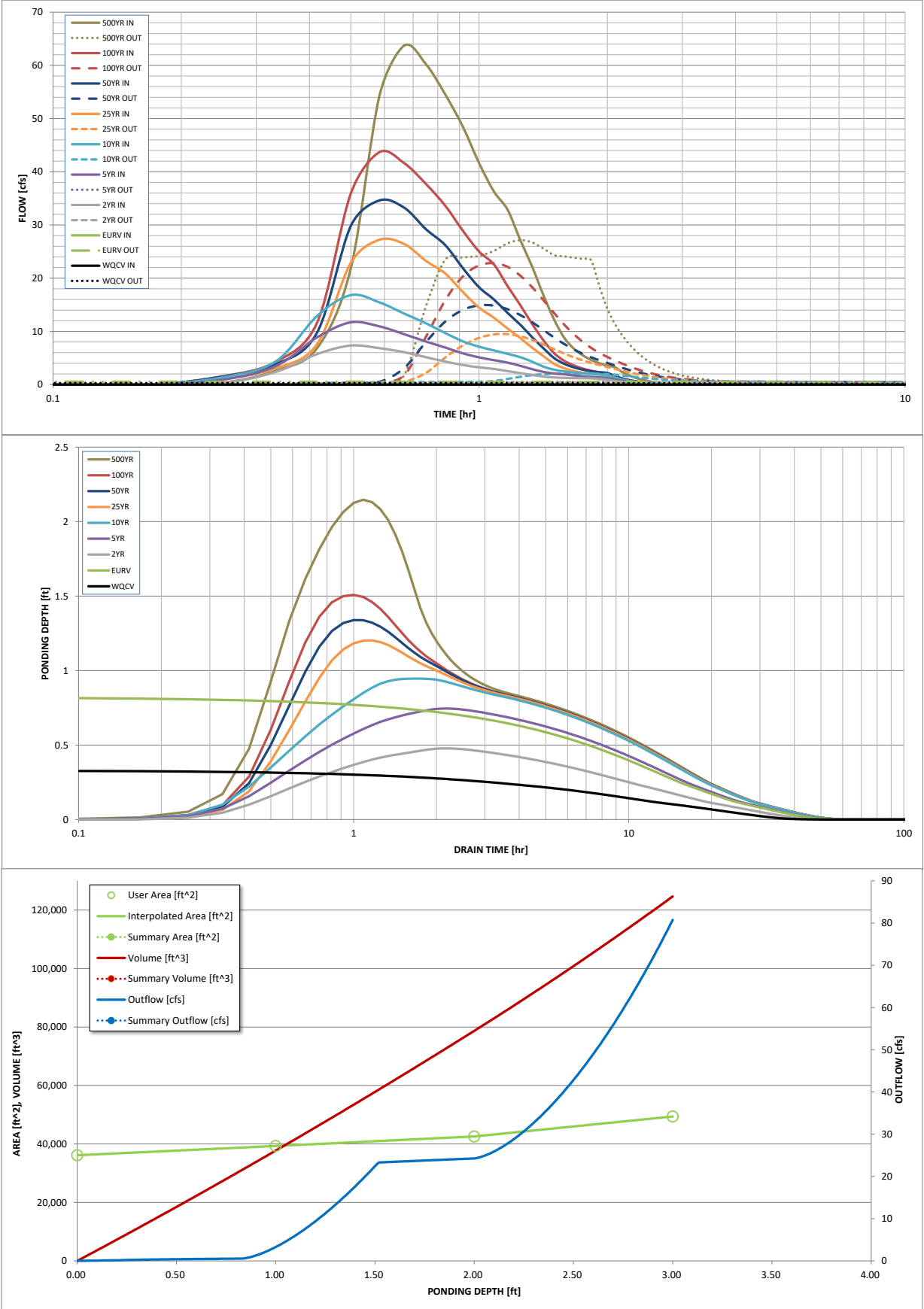
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.278	0.707	0.459	0.713	1.000	1.585	2.013	2.542	3.765
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.459	0.713	1.000	1.585	2.013	2.542	3.765
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.5	2.5	5.9	14.1	19.2	25.3	39.3
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.03	0.14	0.33	0.78	1.07	1.41	2.19
Peak Inflow Q (cfs) =	N/A	N/A	7.3	11.7	16.8	27.2	34.6	43.7	63.7
Peak Outflow Q (cfs) =	0.3	0.6	0.4	0.5	2.1	9.5	14.9	22.8	27.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.4	0.7	0.8	0.9	0.7
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.0	0.1	0.1	0.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	35	42	39	42	42	38	35	32	27
Time to Drain 99% of Inflow Volume (hours) =	40	48	45	49	50	47	46	44	41
Maximum Ponding Depth (ft) =	0.34	0.83	0.48	0.75	0.95	1.20	1.34	1.51	2.15
Area at Maximum Ponding Depth (acres) =	0.85	0.89	0.86	0.88	0.90	0.92	0.93	0.94	1.00
Maximum Volume Stored (acre-ft) =	0.286	0.714	0.398	0.634	0.812	1.048	1.168	1.327	1.944

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

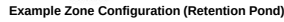
Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

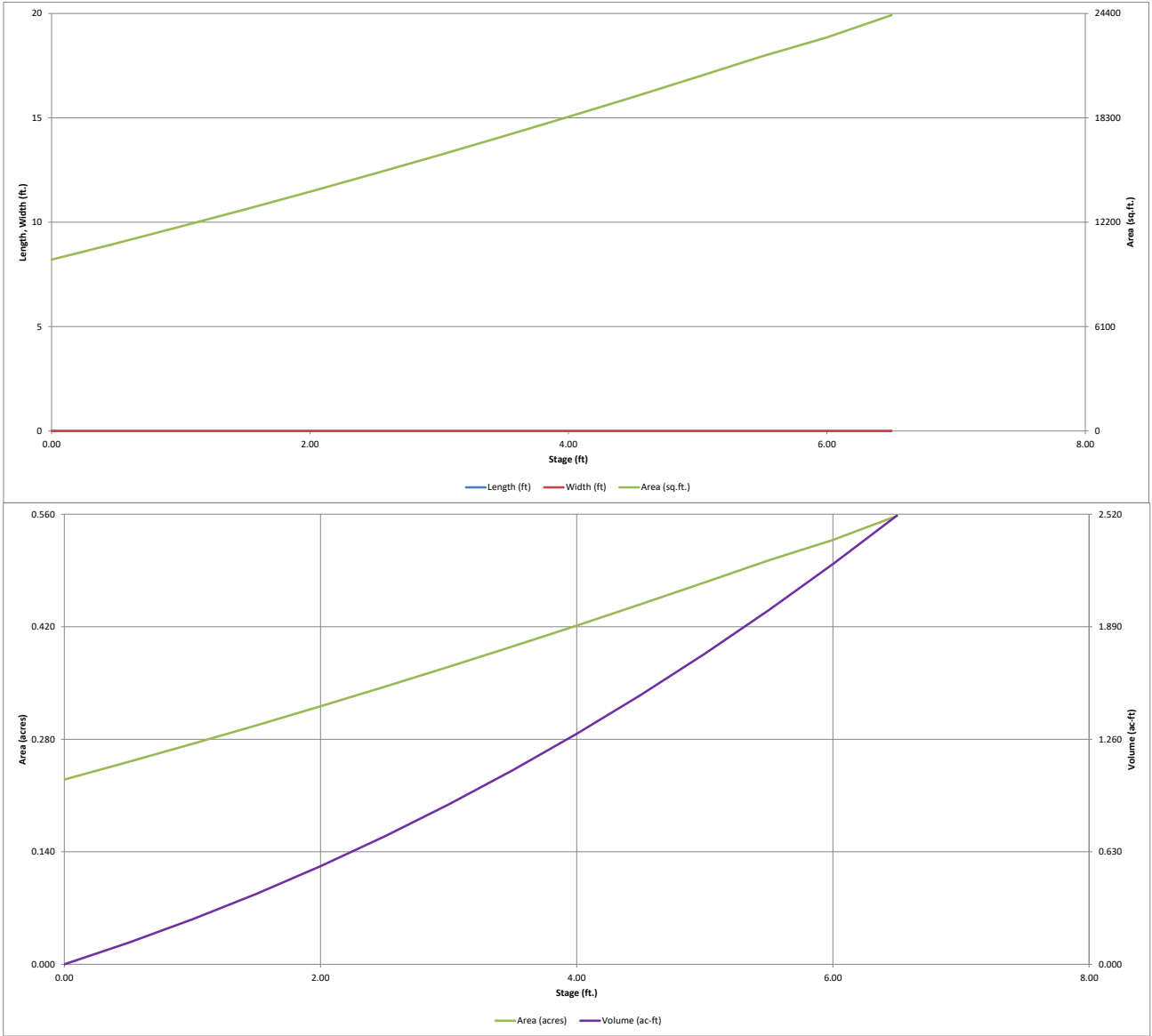
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37
	0:15:00	0	0.00	0.32	0.93	1.36	1.04	1.51	1.56	2.62
	0:20:00	0	0.00	2.38	3.48	4.36	3.05	3.83	4.28	6.85
	0:25:00	0	0.00	5.73	8.88	12.90	7.60	9.78	11.63	21.85
	0:30:00	0	0.00	7.34	11.71	16.81	22.88	29.82	35.92	54.18
	0:35:00	0	0.00	6.85	10.94	15.46	27.22	34.61	43.67	63.70
	0:40:00	0	0.00	6.10	9.48	13.36	26.44	33.27	41.64	60.25
	0:45:00	0	0.00	5.15	8.10	11.53	23.26	29.22	37.73	54.51
	0:50:00	0	0.00	4.33	6.96	9.68	20.87	26.20	33.61	48.43
	0:55:00	0	0.00	3.68	5.87	8.12	17.38	21.87	28.89	41.65
	1:00:00	0	0.00	3.25	5.12	7.12	14.47	18.30	25.03	36.31
	1:05:00	0	0.00	2.94	4.59	6.42	12.58	16.01	22.60	32.87
	1:10:00	0	0.00	2.53	4.13	5.78	10.52	13.47	18.51	27.14
	1:15:00	0	0.00	2.16	3.53	5.15	8.74	11.25	14.93	22.11
	1:20:00	0	0.00	1.80	2.90	4.30	6.92	8.87	11.36	16.77
	1:25:00	0	0.00	1.52	2.39	3.37	5.34	6.82	8.30	12.24
	1:30:00	0	0.00	1.34	2.09	2.80	3.91	4.99	5.91	8.85
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	1:45:00	0	0.00	1.20	1.56	2.10	2.23	2.81	3.02	4.63
	1:50:00	0	0.00	1.18	1.44	2.00	2.00	2.51	2.61	4.02
	1:55:00	0	0.00	1.03	1.35	1.88	1.86	2.32	2.32	3.57
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	2:10:00	0	0.00	0.51	0.69	0.92	0.96	1.17	1.12	1.72
	2:15:00	0	0.00	0.38	0.51	0.66	0.69	0.85	0.82	1.25
	2:20:00	0	0.00	0.28	0.37	0.48	0.50	0.62	0.60	0.92
	2:25:00	0	0.00	0.20	0.26	0.34	0.36	0.44	0.43	0.65
	2:30:00	0	0.00	0.14	0.18	0.24	0.25	0.31	0.30	0.46
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	2:45:00	0	0.00	0.03	0.05	0.06	0.07	0.08	0.08	0.12
	2:50:00	0	0.00	0.02	0.02	0.03	0.03	0.04	0.04	0.06
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	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MHFD-Detention, Version 4.07 (June 2025)

Basin ID: POND H

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

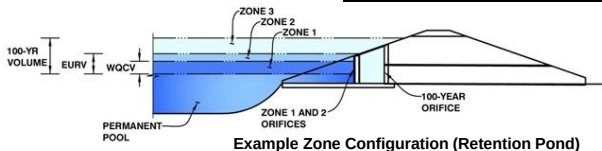


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: POND H



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.50	0.393	Orifice Plate
Zone 2 (EURV)	3.39	0.647	Circular Orifice
Zone 3 (100-year)	5.27	0.824	Weir&Pipe (Restrict)
Total (all zones)		1.864	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = N/A ft²
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 SCM)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 1.50 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 6.00 inches
Orifice Plate: Orifice Area per Row = 3.95 sq. inches (use rectangular openings)

Calculated Parameters for Plate
WQ Orifice Area per Row = 2.743E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00					
Orifice Area (sq. inches)	3.95	3.95	3.95					

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

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = 1.50 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 3.39 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = 0.38 inches

Calculated Parameters for Vertical Orifice
Zone 2 Circular Not Selected
Vertical Orifice Area = 0.00 ft²
Vertical Orifice Centroid = 0.02 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_o = 3.39 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 2.00 feet
Overflow Weir Grate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 8.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
Height of Grate Upper Edge, H_u = 5.39 feet
Overflow Weir Slope Length = 8.25 feet
Grate Open Area / 100-yr Orifice Area = 5.56
Overflow Grate Open Area w/o Debris = 11.48 ft²
Overflow Grate Open Area w/ Debris = 5.74 ft²

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

Depth to Invert of Outlet Pipe = 0.50 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 24.00 inches
Restrictor Plate Height Above Pipe Invert = 15.00 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Zone 3 Restrictor Not Selected
Outlet Orifice Area = 2.07 ft²
Outlet Orifice Centroid = 0.71 feet
Half-Central Angle of Restrictor Plate on Pipe = 1.82 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 5.60 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 16.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.89 feet
Stage at Top of Freeboard = 7.49 feet
Basin Area at Top of Freeboard = 0.56 acres
Basin Volume at Top of Freeboard = 2.51 acre-ft

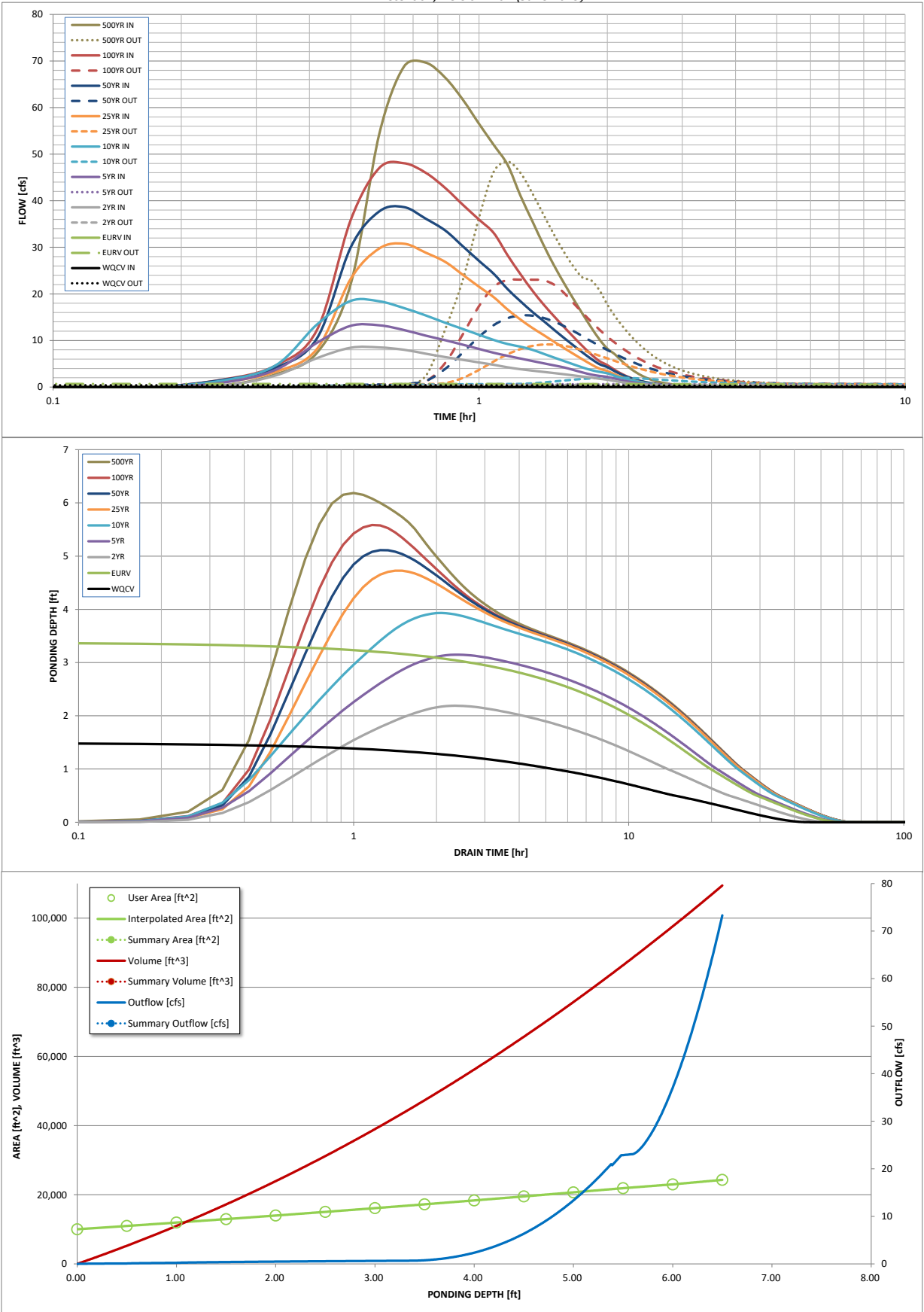
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.393	1.040	0.691	1.055	1.455	2.253	2.841	3.561	5.238
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.691	1.055	1.455	2.253	2.841	3.561	5.238
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.5	2.4	5.7	13.9	18.9	25.5	39.6
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.10	0.23	0.58	0.78	1.05	1.64
Peak Inflow Q (cfs) =	N/A	N/A	8.5	13.3	18.5	30.8	38.6	48.1	69.6
Peak Outflow Q (cfs) =	0.4	0.7	0.5	0.6	2.0	9.1	15.4	23.1	48.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.4	0.7	0.8	0.9	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.7	1.3	1.9	2.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	36	45	41	45	47	43	40	37	32
Time to Drain 99% of Inflow Volume (hours) =	40	51	47	52	55	53	51	49	46
Maximum Ponding Depth (ft) =	1.50	3.39	2.19	3.15	3.93	4.73	5.11	5.58	6.19
Area at Maximum Ponding Depth (acres) =	0.30	0.39	0.33	0.38	0.42	0.46	0.48	0.51	0.54
Maximum Volume Stored (acre-ft) =	0.395	1.043	0.608	0.947	1.261	1.608	1.791	2.023	2.337

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38
	0:15:00	0	0.00	0.33	0.96	1.40	1.07	1.54	1.60	2.74
	0:20:00	0	0.00	2.49	3.71	4.68	3.29	4.16	4.64	7.38
	0:25:00	0	0.00	6.22	9.51	13.45	8.21	10.50	12.31	22.18
	0:30:00	0	0.00	8.45	13.16	18.50	23.26	30.03	35.92	54.37
	0:35:00	0	0.00	8.51	13.26	18.41	29.76	37.72	47.04	68.81
	0:40:00	0	0.00	8.01	12.24	16.95	30.77	38.63	48.05	69.64
	0:45:00	0	0.00	7.16	11.03	15.37	28.84	36.13	45.99	66.39
	0:50:00	0	0.00	6.43	10.05	13.79	26.86	33.60	42.72	61.66
	0:55:00	0	0.00	5.84	9.09	12.45	24.08	30.19	39.11	56.51
	1:00:00	0	0.00	5.29	8.18	11.23	21.54	27.08	35.95	51.95
	1:05:00	0	0.00	4.78	7.35	10.11	19.27	24.29	33.04	47.71
	1:10:00	0	0.00	4.24	6.70	9.24	16.65	21.04	28.30	41.14
	1:15:00	0	0.00	3.84	6.13	8.68	14.52	18.45	24.28	35.65
	1:20:00	0	0.00	3.53	5.59	8.00	12.71	16.15	20.74	30.51
	1:25:00	0	0.00	3.25	5.11	7.15	11.19	14.20	17.75	26.09
	1:30:00	0	0.00	3.00	4.65	6.34	9.72	12.29	15.19	22.29
	1:35:00	0	0.00	2.75	4.21	5.58	8.37	10.54	12.89	18.86
	1:40:00	0	0.00	2.50	3.66	4.87	7.11	8.92	10.75	15.71
	1:45:00	0	0.00	2.25	3.13	4.21	5.94	7.42	8.78	12.80
	1:50:00	0	0.00	2.04	2.69	3.65	4.87	6.05	7.02	10.24
	1:55:00	0	0.00	1.78	2.39	3.26	3.96	4.92	5.58	8.25
	2:00:00	0	0.00	1.58	2.19	2.95	3.44	4.27	4.71	7.04
	2:05:00	0	0.00	1.29	1.80	2.42	2.72	3.39	3.67	5.52
	2:10:00	0	0.00	1.04	1.44	1.95	2.12	2.63	2.79	4.21
	2:15:00	0	0.00	0.84	1.15	1.56	1.65	2.04	2.11	3.19
	2:20:00	0	0.00	0.67	0.92	1.24	1.28	1.59	1.59	2.40
	2:25:00	0	0.00	0.54	0.73	0.97	1.00	1.23	1.18	1.79
	2:30:00	0	0.00	0.42	0.57	0.75	0.77	0.94	0.88	1.34
	2:35:00	0	0.00	0.33	0.44	0.57	0.59	0.71	0.68	1.02
	2:40:00	0	0.00	0.26	0.34	0.44	0.45	0.54	0.52	0.78
	2:45:00	0	0.00	0.20	0.26	0.34	0.34	0.42	0.41	0.61
	2:50:00	0	0.00	0.15	0.20	0.26	0.26	0.32	0.31	0.47
	2:55:00	0	0.00	0.11	0.14	0.19	0.20	0.24	0.23	0.35
	3:00:00	0	0.00	0.08	0.10	0.13	0.14	0.17	0.17	0.25
	3:05:00	0	0.00	0.05	0.07	0.09	0.09	0.11	0.11	0.16
	3:10:00	0	0.00	0.03	0.04	0.05	0.06	0.07	0.06	0.09
	3:15:00	0	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.05
	3:20:00	0	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	3:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

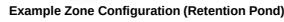
Summary Stage-Area-Volume-Discharge Relationships

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 4.07 (June 2025)

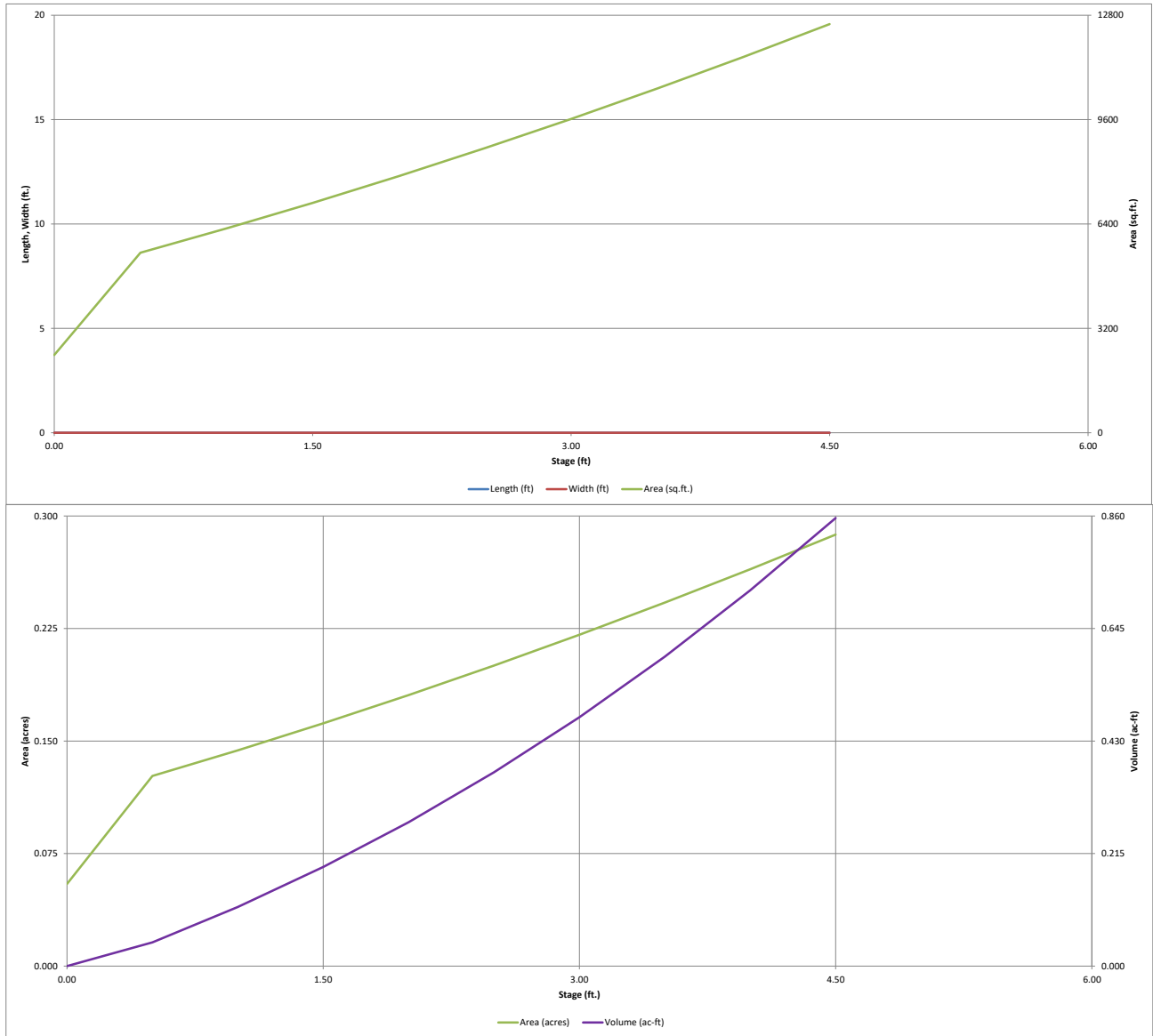
Basin ID: POND 1[illegible]

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

Depth Increment =	0.50	f
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

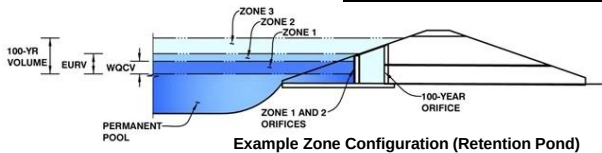


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: **POND I**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.28	0.154	Orifice Plate
Zone 2 (EURV)	2.05	0.130	Circular Orifice
Zone 3 (100-year)	4.16	0.476	Weir&Pipe (Restrict)
Total (all zones)		0.759	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = ft²
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 SCM)

Centroid 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 = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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	0.43	0.85					
Orifice Area (sq. inches)	1.40	1.40	1.40					

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

User Input: Vertical Orifice (Circular or Rectangular)

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 = ft²
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_o = 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_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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 = ft²
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

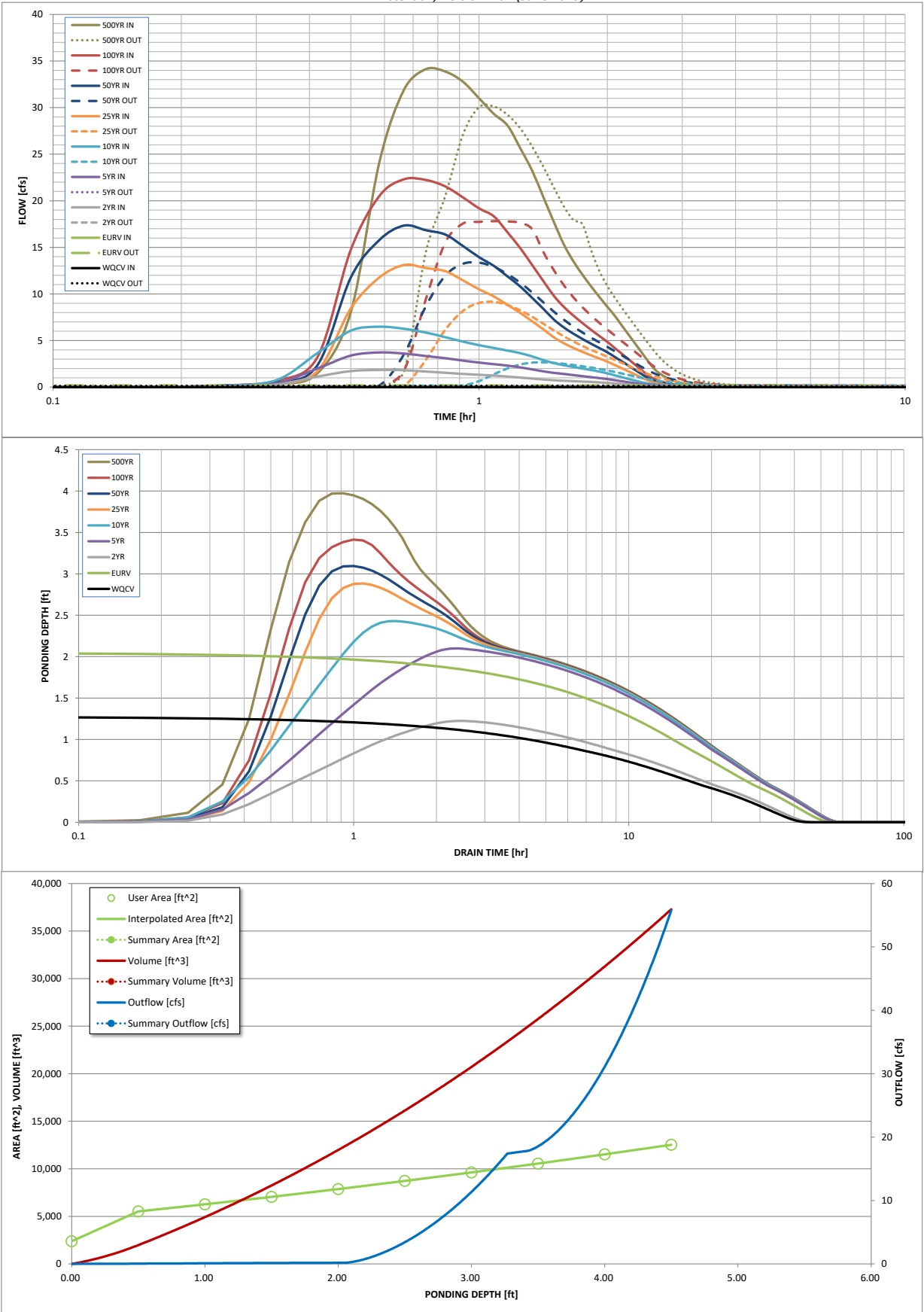
Routed Hydrograph Results

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	0.83	1.09	1.33	1.69	1.99	2.31	3.14
One-Hour Rainfall Depth (in) =	0.154	0.284	0.165	0.327	0.565	1.105	1.486	1.981	3.096
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.165	0.327	0.565	1.105	1.486	1.981	3.096
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.4	1.7	4.3	10.6	14.5	19.7	30.9
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.03	0.11	0.28	0.68	0.92	1.25	1.96
Peak Inflow Q (cfs) =	N/A	N/A	1.8	3.7	6.5	13.1	17.3	22.3	34.1
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	2.7	9.1	13.4	17.8	30.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.6	0.9	0.9	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.0	0.1	0.2	0.3	0.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	36	43	38	46	42	35	31	27	21
Time to Drain 99% of Inflow Volume (hours) =	40	48	42	51	49	46	43	41	36
Maximum Ponding Depth (ft) =	1.28	2.05	1.22	2.10	2.43	2.88	3.10	3.41	3.97
Area at Maximum Ponding Depth (acres) =	0.15	0.18	0.15	0.18	0.20	0.22	0.22	0.24	0.26
Maximum Volume Stored (acre-ft) =	0.155	0.284	0.146	0.291	0.356	0.449	0.496	0.570	0.710

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.07 (June 2025)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

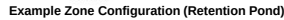
Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
	0:15:00	0	0.00	0.03	0.10	0.15	0.12	0.17	0.17	0.30
	0:20:00	0	0.00	0.26	0.39	0.72	0.35	0.48	0.68	1.45
	0:25:00	0	0.00	1.12	1.98	3.62	1.68	2.29	3.15	8.05
	0:30:00	0	0.00	1.72	3.38	6.06	8.43	11.76	14.74	24.11
	0:35:00	0	0.00	1.84	3.72	6.48	11.76	15.78	20.50	31.92
	0:40:00	0	0.00	1.81	3.60	6.26	13.10	17.33	22.31	34.12
	0:45:00	0	0.00	1.67	3.33	5.85	12.78	16.84	22.23	33.87
	0:50:00	0	0.00	1.54	3.10	5.36	12.44	16.37	21.54	32.77
	0:55:00	0	0.00	1.42	2.84	4.88	11.45	15.14	20.36	31.00
	1:00:00	0	0.00	1.32	2.63	4.50	10.50	13.95	19.19	29.32
	1:05:00	0	0.00	1.24	2.46	4.20	9.73	13.01	18.33	28.07
	1:10:00	0	0.00	1.13	2.30	3.92	8.82	11.88	16.60	25.63
	1:15:00	0	0.00	1.02	2.11	3.64	7.95	10.79	14.91	23.20
	1:20:00	0	0.00	0.92	1.90	3.29	7.05	9.56	13.08	20.36
	1:25:00	0	0.00	0.81	1.69	2.89	6.19	8.39	11.36	17.67
	1:30:00	0	0.00	0.74	1.53	2.57	5.33	7.23	9.77	15.27
	1:35:00	0	0.00	0.68	1.41	2.35	4.69	6.39	8.59	13.48
	1:40:00	0	0.00	0.64	1.29	2.16	4.20	5.72	7.66	12.05
	1:45:00	0	0.00	0.60	1.17	1.99	3.78	5.16	6.86	10.80
	1:50:00	0	0.00	0.56	1.07	1.83	3.40	4.65	6.14	9.67
	1:55:00	0	0.00	0.51	0.96	1.67	3.06	4.19	5.48	8.63
	2:00:00	0	0.00	0.46	0.86	1.48	2.74	3.74	4.86	7.65
	2:05:00	0	0.00	0.39	0.74	1.26	2.37	3.23	4.19	6.57
	2:10:00	0	0.00	0.33	0.62	1.06	2.01	2.74	3.56	5.56
	2:15:00	0	0.00	0.27	0.51	0.86	1.66	2.26	2.94	4.57
	2:20:00	0	0.00	0.22	0.41	0.68	1.32	1.80	2.34	3.63
	2:25:00	0	0.00	0.17	0.31	0.51	0.99	1.36	1.76	2.71
	2:30:00	0	0.00	0.13	0.23	0.38	0.69	0.94	1.22	1.92
	2:35:00	0	0.00	0.10	0.18	0.30	0.48	0.68	0.87	1.40
	2:40:00	0	0.00	0.08	0.14	0.24	0.35	0.50	0.63	1.04
	2:45:00	0	0.00	0.07	0.12	0.20	0.26	0.37	0.46	0.76
	2:50:00	0	0.00	0.05	0.09	0.16	0.19	0.28	0.33	0.56
	2:55:00	0	0.00	0.04	0.08	0.13	0.14	0.21	0.23	0.40
	3:00:00	0	0.00	0.04	0.06	0.10	0.11	0.16	0.16	0.28
	3:05:00	0	0.00	0.03	0.05	0.08	0.08	0.12	0.11	0.20
	3:10:00	0	0.00	0.02	0.04	0.06	0.06	0.09	0.09	0.15
	3:15:00	0	0.00	0.02	0.03	0.05	0.05	0.07	0.07	0.12
	3:20:00	0	0.00	0.02	0.02	0.04	0.04	0.06	0.05	0.09
	3:25:00	0	0.00	0.01	0.02	0.03	0.03	0.04	0.04	0.07
	3:30:00	0	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.05
	3:35:00	0	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.04
	3:40:00	0	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03
	3:45:00	0	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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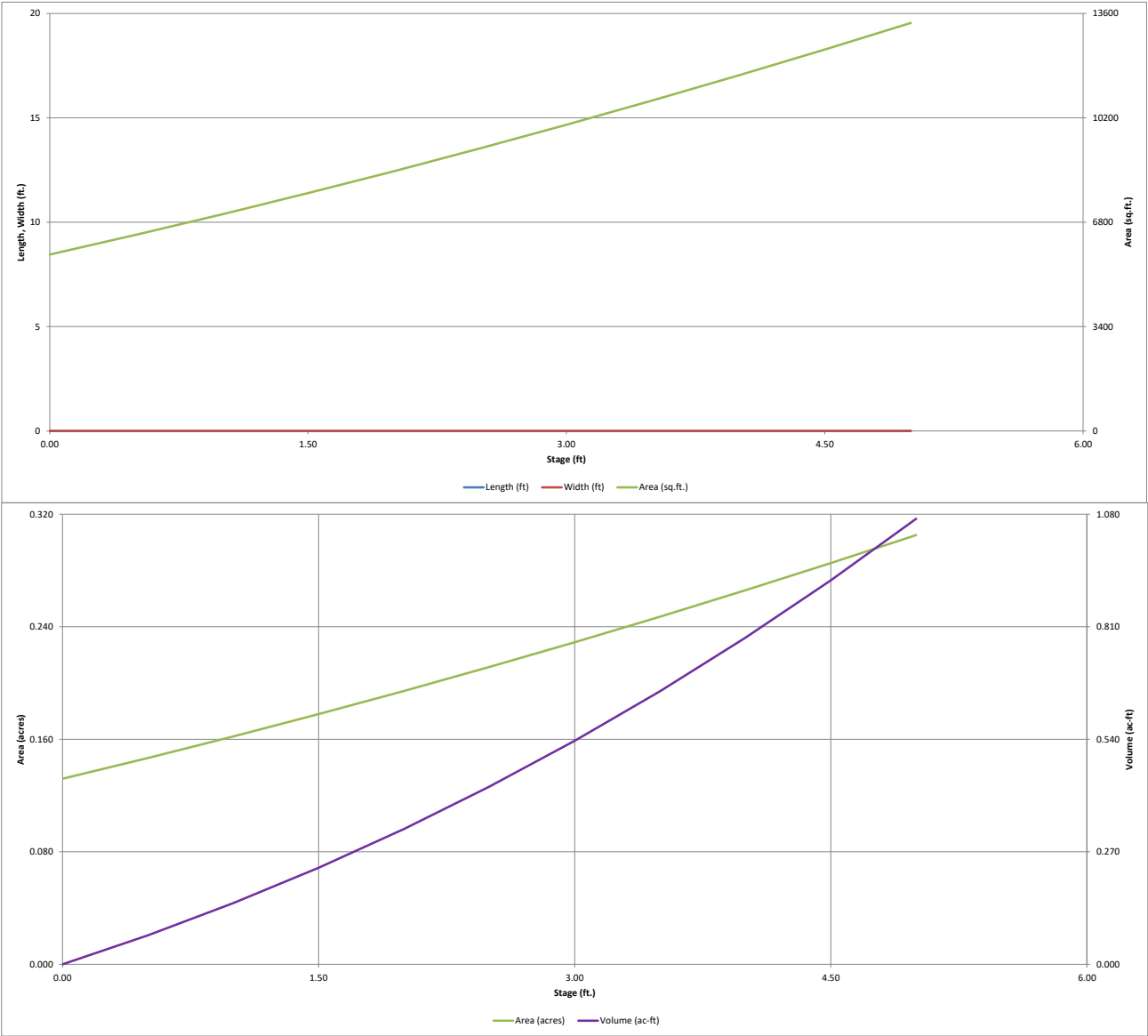
Basin ID: POND J[illegible]

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

6294

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

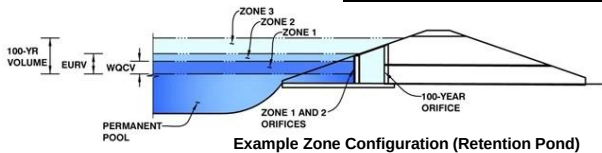


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: POND J



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.10	0.162	Orifice Plate
Zone 2 (EURV)	2.48	0.259	Rectangular Orifice
Zone 3 (100-year)	3.95	0.347	Weir&Pipe (Restrict)
Total (all zones)		0.768	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = N/A ft²
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 SCM)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 2.48 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 9.90 inches
Orifice Plate: Orifice Area per Row = 2.34 sq. inches (diameter = 1-11/16 inches)

Calculated Parameters for Plate
WQ Orifice Area per Row = 1.625E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	0.83	1.65					
Orifice Area (sq. inches)	2.34	2.34	2.34					

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

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = 1.10 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 2.48 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height = 2.00 inches
Vertical Orifice Width = 0.43 inches

Calculated Parameters for Vertical Orifice
Zone 2 Rectangular Not Selected
Vertical Orifice Area = 0.01 ft²
Vertical Orifice Centroid = 0.08 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_o = 2.48 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 9.00 feet
Overflow Weir Grate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 8.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
Height of Grate Upper Edge, H_u = 4.48 feet
Overflow Weir Slope Length = 8.25 feet
Grate Open Area / 100-yr Orifice Area = 42.07
Overflow Grate Open Area w/o Debris = 51.65 ft²
Overflow Grate Open Area w/ Debris = 25.83 ft²

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

Depth to Invert of Outlet Pipe = 4.00 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 18.00 inches
Restrictor Plate Height Above Pipe Invert = 11.80 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Zone 3 Restrictor Not Selected
Outlet Orifice Area = 1.23 ft²
Outlet Orifice Centroid = 0.55 feet
Half-Central Angle of Restrictor Plate on Pipe = 1.89 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 4.80 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 10.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.83 feet
Stage at Top of Freeboard = 6.63 feet
Basin Area at Top of Freeboard = 0.31 acres
Basin Volume at Top of Freeboard = 1.07 acre-ft

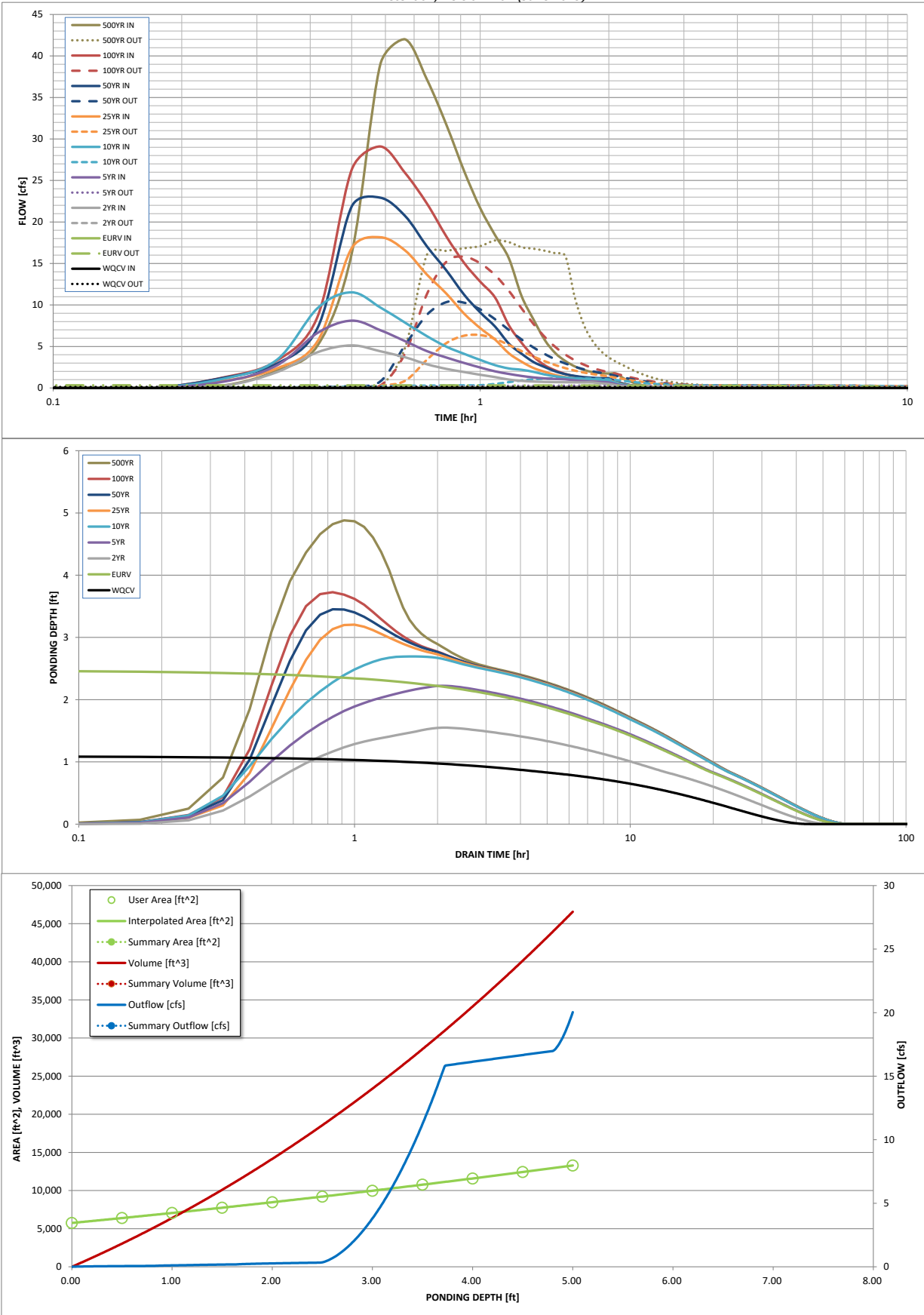
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.162	0.421	0.265	0.408	0.566	0.887	1.123	1.413	2.086
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.265	0.408	0.566	0.887	1.123	1.413	2.086
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.4	1.8	4.1	9.6	13.0	17.1	26.4
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.04	0.18	0.40	0.94	1.26	1.67	2.58
Peak Inflow Q (cfs) =	N/A	N/A	5.1	8.1	11.5	18.2	22.9	29.1	42.0
Peak Outflow Q (cfs) =	0.1	0.3	0.2	0.3	1.2	6.4	10.3	15.8	17.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.3	0.7	0.8	0.9	0.7
Structure Controlling Flow =	Plate	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.2	0.3	0.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	47	43	47	48	44	42	39	34
Time to Drain 99% of Inflow Volume (hours) =	40	52	47	52	54	52	51	49	46
Maximum Ponding Depth (ft) =	1.10	2.48	1.55	2.22	2.69	3.20	3.45	3.73	4.88
Area at Maximum Ponding Depth (acres) =	0.17	0.21	0.18	0.20	0.22	0.24	0.25	0.26	0.30
Maximum Volume Stored (acre-ft) =	0.163	0.422	0.239	0.368	0.467	0.583	0.643	0.711	1.033

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
	0:15:00	0	0.00	0.26	0.75	1.10	0.84	1.22	1.26	2.07
	0:20:00	0	0.00	1.89	2.70	3.36	2.34	2.91	3.27	5.17
	0:25:00	0	0.00	4.32	6.66	9.65	5.69	7.31	8.68	16.16
	0:30:00	0	0.00	5.13	8.11	11.52	16.84	21.85	26.28	38.95
	0:35:00	0	0.00	4.43	6.97	9.70	18.16	22.93	29.10	42.01
	0:40:00	0	0.00	3.70	5.65	7.87	16.57	20.73	25.92	37.18
	0:45:00	0	0.00	2.86	4.44	6.25	13.66	17.06	22.23	31.70
	0:50:00	0	0.00	2.30	3.67	4.97	11.36	14.16	18.25	26.14
	0:55:00	0	0.00	1.92	3.01	4.12	8.96	11.25	15.07	21.67
	1:00:00	0	0.00	1.59	2.46	3.38	7.21	9.11	12.81	18.41
	1:05:00	0	0.00	1.31	2.00	2.75	5.84	7.40	10.90	15.63
	1:10:00	0	0.00	1.02	1.69	2.35	4.18	5.35	7.56	11.07
	1:15:00	0	0.00	0.86	1.45	2.20	3.16	4.12	5.44	8.24
	1:20:00	0	0.00	0.78	1.27	1.94	2.40	3.12	3.78	5.77
	1:25:00	0	0.00	0.73	1.16	1.62	1.94	2.52	2.73	4.19
	1:30:00	0	0.00	0.71	1.08	1.41	1.56	2.00	2.11	3.24
	1:35:00	0	0.00	0.69	1.04	1.27	1.31	1.66	1.69	2.59
	1:40:00	0	0.00	0.68	0.91	1.17	1.16	1.45	1.41	2.18
	1:45:00	0	0.00	0.67	0.82	1.11	1.05	1.31	1.24	1.91
	1:50:00	0	0.00	0.67	0.76	1.06	1.00	1.23	1.17	1.79
	1:55:00	0	0.00	0.56	0.72	0.99	0.97	1.18	1.14	1.74
	2:00:00	0	0.00	0.49	0.67	0.88	0.95	1.16	1.13	1.73
	2:05:00	0	0.00	0.33	0.45	0.59	0.63	0.77	0.76	1.16
	2:10:00	0	0.00	0.22	0.29	0.39	0.42	0.51	0.50	0.76
	2:15:00	0	0.00	0.14	0.19	0.25	0.27	0.33	0.33	0.49
	2:20:00	0	0.00	0.09	0.12	0.16	0.17	0.20	0.20	0.30
	2:25:00	0	0.00	0.05	0.07	0.10	0.11	0.13	0.13	0.19
	2:30:00	0	0.00	0.03	0.04	0.05	0.06	0.07	0.07	0.10
	2:35:00	0	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.04
	2:40:00	0	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	2:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MHFD-Detention, Version 4.07 (June 2025)

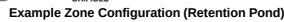
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

Station	Stage	Elevation	Area	Area	Volume	Volume	Total
---------	-------	-----------	------	------	--------	--------	-------

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

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

MHFD-Detention, Version 4.07 (June 2025)

Basin ID: POND K

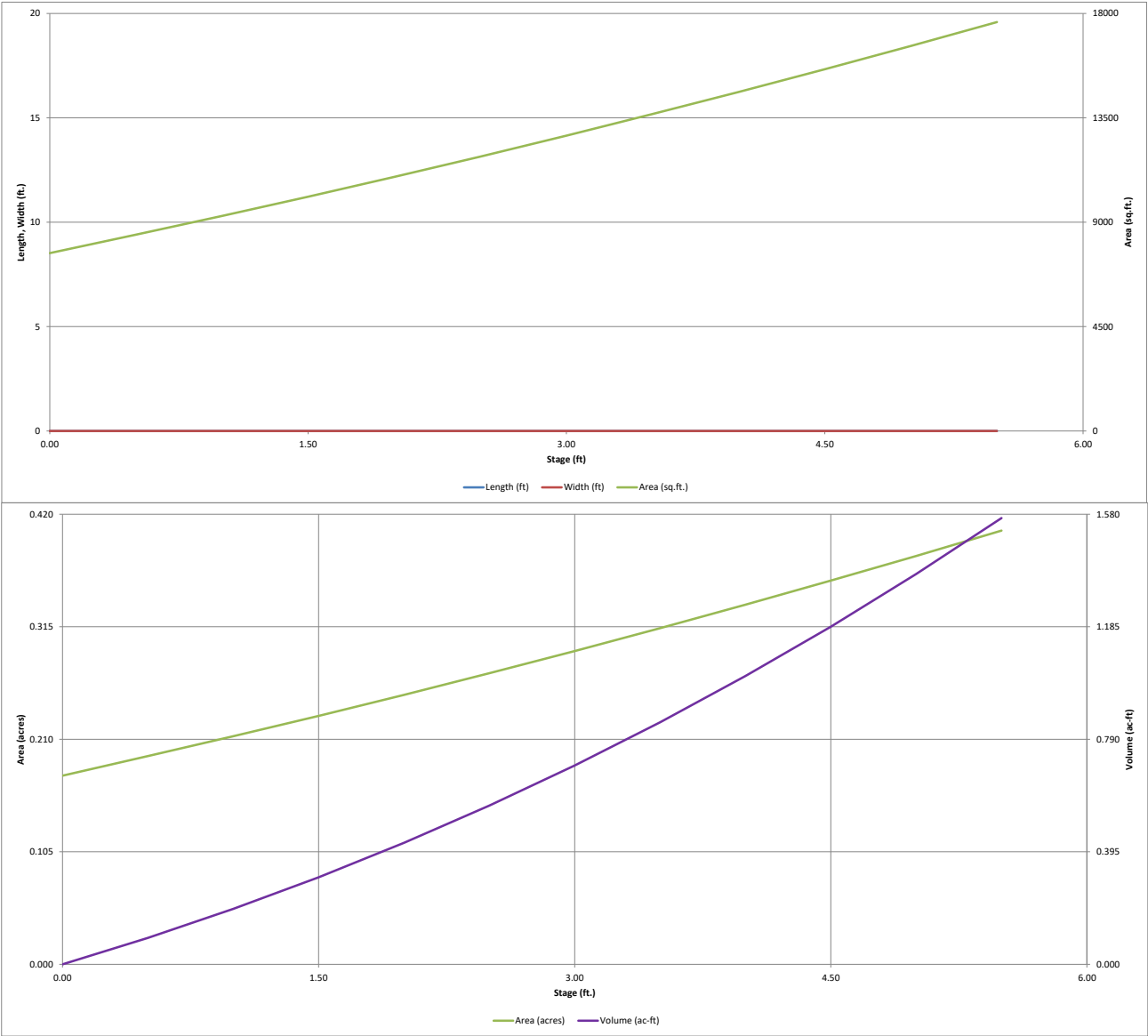
Optional User Overrides

Depth Increment =	0.50	ft
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12/9/2025, 4:11 PM

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

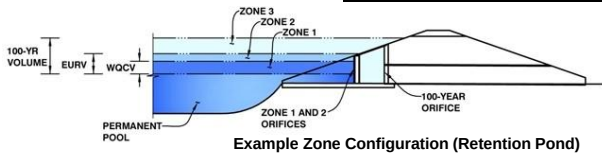


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID: POND K



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.96	0.184	Orifice Plate
Zone 2 (EURV)	2.19	0.290	Circular Orifice
Zone 3 (100-year)	3.58	0.397	Weir&Pipe (Restrict)
Total (all zones)		0.872	

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

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

Calculated Parameters for Underdrain
Underdrain Orifice Area = N/A ft²
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 SCM)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 0.96 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = 3.80 inches
Orifice Plate: Orifice Area per Row = 2.37 sq. inches (diameter = 1-3/4 inches)

Calculated Parameters for Plate
WQ Orifice Area per Row = 1.646E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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	0.32	0.64					
Orifice Area (sq. inches)	2.37	2.37	2.37					

	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 = 0.96 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = 2.19 ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = 0.38 inches

Calculated Parameters for Vertical Orifice
Zone 2 Circular Not Selected
Vertical Orifice Area = 0.00 ft²
Vertical Orifice Centroid = 0.02 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_o = 2.19 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 16.00 feet
Overflow Weir Grate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 8.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

Calculated Parameters for Overflow Weir
Zone 3 Weir Not Selected
Height of Grate Upper Edge, H_u = 4.19 feet
Overflow Weir Slope Length = 8.25 feet
Grate Open Area / 100-yr Orifice Area = 38.11
Overflow Grate Open Area w/o Debris = 91.83 ft²
Overflow Grate Open Area w/ Debris = 45.91 ft²

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

Depth to Invert of Outlet Pipe = 0.50 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 24.00 inches
Restrictor Plate Height Above Pipe Invert = 17.20 inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Zone 3 Restrictor Not Selected
Outlet Orifice Area = 2.41 ft²
Outlet Orifice Centroid = 0.80 feet
Half-Central Angle of Restrictor Plate on Pipe = 2.02 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 3.50 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 12.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.85 feet
Stage at Top of Freeboard = 5.35 feet
Basin Area at Top of Freeboard = 0.40 acres
Basin Volume at Top of Freeboard = 1.51 acre-ft

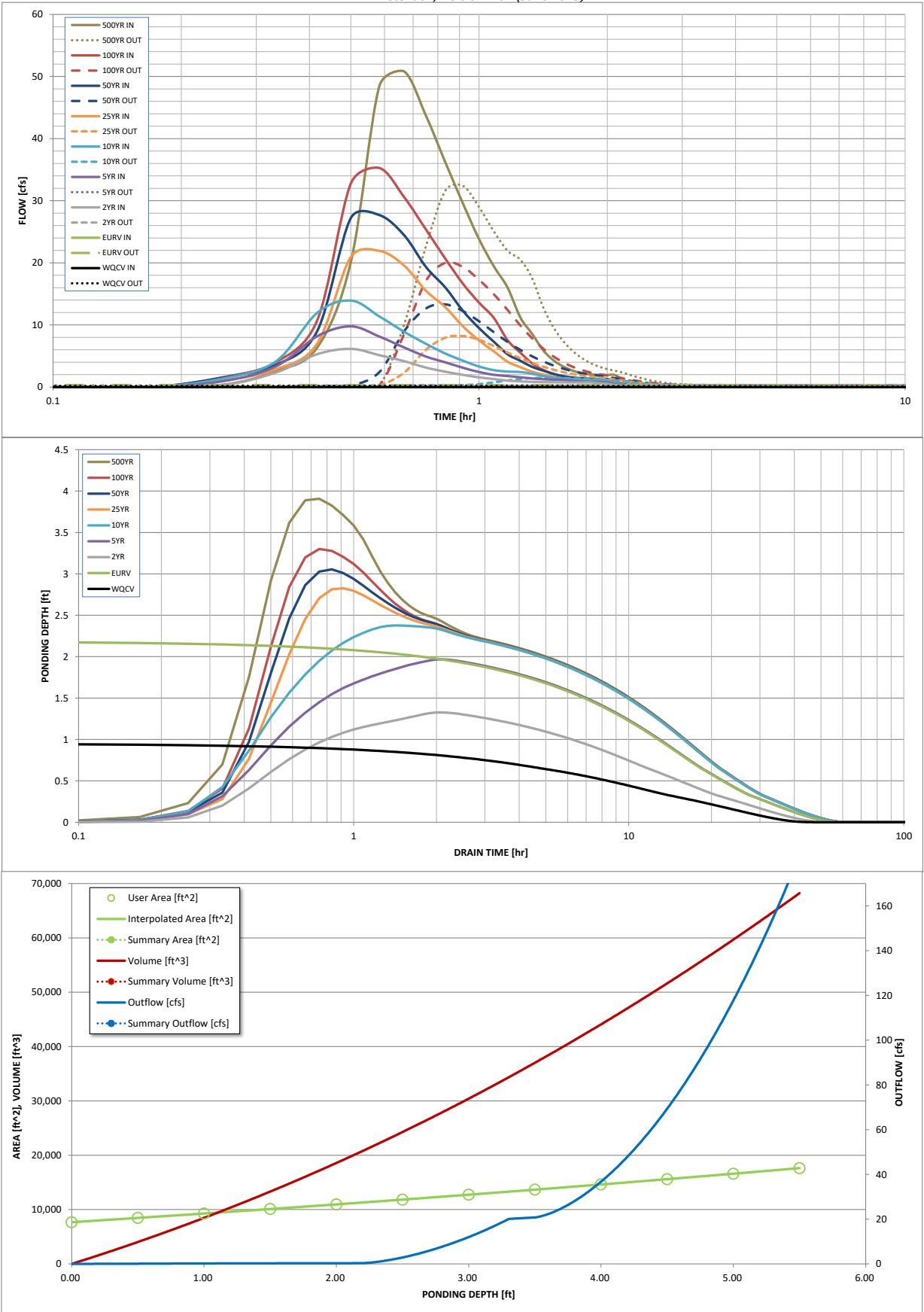
Routed Hydrograph Results

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	0.84	1.10	1.33	1.68	1.97	2.28	3.07
One-Hour Rainfall Depth (in) =	0.184	0.474	0.298	0.460	0.642	1.011	1.281	1.613	2.384
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.298	0.460	0.642	1.011	1.281	1.613	2.384
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.5	2.3	5.1	12.0	16.2	21.4	33.3
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.04	0.19	0.43	1.02	1.37	1.82	2.83
Peak Inflow Q (cfs) =	N/A	N/A	6.2	9.8	13.9	21.9	27.7	35.3	50.8
Peak Outflow Q (cfs) =	0.2	0.3	0.2	0.3	1.5	8.2	13.3	20.0	32.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.3	0.7	0.8	0.9	1.0
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.1	0.2	0.2
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	44	40	44	44	40	37	34	28
Time to Drain 99% of Inflow Volume (hours) =	40	50	45	50	52	49	48	46	42
Maximum Ponding Depth (ft) =	0.96	2.19	1.33	1.97	2.38	2.83	3.05	3.30	3.91
Area at Maximum Ponding Depth (acres) =	0.21	0.26	0.22	0.25	0.27	0.28	0.29	0.31	0.33
Maximum Volume Stored (acre-ft) =	0.186	0.475	0.264	0.416	0.522	0.646	0.713	0.788	0.979

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37
	0:15:00	0	0.00	0.32	0.94	1.37	1.05	1.52	1.57	2.56
	0:20:00	0	0.00	2.34	3.32	4.12	2.87	3.55	4.00	6.33
	0:25:00	0	0.00	5.29	8.18	11.93	6.98	8.97	10.69	20.09
	0:30:00	0	0.00	6.15	9.77	13.93	20.92	27.21	32.77	48.45
	0:35:00	0	0.00	5.14	8.14	11.38	21.94	27.69	35.28	50.83
	0:40:00	0	0.00	4.18	6.38	8.91	19.58	24.47	30.61	43.75
	0:45:00	0	0.00	3.15	4.92	6.97	15.53	19.37	25.40	36.20
	0:50:00	0	0.00	2.47	3.98	5.40	12.87	16.04	20.67	29.56
	0:55:00	0	0.00	1.97	3.11	4.25	9.77	12.27	16.63	23.82
	1:00:00	0	0.00	1.56	2.43	3.31	7.52	9.49	13.60	19.44
	1:05:00	0	0.00	1.29	1.98	2.72	5.75	7.30	11.13	16.02
	1:10:00	0	0.00	1.04	1.78	2.50	4.08	5.28	7.54	11.22
	1:15:00	0	0.00	0.91	1.58	2.43	3.21	4.24	5.54	8.54
	1:20:00	0	0.00	0.84	1.39	2.14	2.47	3.24	3.79	5.86
	1:25:00	0	0.00	0.80	1.27	1.77	2.03	2.64	2.74	4.24
	1:30:00	0	0.00	0.78	1.19	1.53	1.63	2.09	2.10	3.25
	1:35:00	0	0.00	0.76	1.15	1.37	1.38	1.75	1.68	2.60
	1:40:00	0	0.00	0.75	0.99	1.27	1.23	1.53	1.43	2.21
	1:45:00	0	0.00	0.75	0.89	1.20	1.14	1.41	1.32	2.03
	1:50:00	0	0.00	0.75	0.83	1.16	1.09	1.34	1.28	1.96
	1:55:00	0	0.00	0.62	0.79	1.09	1.07	1.31	1.27	1.94
	2:00:00	0	0.00	0.53	0.73	0.98	1.06	1.29	1.27	1.94
	2:05:00	0	0.00	0.34	0.46	0.62	0.67	0.82	0.81	1.23
	2:10:00	0	0.00	0.21	0.29	0.39	0.42	0.52	0.51	0.77
	2:15:00	0	0.00	0.13	0.17	0.24	0.26	0.31	0.31	0.46
	2:20:00	0	0.00	0.07	0.10	0.14	0.15	0.18	0.18	0.27
	2:25:00	0	0.00	0.04	0.06	0.07	0.08	0.10	0.10	0.15
	2:30:00	0	0.00	0.01	0.02	0.03	0.04	0.04	0.04	0.06
	2:35:00	0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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MHFD-Detention, Version 4.07 (June 2025)

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.

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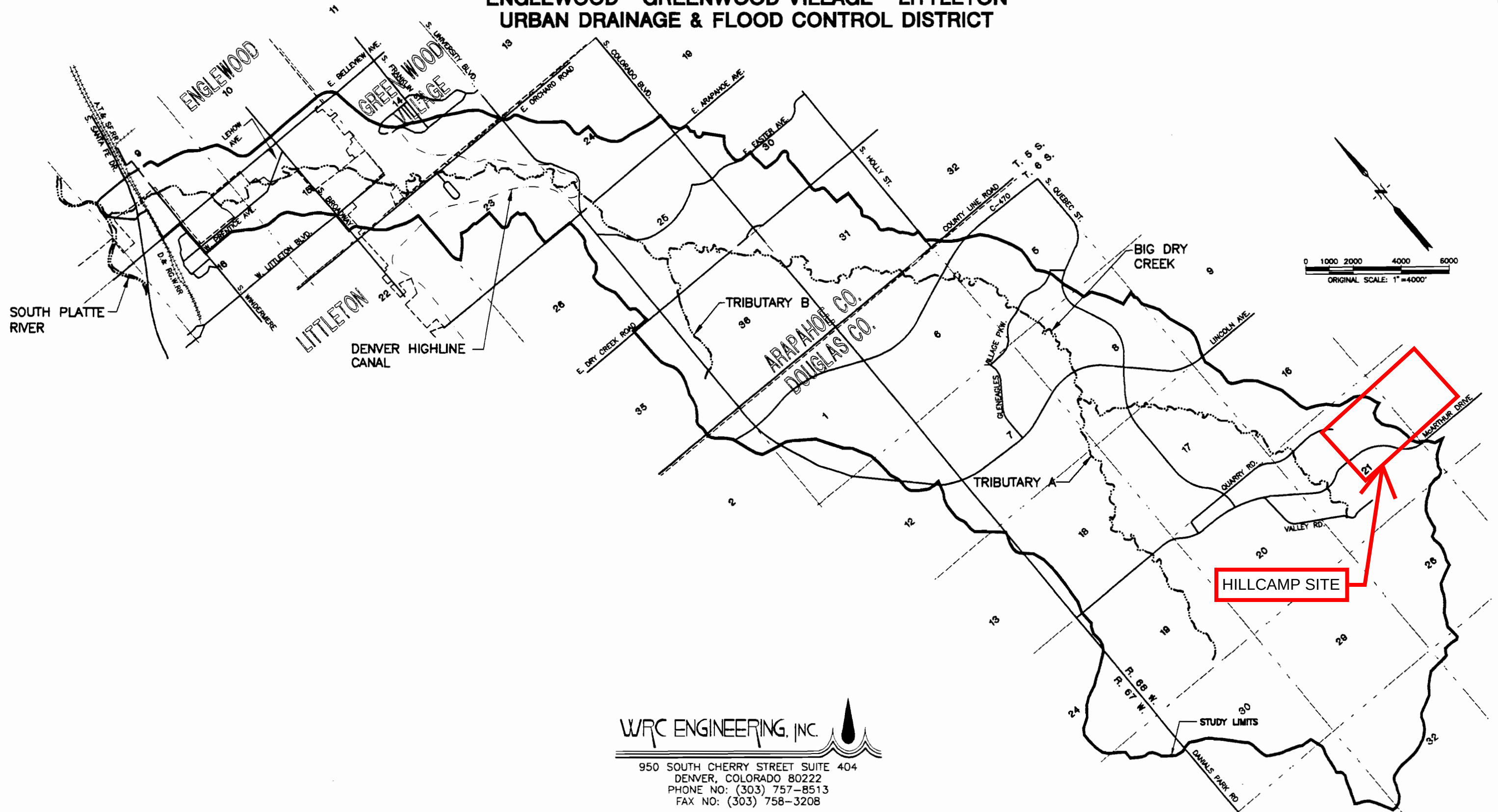
For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

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

APPENDIX E
REFERENCED MATERIAL

BIG DRY CREEK (ARAPCO) & TRIBUTARIES MAJOR DRAINAGEWAY PLANNING PHASE - A EVALUATION OF ALTERNATIVES REPORT

ARAPAHOE COUNTY • DOUGLAS COUNTY
ENGLEWOOD • GREENWOOD VILLAGE • LITTLETON
URBAN DRAINAGE & FLOOD CONTROL DISTRICT



WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET SUITE 404
DENVER, COLORADO 80222
PHONE NO: (303) 757-8513
FAX NO: (303) 758-3208

**BIG DRY CREEK (ARAPCO)
AND TRIBUTARIES**

MAJOR DRAINAGEWAY PLANNING

**PHASE - A
EVALUATION OF ALTERNATIVES REPORT**

Prepared For:

**ARAPAHOE COUNTY
DOUGLAS COUNTY
CITY OF ENGLEWOOD
CITY OF GREENWOOD VILLAGE
CITY OF LITTLETON
URBAN DRAINAGE & FLOOD CONTROL DISTRICT**

Prepared By:

**WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80222
TELEPHONE (303) 757-8513
FAX (303) 758-3208**

**JULY, 1996
WRC File: 1913/47**

I. INTRODUCTION

A. GENERAL

This report is part of a study authorized by the Urban Drainage and Flood Control District (UD&FCD) in the agreement regarding Major Drainageway Planning and Flood Hazard Area Delineation (FHAD) for Big Dry Creek (ARAPCO) and Tributaries, dated April 10, 1995 (Agreement No. 9501.08). The study area, shown in Figure I-1, consists of the entire Big Dry Creek watershed which encompasses parts of the City of Littleton, the City of Englewood, the City of Greenwood Village, Arapahoe County and Douglas County.

The study is divided into three parts. The first part (Phase A) for which this report was prepared, covers the hydrological, hydraulic, and alternative evaluation aspects of the study. The second part (Phase B) covers the preliminary design of the selected alternative. The third part is the FHAD, which was submitted for review on January 18, 1996. The Hydrology Report (Reference 16), summarized herein, was submitted for review on November 10, 1995.

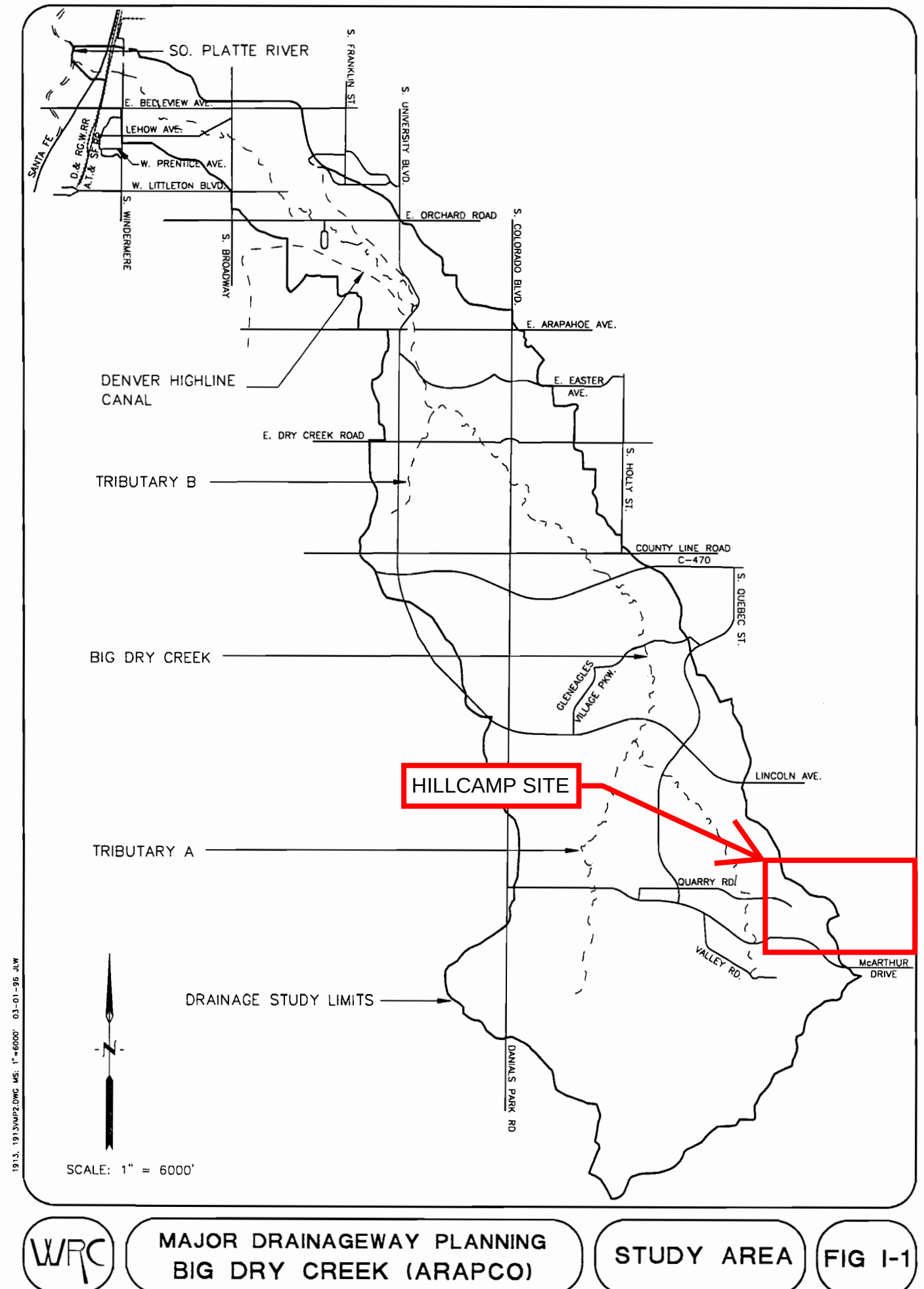
B. PURPOSE AND SCOPE

The purpose of this study is to update the original master plan report for Big Dry Creek, *Major Drainageway Plan Big Dry Creek*, dated June 1975 (Reference 10).

This update has been necessitated by several factors which have changed since 1975 including changes in land use assumptions, development conditions, channel conditions and improvements, and the general public's perceptions, desires and requirements. It is believed that these changes are of such significance that continued future reliance on the 1975 master plan is not in the best interests of the project sponsors nor the affected citizens and businesses.

The general scope of the Major Drainageway Planning Phase - A part of the study is as follows:

1. Gather and assemble available information on existing drainage facilities, comprehensive plans, land use plans, zoning and land ownership maps, and other applicable information.
2. Determine the hydrologic aspects of the drainage area including runoff rates and volumes under existing and full development scenarios for various return periods of storm events.



II. STUDY AREA DESCRIPTION

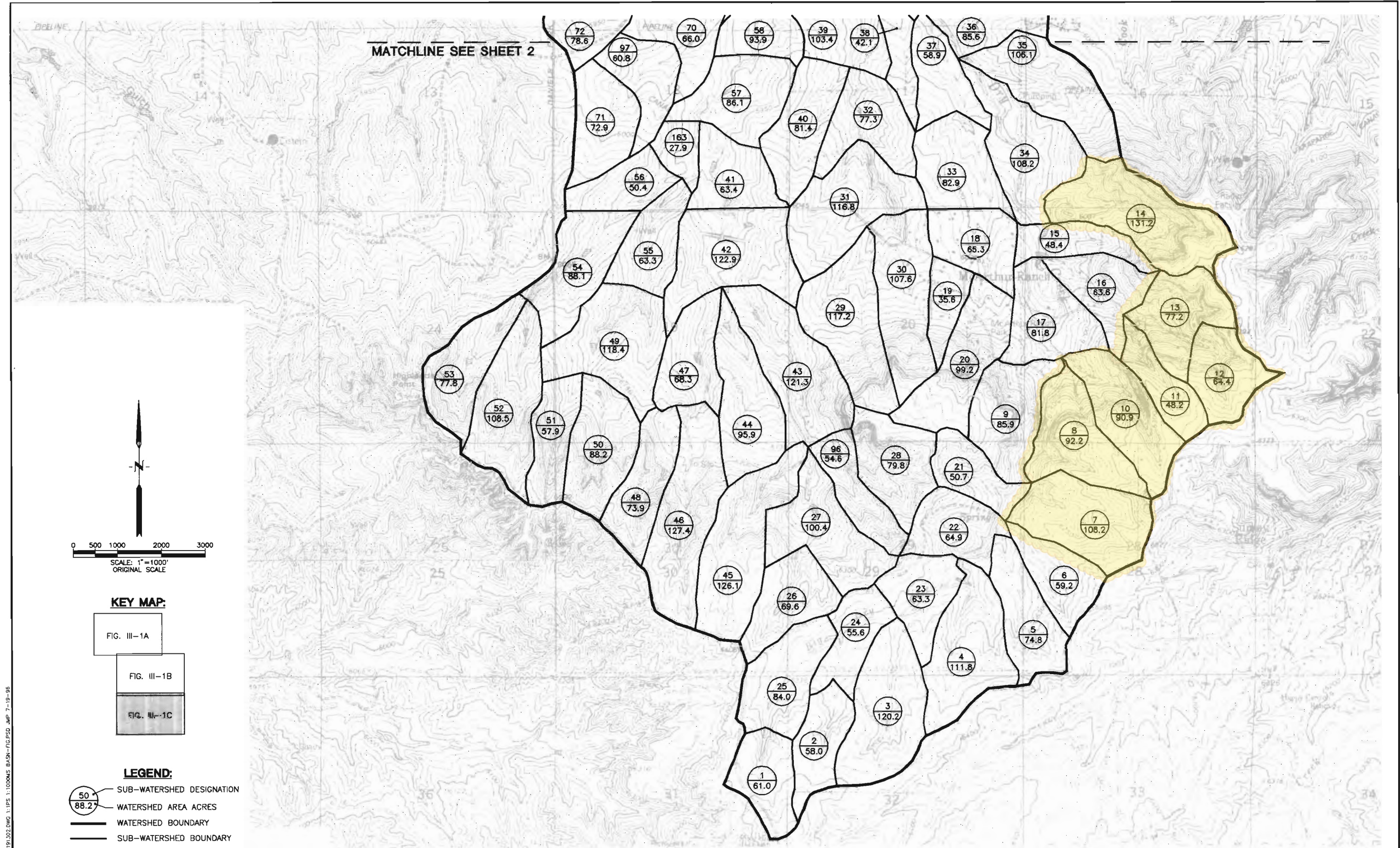
The Big Dry Creek (ARAPCO) watershed lies largely within the southern and southwestern portion of the Denver metropolitan area. The upper end of the watershed is located in Douglas County about five and one-half miles south of the Arapahoe-Douglas County Line in Section 31, Township 6 South, Range 67 West of the 6th Principal Meridian. The confluence of Big Dry Creek with the South Platte River is located west of Santa Fe Drive and north of Belleview Avenue in the City of Englewood in the west half of Section 9, Township 5 South, Range 68 West of the 6th Principal Meridian.

The area of the watershed tributary to Big Dry Creek is approximately 19.5 square miles (12,500 acres). The drainageway extends from Douglas County through Arapahoe County and the Cities of Littleton, Greenwood Village, and Englewood. A number of changes have occurred in the watershed since 1975 when the hydrology was first studied and reported (Reference 10). During this period the watershed has become increasingly urbanized, particularly the headwaters area that was largely undeveloped in 1975. Major drainageway features including bank protection, grade-control structures, crossing structures and detention facilities have been constructed along the length of the major drainageway. Similar drainage features within many sub-watersheds have also been constructed.

At the upper end of the watershed is the Wildcat Mountain Reserve, a conservation area that is to remain undeveloped and covers approximately 3½ square miles of the watershed. The McArthur Ranch Subdivision is being developed into about 5 acre lots in Sections 20 and 21, T6S, R67W, and is approximately fifty-percent developed. The Big Dry Creek channel passes through Highlands Ranch which consists of mixed residential uses with some commercial development, and the Links Golf Course. The drainageway itself has been retained primarily in its natural state in dedicated open space.

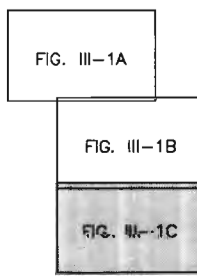
The channel passes through the South Suburban golf course as it enters Arapahoe County. In this area, the channel also retains much of its natural character. Continuing downstream, the channel meanders through an extensive greenbelt as it passes under South Colorado Boulevard and Dry Creek Road, and through to Cherry Knolls Park in Section 25, T5S, R68W, and East Arapahoe Road. This greenbelt extends north of East Arapahoe Road into Sections 23 and 24, T5S, R68W, through Julia De Koevend Park.

In the north central part of Section 23, the channel passes through an area of large private homesites. North of Orchard Road, the channel continues through an open greenbelt area which is a part of the Green Oaks Development. From Littleton Boulevard to Progress Park the channel meanders through a partly confined corridor among numerous business, commercial, and residential sites. The channel is relatively unconfined as it continues through Progress Park and across Belleview Avenue into Belleview Park. As the channel exits Belleview Park and Natural Area at South Windermere Street, it passes under two railroad bridges and the south Santa Fe Drive bridge through a commercial-industrial area to the South Platte River.



1913_19102.DWG 1:PS 1:1000MS BASH-FIGP50 JMP 7-19-96

KEY MAP:



LEGEND:

- SUB-WATERSHED DESIGNATION
- WATERSHED AREA ACRES
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET,
SUITE 404
DENVER, COLORADO 80222
PHONE NO: (303) 757-3513
FAX NO: (303) 758-3208

DESIGNED	GPB	DATE	06-19-95
DRAWN	JLW	DATE	06-19-95
CHECKED		DATE	
REVISED		DATE	
AS-BUILT		DATE	

ARAPAHOE COUNTY • DOUGLAS COUNTY
ENGLEWOOD • GREENWOOD VILLAGE • LITTLETON
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

MAJOR DRAINAGEWAY PLANNING
BIG DRY CREEK (ARAPCO)
AND TRIBUTARIES

WATERSHED MAP
SHEET 3 OF 3

FIGURE
III-1C

623+46. This tributary contributes approximately 40 percent of the total 100-year runoff in Big Dry Creek downstream of the confluence point.

o) South Quebec Street to Quarry Road

This reach of Big Dry Creek remains in its natural condition and exhibits the normally dry sandy bottom channel characteristics. 100-year average velocities in this reach range from a low of 0.7 fps (upstream of South Quebec Street) to a high of 16 fps at the outlet of the Quarry Road culverts. The typical average velocity is from 10 to 11 fps. At these velocities, severe erosion is expected to occur during the 100-year and more frequent flood events. The culvert at South Quebec Street is inadequate to convey the 100-year flood peak without overtopping. Approximately 1,190 cfs will overtop Quebec Street during the 100-year flood event.

p) Quarry Road to Valley Road

This reach of Big Dry Creek is characterized by encroachments into the main channel of small livestock pond embankments and undersized road crossings. The livestock ponds have either undersized or no apparent outlets and thus are subject to washout during any storm event. The culvert crossings at Quarry Road McArthur Drive, and Valley Road are all inadequate to convey the 100-year flood peaks without overtopping. 100-year overtopping flows are about 1,280 cfs, 1050 cfs, and 860 cfs, respectively. These overtopping flows have the potential to inundate private residences in the subject area. The limits of flooding from these overtopping flows shown on the drawings are estimated and thus are approximate in nature. 100-year average velocities range from 1.4 fps in ponding areas to 10 fps.

2. Big Dry Creek Tributary A

a) Big Dry Creek to McArthur Drive

This reach remains primarily in a natural condition with erosion check structures constructed at utility crossings. The channel is natural sandy bottomed, and exhibits characteristics of a normally dry sandy alluvial channel. An old irrigation/stock watering embankment still exists at Station 1089+73. This embankment has no apparent outlet and overtopping flows on the west side of the embankment will

remain separated from the main channel until about Station 1082+30. Average 100-year velocities range from 5 fps to 11 fps with an average of about 10 fps. Significant erosion of the channel is likely during a 100-year flood event.

b) McArthur Drive to Upstream Project Limit (Station 1160+00)

The most significant feature of this reach is a fairly large breached irrigation and/or flood control dam at Station 1113+93. The embankment appears to have been originally about 25 feet high. Headcutting through the breach has created a channel thalweg drop of about 18 feet. About 7 feet of said drop is protected by a concrete cutoff structure. Further upstream at Section 1143+75 is another old livestock/irrigation pond with no apparent outlet. All flood flows overtop said embankment on the west side and continue flowing outside of the main channel until rejoined at about Station 1138+00.

The culverts at McArthur Drive are inadequate to convey the 100-year flood peak without overtopping. About 1,140 cfs overtops said road during a 100-year flood event. The average 100-year velocities in this channel reach ranges from 1.9 fps in backwater conditions to 9.8 fps with an average rate of about 6 fps.

3. Big Dry Creek Tributary B

a) Big Dry Creek to East Dry Creek Road

This tributary reach was channelized and improved by Arapahoe County and the UD&FCD within the last three years. The channel consists of six grouted riprap drop structures joined by short, flat sections of channel. 100-year average velocities range from 6 to 10 fps at the drop structure crests.

b) East Dry Creek Road to Upstream Project Limits (Station 1560+00).

During the progress of the study, the crossing of Dry Creek Road was replaced with a box culvert that has a 100-year capacity without overtopping. The Jamison Street crossing contains two culverts; one exposed and one buried. About 1,170 cfs will overtop Jamison Street and drain directly back to the tributary channel during a 100-year flood event.

Happy Canyon Creek Major Drainageway Plan

March 2014



CITY OF LONE TREE



Crossing Alternatives. Improvements to roadway crossings with less than 100-year capacity were included in the alternative analysis. New crossings were assumed to be the same type as the existing crossing (e.g. culvert or bridge), with the exception of Dogwood Avenue. Douglas County provided guidance on the two desired alternatives for Dogwood: replacement with a steel truss bridge that will span the 100-year floodplain, and permanent closure of Dogwood to allow removal of the crossing.

Conceptual Design Plan

The plan selected by the project sponsors was generally consistent with the recommended plan. The plan is shown on the conceptual design drawings and profiles and is summarized in Figures ES-3 through ES-5. The plan includes regional full-spectrum detention improvements, channel stabilization and capacity improvements, fencing to reduce damage to the riparian corridor from cattle, and road and trail crossing capacity improvements.

Full-spectrum detention improvements. The conceptual design plan reflects the most extensive full-spectrum detention approach investigated during the study because it most effectively reduces peak runoff during frequent and large, infrequent storms to levels similar to historic conditions. This in turn reduces stresses imposed on Happy Canyon Creek during runoff events and allows a more modest (and less costly) program of stabilization improvements to be implemented. The maximum detention alternative also provides the most water quality treatment via extended detention, and significantly reduces 100-year peaks through the flood-prone Grandview Estates.

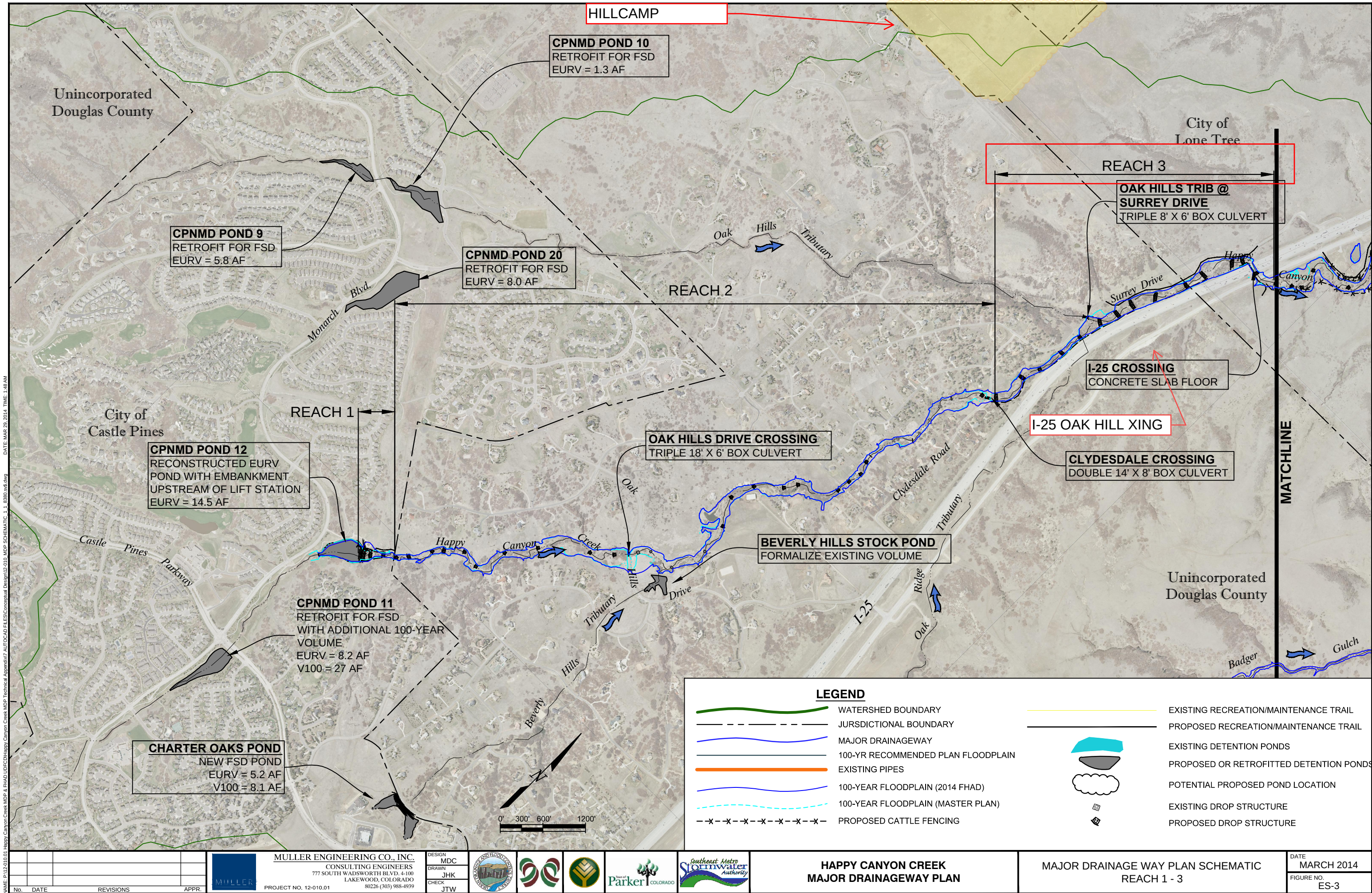
The plan shows 8 of the existing 16 detention facilities in the watershed as being retrofit to provide full-spectrum detention performance, primarily through the provision of EURV. In addition, 5 new full-spectrum detention facilities are shown (not including all of the new detention facilities that will serve the RidgeGate development. Strategic benefits to the watershed are able to be attained by the plan’s detention improvements, particularly in two key areas.

Castle Pines. Five existing regional and sub-regional detention facilities are in place and attenuating runoff from the relatively densely built-out residential areas of Castle Pines. However, these facilities were not constructed as full-spectrum detention basins and do not reduce peak discharges much in smaller, more frequent events including events in the 2-year to 5-year range. As a result, streams are degrading immediately downstream. The conceptual design plan calls for retrofit full-spectrum detention improvements to these existing facilities (CPNMD Ponds 9, 10, 11, 12, and 20) and one new full-spectrum detention facility (Charter Oaks Pond) to provide better attenuation of the more frequent events. This is viewed as critical to reduce stresses imposed on the downstream reach of Happy Canyon Creek; once these flows are better controlled, the downstream channel is expected to remain relatively stable, since the adjacent large lot residential area does not generate excessive runoff.

RidgeGate Development. The conceptual design plan calls for a specific full-spectrum detention strategy in the large RidgeGate parcel in the City of Lone Tree. All runoff from developing areas within RidgeGate will be captured and attenuated in EURV-only ponds located offline from mainstem Happy Canyon Creek and Badger Gulch. In this way, all urban runoff will be released to Happy Canyon Creek and Badger Gulch at rates similar to pre-development conditions up to events in the 2-year to 5-year range, and the ponds will not impede the natural movement of sediment in the mainstem streams since they will be located offline. This is important to maintain conditions as close as possible to a balance in water and sediment equilibrium to avoid major changes in channel slope and dramatic shifts toward aggradation and degradation. The offline sub-regional EURV ponds will be located to pick up runoff from all development parcels and will be sized based on the upstream area, soil type, and imperviousness according to standard UDFCD criteria, except that there will be no requirement to attenuate events exceeding that which fills the EURV down to historic levels.

In addition to the sub-regional offline EURV ponds, the conceptual design plan calls for 100-year online peak-skimming detention facilities. These ponds will be controlled by a road crossing or other embankment with a large culvert which passes base flows, smaller storm events, and sediment relatively unrestricted while providing some attenuation of larger storms. Like the EURV ponds, the number and locations of these ponds were assumed for hydrologic modeling purposes but have not been shown on the Conceptual Design Plan; the actual configuration will be dictated by the locations of road and/or trail crossings within the development. Additional design criteria for the offline EURV and online peak skimming ponds are identified in Section 7.2, Reach 4.

The detention improvements shown in the conceptual design plan are estimated to reduce future development 2-year peak discharges by 70 to 80 percent. A summary of discharges for the plan in comparison to baseline flow rates is shown in Table ES-3. By providing a high level of EURV within the Happy Canyon Creek watershed, the selected plan will significantly improve water quality in the stream. EURV facilities capture and treat approximately twice the volume of WQCV facilities, and reduce peak flows from small, frequently occurring storms close to historic levels.



NAME: P12-010.01 Happy Canyon Creek MDP & FHAD UDFCON Happy Canyon Creek MDP Technical Appendix AUTOCAD FILES/Conceptual Design/12-010 MDP SCHEMATIC 1.1 8380.sbf.dwg DATE: MAR 29, 2014 TIME: 1:48 AM

No.	DATE	REVISIONS	APPR.



MULLER ENGINEERING CO., INC.
CONSULTING ENGINEERS
777 SOUTH WADSWORTH BLVD. 4-100
LAKEWOOD, COLORADO 80226 (303) 988-4939

DESIGN MDC
DRAWN JHK
CHECK JTW

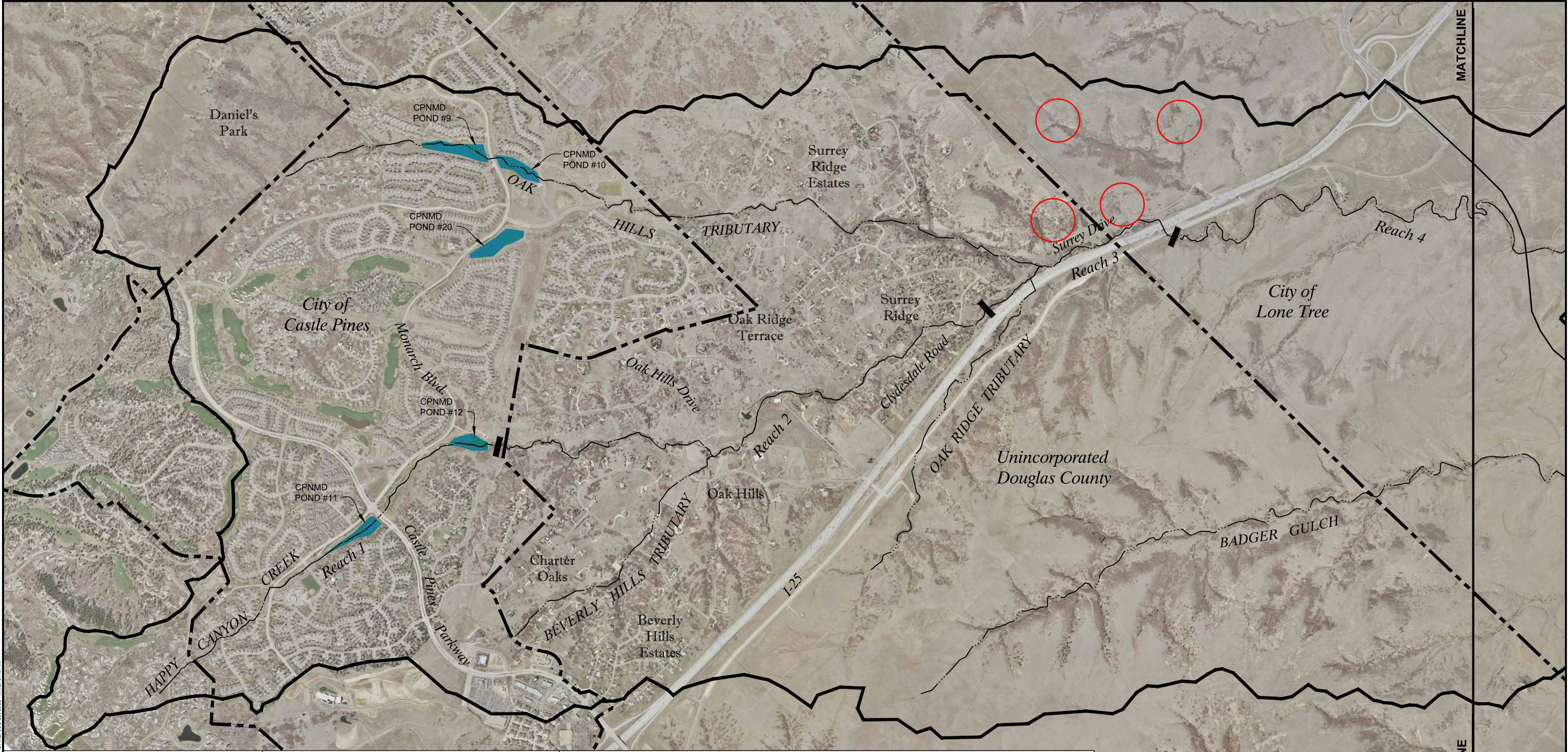
PROJECT NO. 12-010.01



HAPPY CANYON CREEK
MAJOR DRAINAGEWAY PLAN

MAJOR DRAINAGE WAY PLAN SCHEMATIC
REACH 1 - 3

DATE: MARCH 2014
FIGURE NO. ES-3



Map Controls (Select from Below):

- Study Area Map
- Soil Survey Map
- Existing Land Use Map
- Future Land Use Map
- Subwatershed Boundaries Map**
- Baseline Hydrology SWMM Routing Map

CLICK FOR RELEVANT SHEET

The availability of the layers and subwatershed map. Additional layers are available through the "Layers" Navigation Panel which can be accessed from the View Menu under Navigation Panels. In the Panel, the visibility of layers and layer groups can be changed by clicking the square left of the layer/group. An eye in the square indicated that the layer is on. An empty square indicates that the layer is off. Layer groups can be expanded and reduced by clicking the +/- symbol left of the layer/group.

Map Legend

	Watershed Boundary		Design Point	Imperviousness (%)	
	Major Basin Boundary		SWMM Subwatershed		2
	Sub-basin Boundary		Conveyance Element		5
	Jurisdiction Boundary		Detention Facility		10
	Existing Regional Detention		Outfall		15
	Reach Delimiter	Soil Type			20
	Subwatershed Label		A		25
			B		30
			C/D		40
					50
					60
					70
					75
					80
					85
					95
					100

0' 450' 900' 1800'

North Arrow

DESIGN	MDC
DRAWN	JHK
CHECK	JTW

MULLER ENGINEERING CO., INC.
CONSULTING ENGINEERS
777 SOUTH WADSWORTH BLVD. 4-100
LAKEWOOD, COLORADO 80226 (303) 988-4939

PROJECT NO. 12-010.01

NAME: P12-010.01_Happy_Canyon_Creek_Map & Flood_UplandCAD12010-HYDROLOGY MAPS.dwg
DATE: JUL 19, 2013 TIME: 9:48 AM

**HAPPY CANYON CREEK
MAJOR DRAINAGEWAY PLAN**

INTERACTIVE HYDROLOGY MAP
STUDY AREA

DATE
JULY 2013
FIGURE NO.
B-1

**MASTER DRAINAGE PLAN
FOR
RIDGEGATE - COTTONWOOD CREEK DRAINAGE BASIN**

January 2012

Prepared For:

Rampart Range Metropolitan District No. 1

8390 E. Crescent Parkway, Suite 500

Greenwood Village, CO 80111

Phone: (303) 779-4525

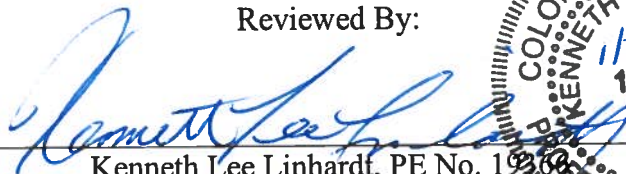
Fax: (303) 773-2050

Prepared By:



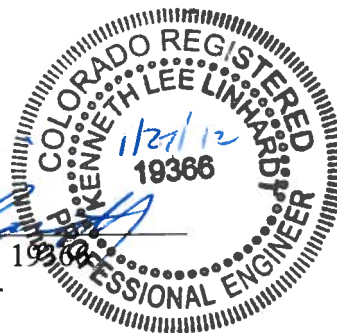
Carson Besgrove, PE

Reviewed By:



Kenneth Lee Linhardt, PE No. 19366

Senior Project Manager



Merrick Job No. 65117247



2450 South Peoria Street

Aurora, CO 80014-5472

Phone: (303) 751-0741

Fax (303) 752-4451



III. **DRAINAGE BASINS AND SUB-BASINS**

A. Major Drainage Basins

The Site is located in the upper reach of the Cottonwood Creek Drainage Basin which is a tributary to Cherry Creek. The drainage basin generally flows from southwest to northeast. There are no off-site major basins that are tributary to the Site. A portion of the major basin is located off-site and is covered in more detail in the minor basin section to follow.

Portions of the major basin are developed including part of the Sky Ridge Hospital, I-25, and some street improvements built to support anticipated development. Once built out, the area will consist of residential mixed-use, commercial mixed-use, rural residential, parks, and open space areas. Runoff in the fully developed condition will generally sheet flow to curb and gutter and/or individual on-site storm drainage collection systems where it will be routed to public storm inlets, through storm conveyance systems, through regional detention ponds, and will finally be conveyed to the historical outfalls under Lincoln Avenue.

The Cottonwood Creek Drainage Basin is adjacent to, and east of, the Willow Creek Drainage Basin. The existing and proposed development patterns for RidgeGate look to create a net transfer of 15.7 acres from the Cottonwood Creek Drainage Basin to the Willow Creek Drainage Basin. The approved MDP-W10 accounts for the transfer with the exception of changes to Filing No. 17 (Tract J) and the Filing No. 14 (Tract P) boundary which is proposed to develop as residential. The RidgeGate Section 15, Filing No.14, Phase III Drainage Report, by Calibre modified the Filing No. 14 basin boundary and transferred 1.1 acres from the Willow Creek Drainage Basin as defined in the MDP-W10 to the Cottonwood Creek Drainage Basin. The transfer has been accounted for in the current master plan but was not accounted for in the MDP-W10 before its approval. The transfer will not negatively impact the MDP-W10 since the change reduced the Willow Creek Drainage Basin size and thus the basin runoff. The final major basin sizes and the transfer of runoff between the major basins will be determined with final development of the Site and the associated Phase III Drainage Studies.

West of I-25

Basins C15A-C15H drain through natural tributary channels to their respective Design Points and into the Cottonwood Creek main channel. Southeast of Filing No. 14 (Tract P) there is a proposed roadway crossing the main channel. The proposed roadway crossing the drainage channel will create ponding south of the embankment (CCFCS, SWMM Storage Unit P). Per the Phase III Drainage Report for RidgeGate Parkway Street Widening, April, 2008 Update (DRRP-08), the runoff upstream of RidgeGate Parkway must be restricted to ensure that runoff from the basins do not enter the pedestrian crossing under RidgeGate Parkway. The maximum allowable inflow into the main pipe of the storm sewer system under RidgeGate Parkway (SWMM node 14B) as calculated in the DRRP-08 is 241 cfs.

The Cottonwood Creek Flow Control Structure (SWMM Storage Unit P) is accomplished by reducing the size of the culvert under the roadway embankment, by restricting the runoff at the roadway embankment crossings upstream, or by a combination of the two. For this study, the peak discharge was limited at the Cottonwood Creek Flow Control Structure only. The specific method of peak runoff restriction and the associated ponding behind the roadway embankments is addressed in Appendix E.

Basin C14-A drains to a proposed storm sewer extension (by Ridgegate Section 15, Filing No. 14, Phase III Drainage Report, by Calibre Engineering, Inc., dated August 2010) of the existing 36" RCP intended to capture runoff for the development. The storm sewer is connected to the 84" RCP under RidgeGate Parkway.

Basin C14-B drains to the main Cottonwood Creek drainage channel south of RidgeGate Parkway and into the 60" RCP on the upstream (south-west) side. The 60" RCP is part of the storm sewer system under RidgeGate Parkway and defined in the DRRP-08.

An existing area inlet sits southeast of the RidgeGate Parkway pedestrian underpass in the drainage channel. Future development in upstream basins south of RidgeGate Parkway shall be designed such that the ponding at the area inlet does not exceed the invert of the south

Two existing 96" CMP's provide the main outfall under Lincoln Avenue for all of the minor basins except for Basins C40 and C50. An outfall capacity analysis is provided in Appendix F. Both pipes were analyzed separately with inlet control since the pipe elevations varied slightly. The results proved that the combined capacity of the two pipes at full flow (when clean of debris and sediment) exceed the historical flows.

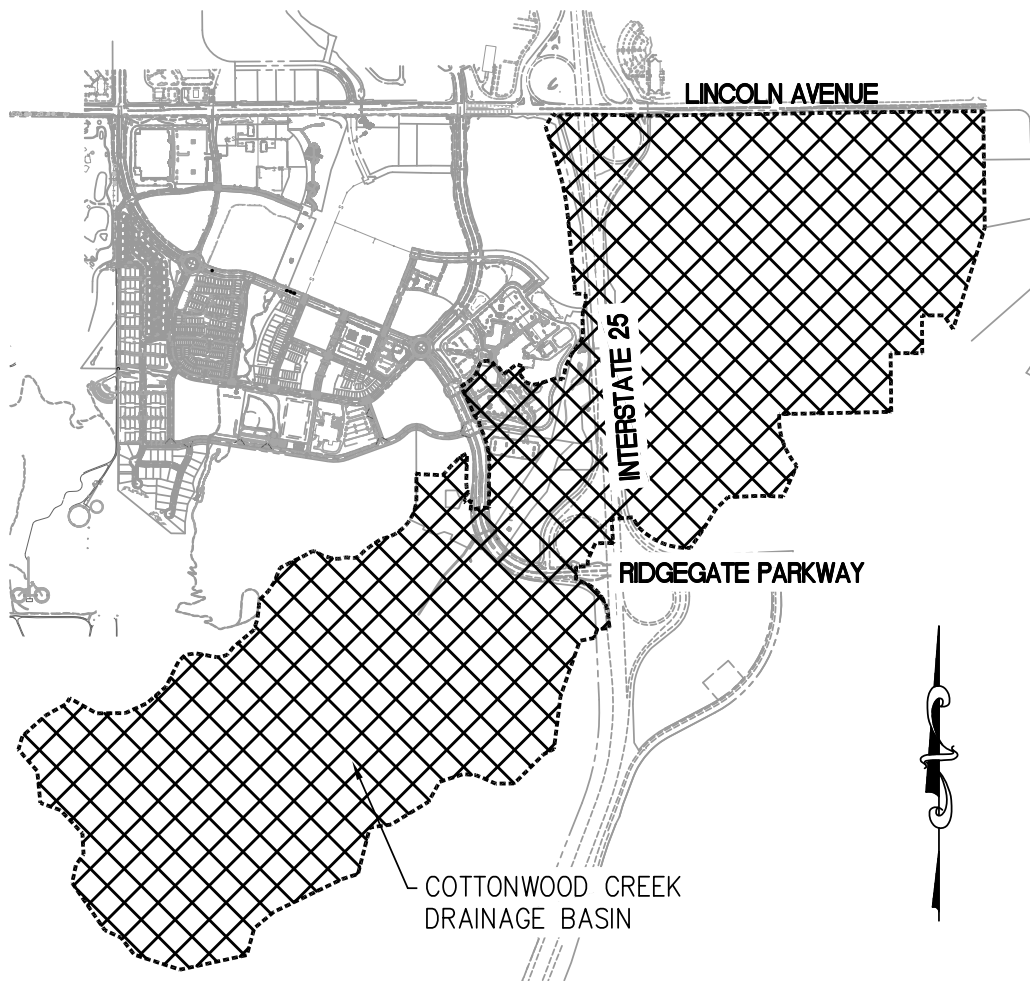
Basins C40 and C50 will utilize local on-channel EURV and 100-year detention to reduce peak developed flow rates to the Plan 100-year Release Rates from the OSP-10 at their respective outfalls. Appendix C presents the developed 100-year SWMM analysis.

An existing 72" CMP that reduces to a 54" CMP under Lincoln Avenue serves as the outfall for basin C40. An existing 48" CMP under Lincoln Avenue serves as the outfall for basin C50. Both outfalls are part of existing downstream storm sewer systems that were not analyzed for capacity in this report. A storm sewer capacity analysis will need to be provided with the future Phase III drainage reports for both basins.

B. Stormwater Storage Facilities

The Cottonwood Creek Flow Control Structure will be located upstream of the Filing No. 14 (Tract P) access road. The upstream flow control structure will be designed to reduce 100-year peak flow so that the maximum allowable inflow at the RidgeGate Parkway storm sewer system main storm pipe is 241 cfs. The flow control structure is not intended to provide water quality and is not designed to attenuate the difference between historical and developed flows. Appendix E presents the calculations for Cottonwood Creek Flow Control Structure (SWMM storage unit P) upstream of the Tract P access road.

The MDP-07 indicated that an additional detention pond would be installed upstream of Pond 311. It has since been determined that retrofitting existing Pond 311 will provide the necessary EURV for the Cottonwood Creek Basin west of I-25. Therefore, Pond 311 will be converted to provide water quality only in the form of EURV since the Cottonwood Creek Flow Control Structure does not account for water quality.



VICINITY MAP
2000 SCALE



RIDGEGATE – SECTION 22, FILING NO. 1

PHASE III DRAINAGE REPORT

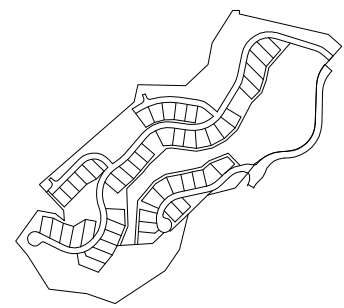
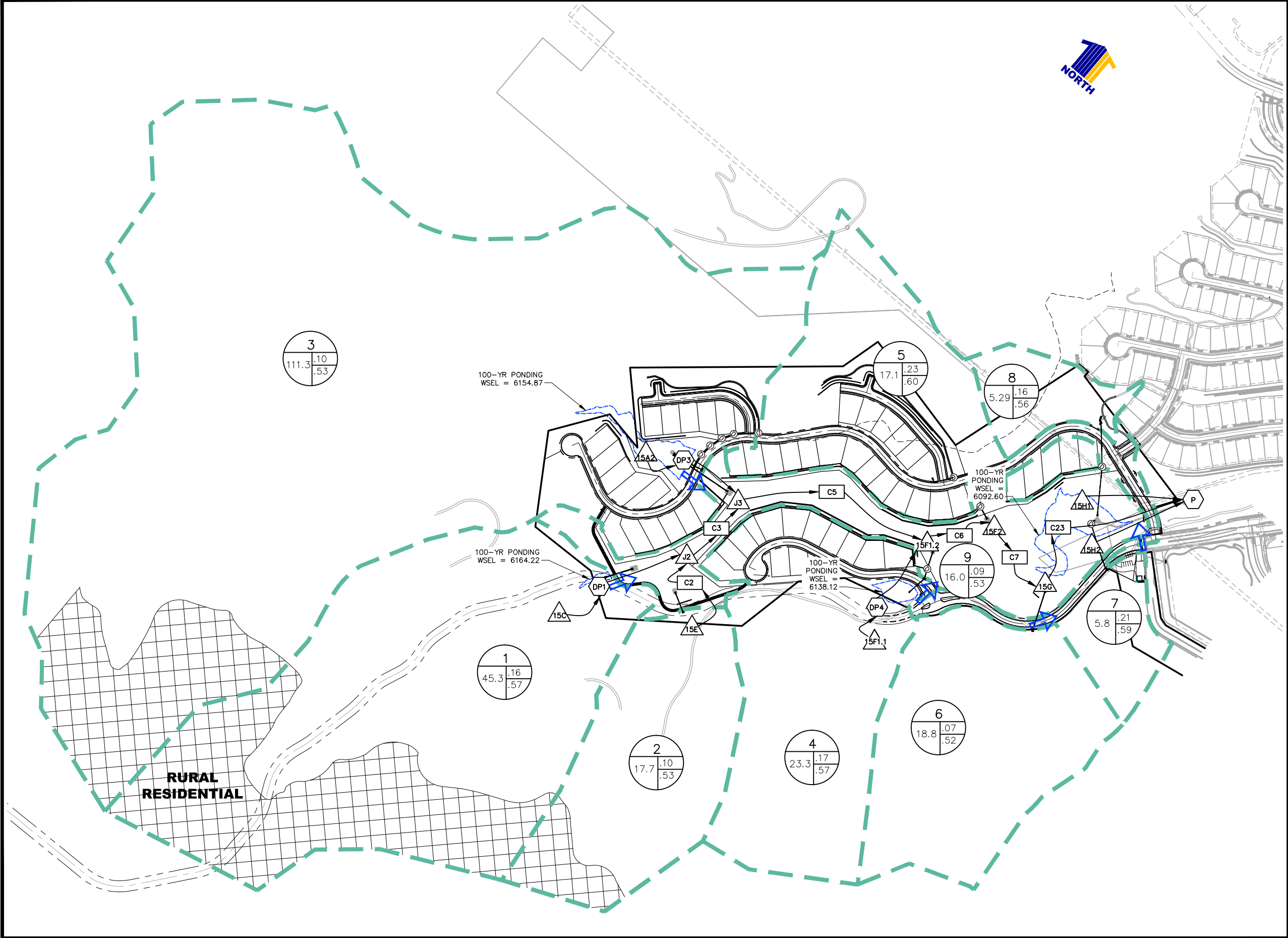
JANUARY 2017

For:
Century Communities
8390 E. Crescent Parkway, Suite 650
Greenwood Village, CO 80111

City of Lone Tree Review & Approval Is With Respect
To General Conformance With City Standards. Responsibility
For The Design Remains With The Professional(s) Submitting
And Stamping The Document(s).



PATH: P:\CENTURY RG TGGCADD\EXHIBITS\X-PDR.DWG
PLOTTED BY: JESSICA SAWYER, PLOT DATE: 1/24/2017 8:48 AM
XREFS: W-Wellands-RECVD, X-20PDR, 10PUT, 10KMDR, 10EPN, 10EUT, 10PPN, 10BASE.



KEYMAP

LEGEND

- PROPOSED MAJOR CONTOUR — 5250 —
- PROPOSED MINOR CONTOUR — —
- EXISTING MAJOR CONTOUR - - - 5250 - - -
- EXISTING MINOR CONTOUR - - - - -
- PROPOSED STORM DRAIN PIPE ———
- PROPOSED STORM DRAIN INLET □
- PROPOSED RIPRAP PAD ■
- PROPOSED SWALE ———→
- PROPERTY LINE ———
- DIRECTIONAL FLOW ARROW →
- BASIN LINE ———
- 100-YR PONDING EXTENTS ———
- EMERGENCY OVERFLOW ARROW →
- DESIGN POINT ▲
- PROPOSED BASIN LABEL A1 BASIN DESIGNATION
AREA (AC.) 1.00 .40 MINOR RUNOFF COEF.
.60 MAJOR RUNOFF COEF.
- 1J SWMM NODE
- P STORAGE UNIT
- C1 SWMM CONVEYANCE ELEMENT



UNCC
CALL BEFORE
YOU DIG
811
OR
1-800-922-1987
Utility Notification
Center of Colorado

City of Lone Tree

Date

These construction plans have been reviewed
by the City of Lone Tree for street and
drainage improvements only.

Engineering Division Acceptance Block

DATE	REVISION	DESCRIPTION
	1	
	2	
	3	
	4	
	5	

Drawing Name X-PDR.dwg
Job Number
Prepared For CENTURY

0 100 200 400	HORIZONTAL SCALE: 1"=200'		
Designer KLH	Drafter MAS	Checked TAJ	

Calibre
Calibre Engineering, Inc.
9090 South Ridgeline Boulevard, Suite 105
Highlands Ranch, CO 80129 (303) 730-0434
www.calibre-engineering.com
Construction Management Civil Engineering Surveying

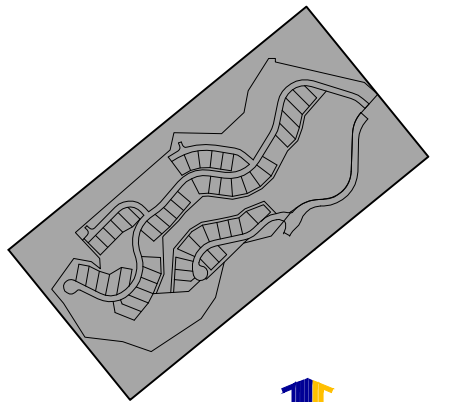
RIDGEGATE - SECTION 22, FILING 1
PHASE III DRAINAGE REPORT
SWMM MAP

Sheet DR1	1 of 2
Date JANUARY 24, 2017	

RIPRAP PROTECTION TABLE			
DESIGN PT.	TYPE	LENGTH & WIDTH (FT)	DEPTH (FT)
DP 1	VL	L.T. Basin	20
DP 2	L	L.T. Basin	15
DP 3	L	L.T. Basin	20
DP 3.4 (outlet)	VL	L.T. Basin	15
DP 4	VL	L.T. Basin	15
DP 5	VL	L.T. Basin	20
DP 6	VL	L.T. Basin	15
DP 7	L	Pad	15
DP 8	L	Pad	15

SUMMARY RUNOFF TABLE				
DESIGN PT.	BASIN	AREA	ROUTED Q ₂	ROUTED Q ₁₀₀
		(ACRES)	(CFS)	(CFS)
1.1	OS1.1	0.98	0.1	3.0
	OS1.2	44.3	13.9	82.6*
	OS2.1	0.86	0.1	2.7
	OS2.2	15.5	2.5	28.5*
2.1	OS2.3	1.33	0.1	4.0
	OS3.1	6.21	0.3	17.1
	A1	2.56	2.2	10.2
	A2.1	1.11	2.3	6.4
3.1	A2.2	0.60	3.8	10.0
	OS3.2	99.6	10.0	197.8*
	A3	1.30	2.0	6.6
	OS4.1	3.48	1.0	10.5
4.1	OS4.2	14.53	2.4	47.0*
	B1	2.92	3.6	12.8
	B2	2.33	3.0	9.6
	OS5	7.51	0.4	21.3
5.1	OS5	7.51	0.4	21.3
	OS6.1	6.87	0.3	17.2
	OS6.2	9.86	0.8	30.6*
	OS6.3	2.11	0.1	6.4
6.1	OS7	4.55	0.8	13.7
	D1	0.61	1.7	4.0
	D2	0.59	1.3	3.5
	OS8	4.09	0.4	11.2
7.1	E	1.21	2.1	6.8
	CH	5.29	30.4	321.0*
	F1	0.84	1.6	4.9
	F2	1.00	2.2	7.2

* Runoff values taken from SWMM model



KEYMAP

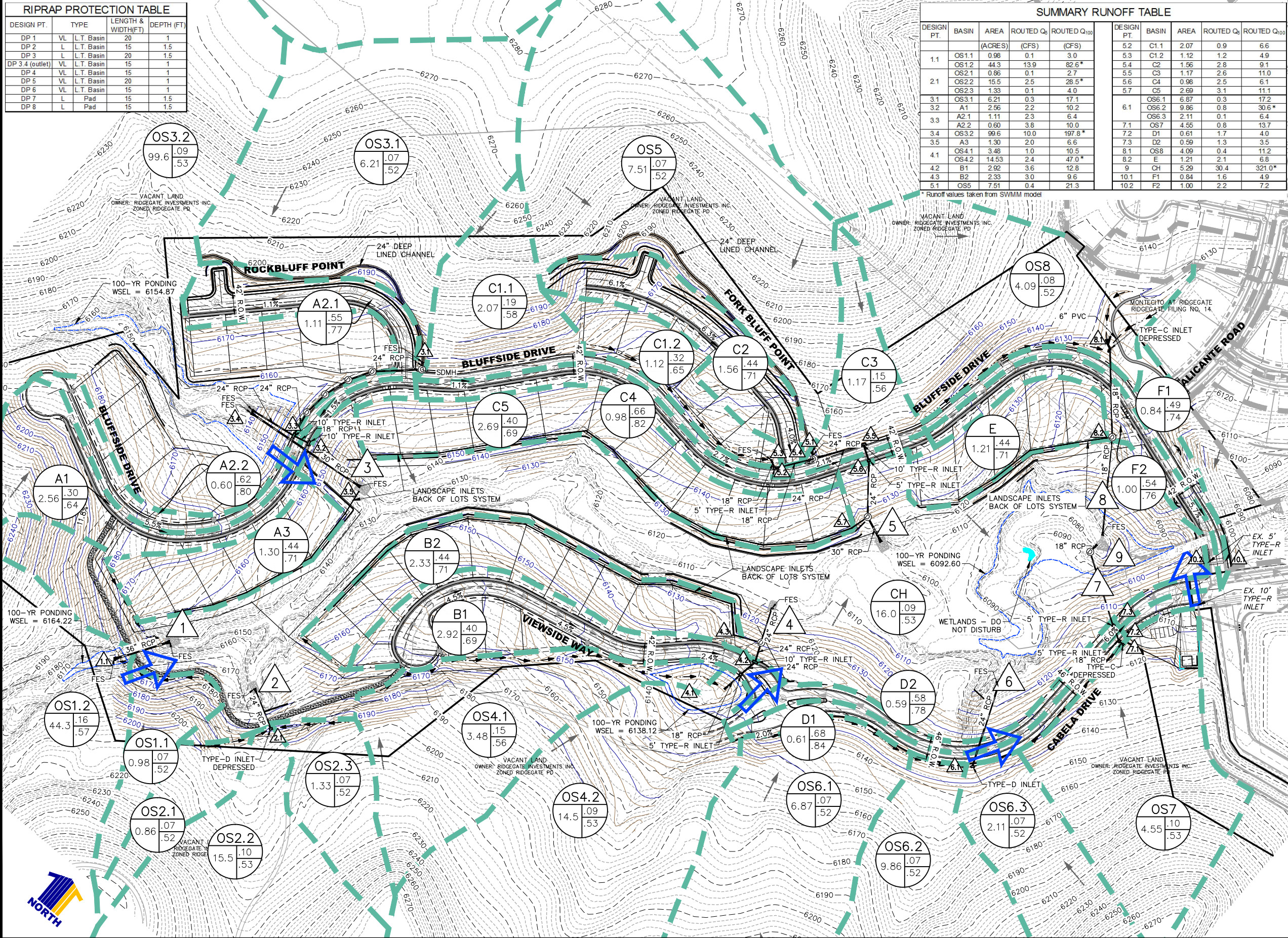
LEGEND

- PROPOSED MAJOR CONTOUR — 5250 —
- PROPOSED MINOR CONTOUR — 5250 —
- EXISTING MAJOR CONTOUR - - - 5250 - - -
- EXISTING MINOR CONTOUR - - - 5250 - - -
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- DESIGN POINT △
- PROPOSED BASIN LABEL A1 BASIN DESIGNATION
- AREA (AC.) 1.00 .40 MINOR RUNOFF COEF.
- .60 MAJOR RUNOFF COEF.



Utility Notification
Center of Colorado

City of Lone Tree
Date
These construction plans have been reviewed by the City of Lone Tree for street and drainage improvements only.
Engineering Division Acceptance Block



DATE	REVISION	DESCRIPTION
	1	
	2	
	3	
	4	
	5	

Drawing Name	X-PDR.dwg
Job Number	
Prepared For	CENTURY

0	25	100	200
1 inch = 1 ft. Horizontal			
Designer	Drafter	Checked	
KLH	MAS	TAJ	

Calibre Engineering, Inc.
9090 South Ridgeline Boulevard, Suite 105
Highlands Ranch, CO 80129 (303) 730-0434
www.calibre-engineering.com
Construction Management Civil Engineering Surveying

RIDGEGATE - SECTION 22, FILING 1

PHASE III DRAINAGE REPORT

PROPOSED DRAINAGE PLAN

Sheet

DR2

Date

JANUARY 24, 2017

**PHASE III DRAINAGE REPORT
FOR
HILLCAMP DRIVE**

Prepared for:

Rampart Range Metropolitan District No. 1

8390 East Crescent Parkway, Suite 300
Greenwood Village, CO, 80111
Contact: John Connelly
(303) 779-5710

Prepared by:

JR ENGINEERING

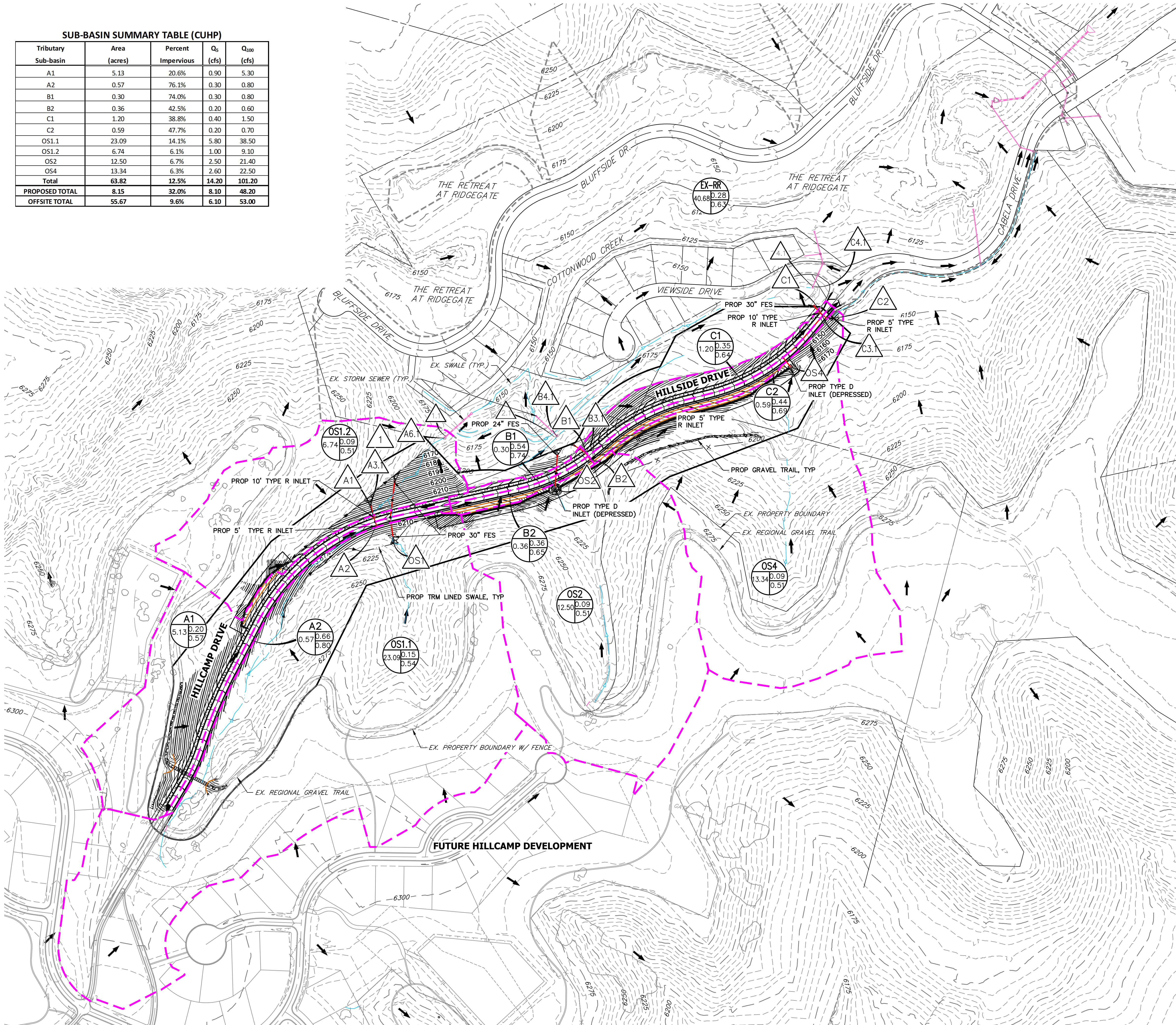
7200 S Alton Way, Suite C400
Centennial, Colorado 80112
(303) 740-9393
Contact: Kevin Rohrbough, P.E.

March 2025

Job Number 15950.18



SUB-BASIN SUMMARY TABLE (CUHP)				
Tributary Sub-basin	Area (acres)	Percent Impervious	Q _s (cfs)	Q ₁₀₀ (cfs)
A1	5.13	20.6%	0.90	5.30
A2	0.57	76.1%	0.30	0.80
B1	0.30	74.0%	0.30	0.80
B2	0.36	42.5%	0.20	0.60
C1	1.20	38.8%	0.40	1.50
C2	0.59	47.7%	0.20	0.70
OS1.1	23.09	14.1%	5.80	38.50
OS1.2	6.74	6.1%	1.00	9.10
OS2	12.50	6.7%	2.50	21.40
OS4	13.34	6.3%	2.60	22.50
Total	63.82	12.5%	14.20	101.20
PROPOSED TOTAL	8.15	32.0%	8.10	48.20
OFFSITE TOTAL	55.67	9.6%	6.10	53.00



DESIGN POINT DELTA TABLE (CUHP FLOWS)					
Ex Calibre Design Point	EX Q _s (cfs)	EX Q ₁₀₀ (cfs)	Prop JR Design Point	PROP Q _s (cfs)	PROP Q ₁₀₀ (cfs)
1.1	13.9	82.1	A6.1	8.0	53.7
2.1	2.5	28.5	B4.1	2.9	22.7
4.1	2.4	30.6	C4.1	3.1	24.8
SUM	18.8	141.2	SUM	14.1	101.3

*DELTA CALCULATED AS PROPOSED MINUS EXISTING, NEGATIVE RESULTS MEANS PROPOSED PRODUCES LESS RUNOFF THAN PREDICTED BY CALIBRE REPORT

LEGEND

EXISTING

BOUNDARY LINE

PROPERTY LINE

EASEMENT LINE

RIGHT OF WAY

CENTERLINE

TOP OF SLOPE

TOE OF SLOPE

INDEX CONTOUR

INTERMEDIATE CONTOUR

SWALE/WATERWAY FLOWLINE

STORM DRAIN

FLOW DIRECTION ARROW

EXISTING RETREAT AT RIDGEGATE

DESIGN POINT

PROPOSED

RIGHT OF WAY

INDEX CONTOUR

INTERMEDIATE CONTOUR

SWALE/WATERWAY FLOWLINE

STORM DRAIN

RETAINING WALL

CENTER LINE

DRAINAGE SUB-BASIN

BASIN DESIGNATION (ACRES, IMP. %)

FLOW DIRECTION ARROW

PROPOSED JR DESIGN POINT

NOTES:

1. DRAINAGE BASIN AREA AND IMPERVIOUS VALUES TAKEN FROM THE RIDGEGATE - SECTION 22, FILING NO.1 PHASE III DRAINAGE REPORT, DATED JANUARY 2017, BY CALIBRE ENGINEERING (RETREAT AT RIDGEGATE REPORT) AND ACCOUNT FOR THE PROPOSED CABELA DRIVE IMPERVIOUSNESS.

2. ALL EXISTING DRAINAGE INFRASTRUCTURE DOWNSTREAM OF THE PROPOSED IMPROVEMENTS IS DESIGNED TO ACCOUNT FOR THE PROPOSED CABELA DRIVE IMPROVEMENTS PER THE "RIDGEGATE - SECTION 22, FILING NO.1 PHASE III" DRAINAGE REPORT, DATED JANUARY 2017, BY CALIBRE ENGINEERING (RETREAT AT RIDGEGATE REPORT).

3. SEE THE RETREAT AT RIDGEGATE REPORT FOR MORE INFORMATION.

150 75 0 150 300

ORIGINAL SCALE: 1" = 150'

811

Know what's below. Call before you dig.

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE AGENCIES, OR ENGINEERING APPROVES THEIR USE, THESE DRAWINGS ARE DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
RAMPART RANGE METRO DISTRICT
8390 E CRESCENT PKWY
SUITE 300
GREENWOOD VILLAGE, CO 80111
PHONE: 303-779-5710

J.R. ENGINEERING
A Westman Company
Central 303-740-9888 • Colorado Springs 719-583-2583
Fort Collins 970-491-9888 • www.jrengineering.com

BY	DATE	NO.	REVISION	1"=150'	H-SCALE	N/A	3/19/2025	DATE	BP	BP	CHECKED BY

CABELA DRIVE EXTENSION

PROPOSED DRAINAGE MAPS

DR-01

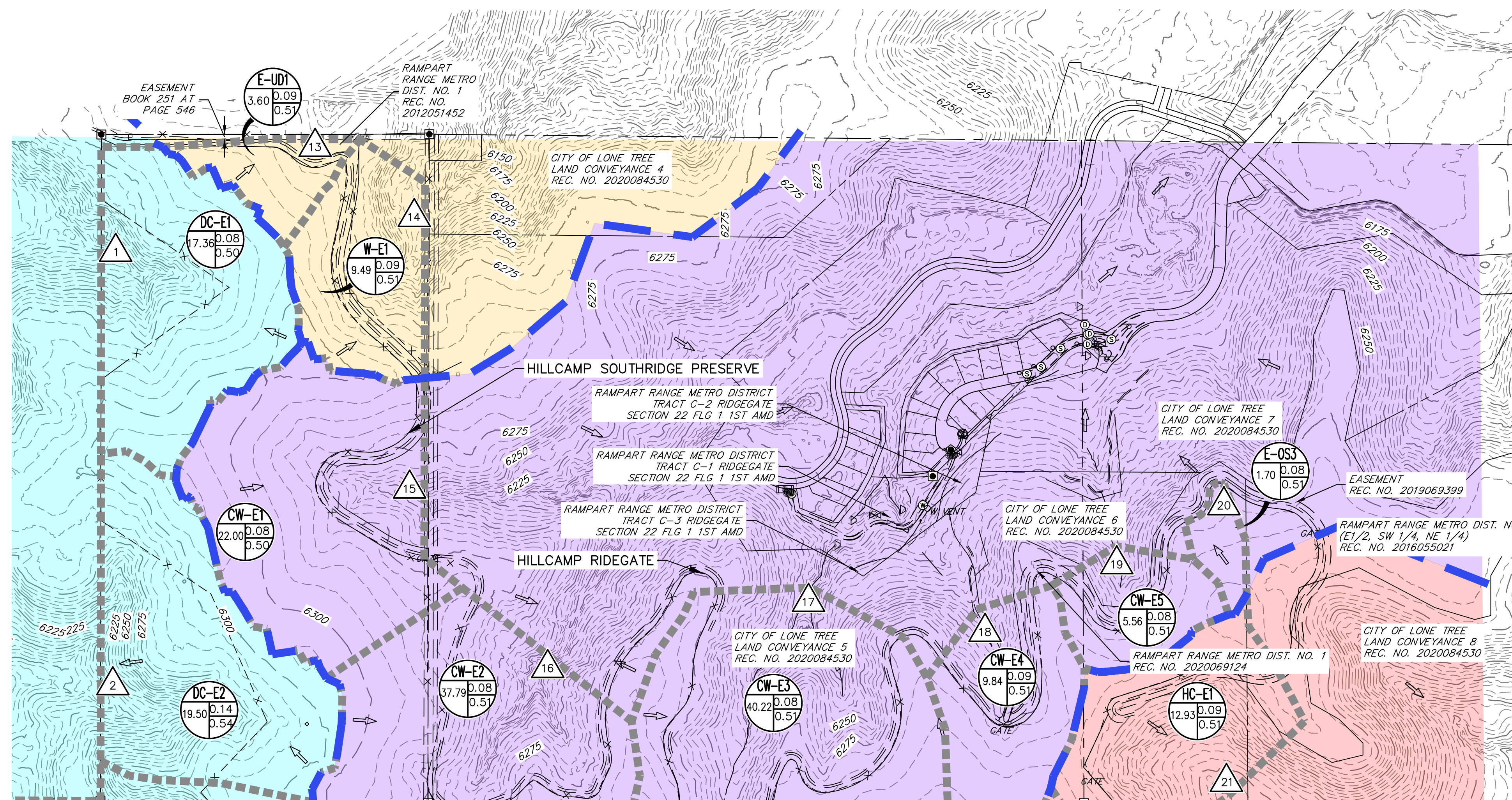
SHEET 1 OF 6

JOB NO. 15950.18

APPENDIX F
DRAINAGE MAPS

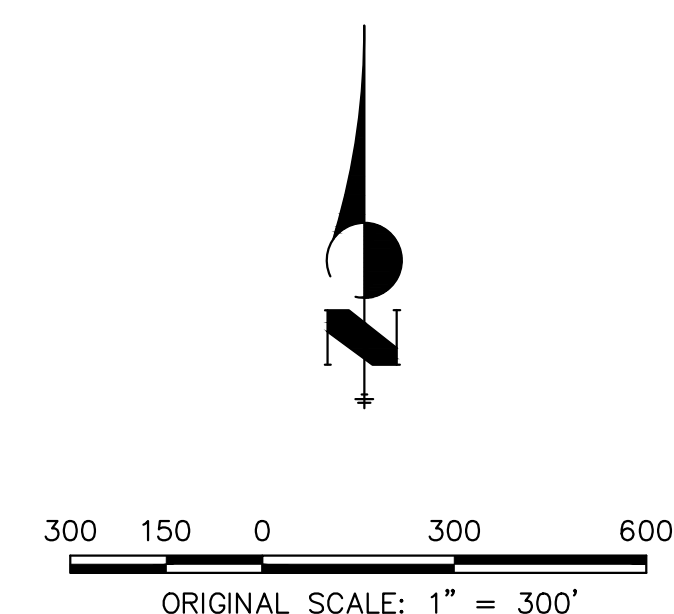
HILLCAMP SUBDIVISION

SECTION 21/22/28, TOWNSHIP 6 SOUTH
RANGE 67 WEST OF THE 6TH PM
CITY OF LONE TREE, DOUGLAS COUNTY, COLORADO
EXISTING DRAINAGE MAPS



LEGEND

MAJOR DRAINAGE BASIN	
EXISTING SUB-BASIN	
DESIGN POINT	
SUB-BASIN DESIGNATION	
EXISTING FLOW ARROW	
COTTONWOOD CREEK MAJOR DRAINAGE BASIN	
WILLOW CREEK MAJOR DRAINAGE BASIN	
BIG DRY CREEK MAJOR DRAINAGE BASIN	
HAPPY CANYON CREEK MAJOR DRAINAGE BASIN	



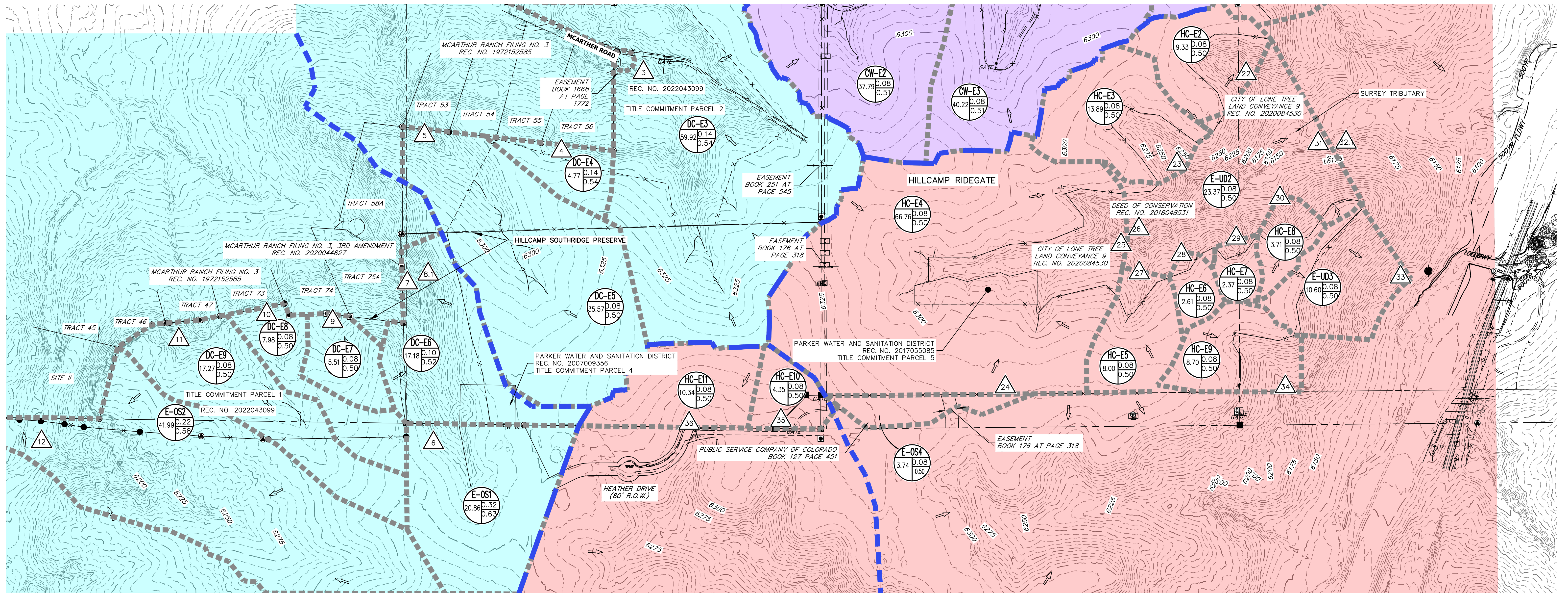
EXISTING DRAINAGE MAPS
HILLCAMP SUBDIVISION
JOB NO. 15950.12
2025-12-12
SHEET 1 OF 5



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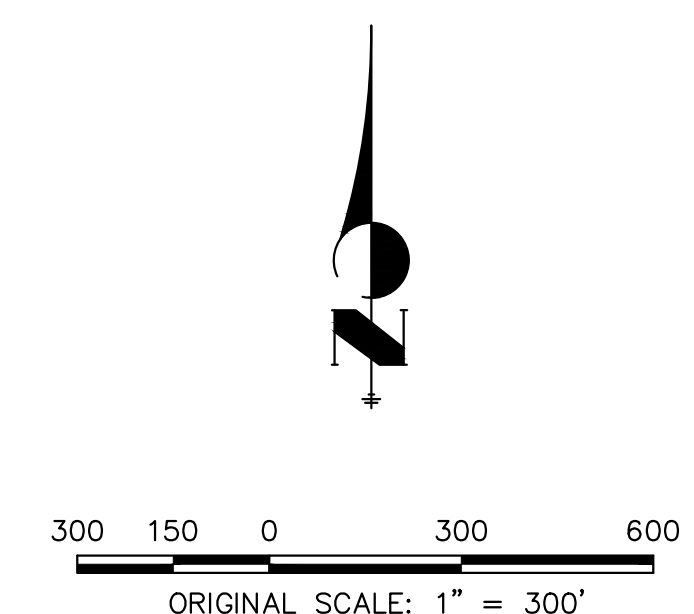
HILLCAMP SUBDIVISION

SECTION 21/22/28, TOWNSHIP 6 SOUTH
RANGE 67 WEST OF THE 6TH PM
CITY OF LONE TREE, DOUGLAS COUNTY, COLORADO
EXISTING DRAINAGE MAPS



LEGEND

MAJOR DRAINAGE BASIN	
EXISTING SUB-BASIN	
DESIGN POINT	
SUB-BASIN DESIGNATION	
EXISTING FLOW ARROW	
COTTONWOOD CREEK MAJOR DRAINAGE BASIN	
WILLOW CREEK MAJOR DRAINAGE BASIN	
BIG DRY CREEK MAJOR DRAINAGE BASIN	
HAPPY CANYON CREEK MAJOR DRAINAGE BASIN	



EXISTING DRAINAGE MAPS
HILLCAMP SUBDIVISION
JOB NO. 15950.12
2025-12-12
SHEET 2 OF 5



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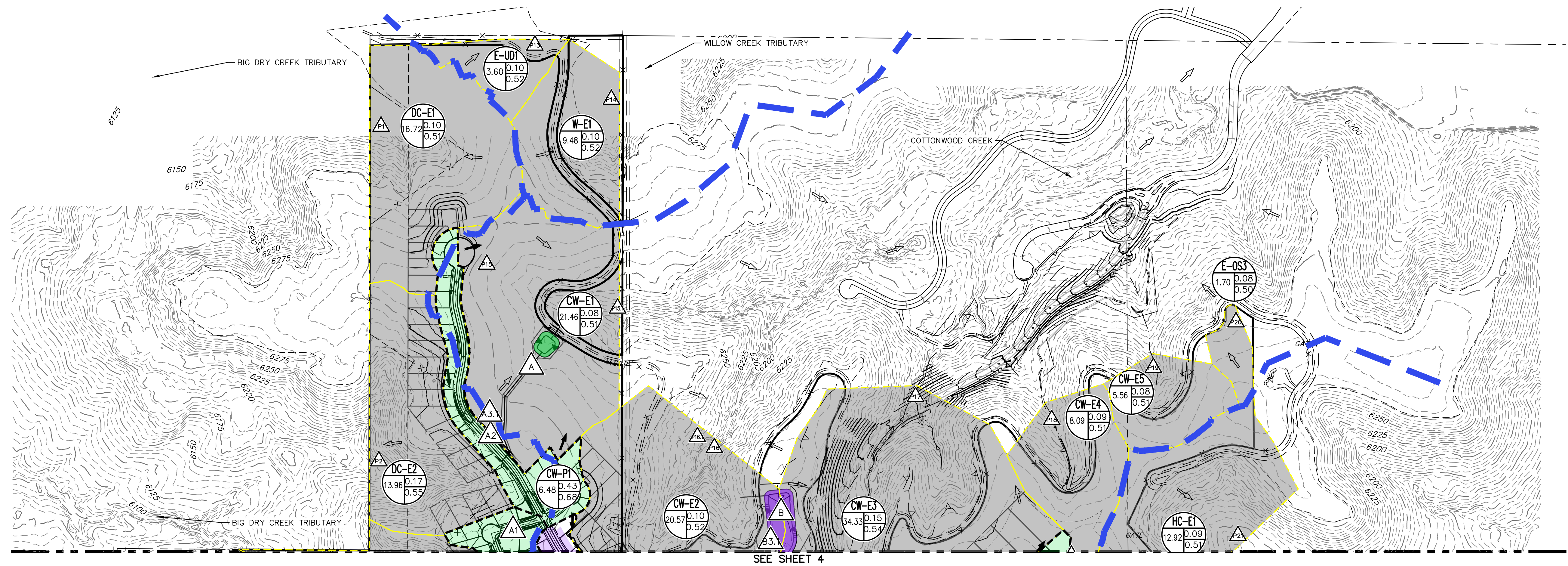
HILLCAMP SUBDIVISION

SECTION 21/22/28, TOWNSHIP 6 SOUTH

RANGE 67 WEST OF THE 6TH PM

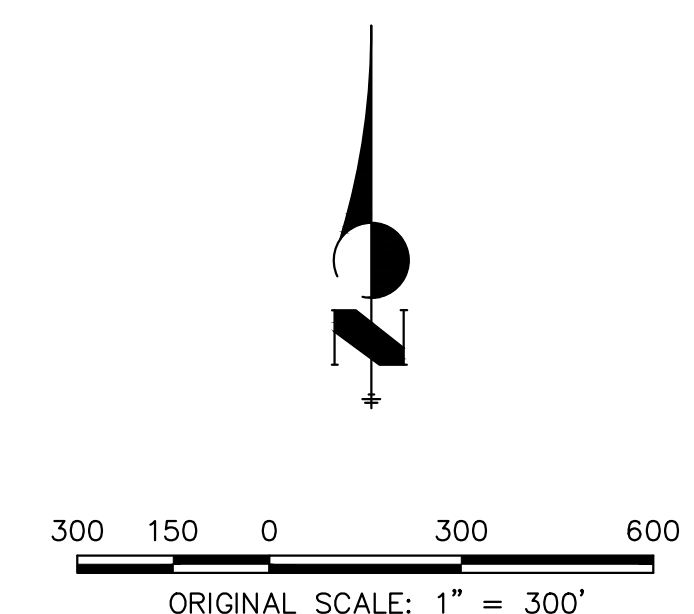
CITY OF LONE TREE, DOUGLAS COUNTY, COLORADO

PROPOSED DRAINAGE MAPS



LEGEND

- MAJOR DRAINAGE BASIN
- PROPOSED SUB-BASIN
- MODIFIED EX SUB-BASIN
- PROPOSED DESIGN POINT
- PROPOSED SUB-BASIN DESIGNATION
- EX DESIGN POINT
- MODIFIED EX SUB-BASIN DESIGNATION
- PROPOSED FLOW ARROW
- EXISTING FLOW ARROW



PROPOSED DRAINAGE MAPS
HILLCAMP SUBDIVISION
JOB NO. 15950.12
2025-12-12
SHEET 3 OF 5



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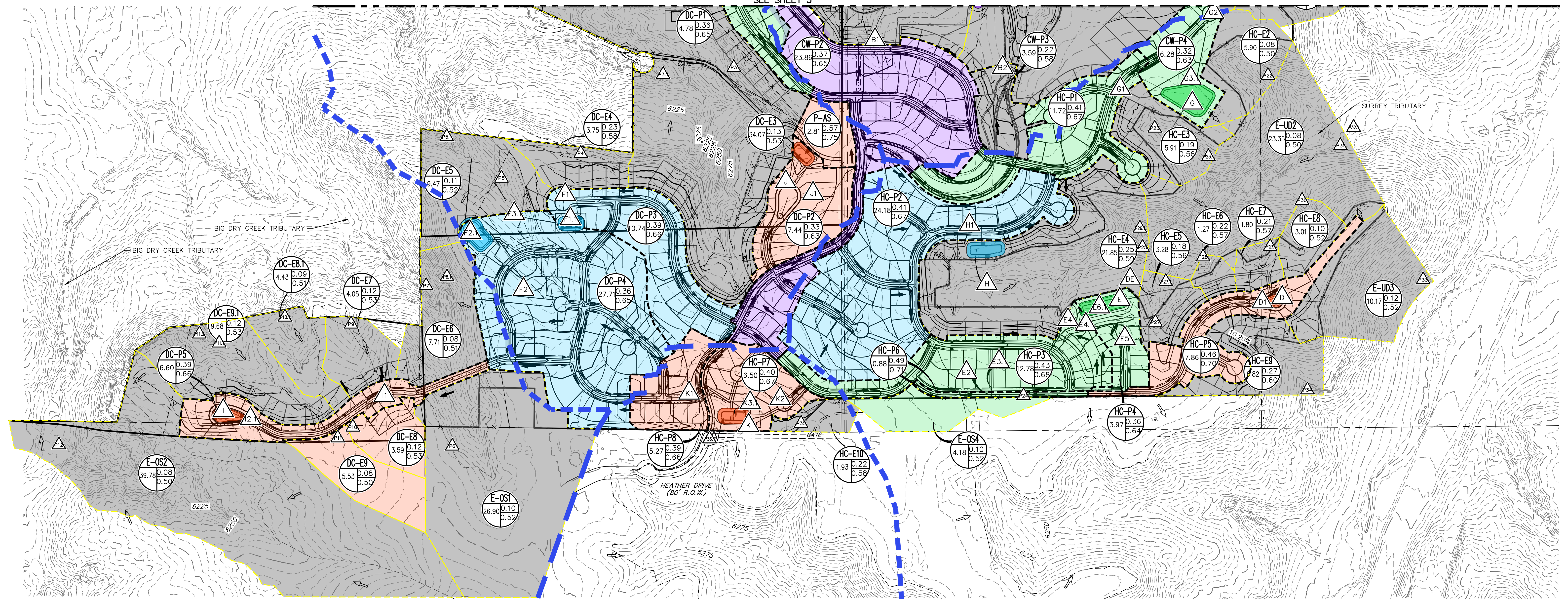
SECTION 21/22/28, TOWNSHIP 6 SOUTH

RANGE 67 WEST OF THE 6TH PM

CITY OF LONE TREE, DOUGLAS COUNTY, COLORADO

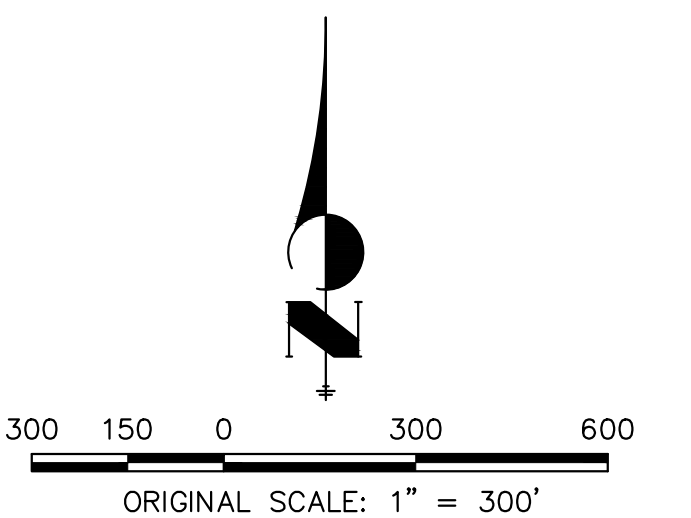
PROPOSED DRAINAGE MAPS

SEE SHEET 3



LEGEND

- MAJOR DRAINAGE BASIN
- PROPOSED SUB-BASIN
- MODIFIED EX SUB-BASIN
- PROPOSED DESIGN POINT
- PROPOSED SUB-BASIN DESIGNATION
- EX DESIGN POINT
- MODIFIED EX SUB-BASIN DESIGNATION
- PROPOSED FLOW ARROW
- EXISTING FLOW ARROW



PROPOSED DRAINAGE MAPS
HILLCAMP SUBDIVISION
JOB NO. 15950.12
2025-12-12
SHEET 4 OF 5

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HILLCAMP SUBDIVISION
SECTION 21/22/28, TOWNSHIP 6 SOUTH
RANGE 67 WEST OF THE 6TH PM
CITY OF LONE TREE, DOUGLAS COUNTY, COLORADO
PROPOSED DRAINAGE MAPS

DESIGN POINT COMPARISON TABLE BY MAJOR DRAINAGE BASIN					
MAJOR DRAINAGE BASIN	EX DOWNSTREAM DESIGN POINT	EX FLOW (CFS)	PROPOSED DESIGN POINT	PROP FLOW (CFS)	DELTA FLOW RATE (CFS)
BIG DRY CREEK	1	45.8	P1	40.8	-5.0
	2	51.2	P2	42.7	-8.5
	3	124.3	P3.1	93.4	-30.9
	4	13.1	P4	18.9	5.7
	5	64.4	P5.1	52.3	-12.0
	6	50.0	P6	59.4	9.4
	7	34.5	P7	15.7	-18.7
	8.1	80.3	P8.1	71.6	-8.6
	9	15.2	P9	16.6	1.4
	10	17.3	P10.1	13.1	-4.2
	11	34.7	P11.2	85.4	50.7
	12	71.3	P12	67.6	-3.7
	SUM	601.9	SUM	577.4	
WILLOW CREEK	13	9.5	P13	9.4	-0.2
	14	21.4	P14	21.5	0.2
	SUM	30.9	SUM	30.9	
COTTONWOOD CREEK	15	53.4	P15.1	81.6	28.3
	16	80.8	P16.1	53.2	-27.7
	17	78.8	P17	76.8	-2.0
	18	27.2	P18	22.6	-4.6
	19	17.2	P19	15.3	-1.8
	20	4.0	P20	4.0	0.0
SUM	261.3	SUM	253.5		
HAPPY CANYON CREEK	21	33.5	P21	34.8	1.4
	22	20.4	P22	17.2	-3.2
	23	30.0	P23.1	39.8	9.9
	24	8.8	P24	8.0	-0.8
	25	118.1	P25	56.2	-61.9
	26.1	124.9	P26.1	79.3	-45.6
	27	18.1	P27.1	38.1	20.0
	28	6.4	P28	6.4	0.0
	29	6.6	P29	9.1	2.5
	30	8.8	P30	13.8	4.9
	31	49.4	P31	49.2	-0.2
	32.1	248.3	P32.1	225.8	-22.5
	33	26.4	P33	31.8	5.4
	34	19.0	P34	30.6	11.6
	35	10.9	P35	7.1	-3.8
	36	24.2	P36.1	20.0	-4.2
	SUM	753.8	SUM	632.3	
	EX SITE TOTAL		1648.0	PROP SITE TOTAL	
			*RATIO		91%
*RATIO CALCULATED AS PROPOSED SITE TOTAL DIVIDED BY EXISTING SITE TOTAL					

PROPOSED SUB-BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
DC-P1	4.78	40.3%	0.37	0.65	14.4	5.9	18.7
DC-P2	7.44	35.9%	0.33	0.63	24.4	6.3	21.5
DC-P3	10.74	33.6%	0.31	0.62	24.1	8.7	30.9
DC-P4	27.71	45.2%	0.41	0.67	26.6	27.6	81.0
DC-P5	6.60	38.8%	0.35	0.64	22.9	6.2	20.2
PROPOSED BIG DRY CREEK TRIBUTARY	57.27	40.7%	---	---	---	48.8	153.6
CW-P1	6.48	42.2%	0.38	0.66	27.0	6.0	18.4
CW-P2	23.86	40.5%	0.37	0.65	28.2	20.8	65.6
CW-P3	3.59	22.9%	0.22	0.58	8.0	3.4	15.8
CW-P4	6.28	35.1%	0.32	0.63	14.6	6.8	23.6
PROPOSED COTTONWOOD CREEK TRIBUTARY	40.21	38.4%	---	---	---	31.1	105.0
HC-P1	11.72	45.8%	0.41	0.67	22.3	13.1	38.0
HC-P2	24.18	45.8%	0.41	0.67	23.2	26.3	76.7
HC-P3	12.78	48.2%	0.43	0.68	20.7	15.5	43.8
HC-P4	3.97	39.0%	0.35	0.64	8.2	6.0	19.4
HC-P5	7.86	52.1%	0.46	0.70	24.0	9.5	25.5
HC-P6	0.88	56.0%	0.49	0.71	7.9	1.9	4.8
HC-P7	6.50	44.2%	0.40	0.67	13.6	9.0	26.7
HC-P8	5.27	41.7%	0.38	0.65	13.9	6.8	21.1
PROPOSED HAPPY CANYON CREEK TRIBUTARY	73.16	46.2%	---	---	---	88.0	255.8
P-AS	2.81	65.0%	0.57	0.75	9.5	6.4	15.2
PROPOSED AMENITY CENTER	2.81	65.0%	---	---	---	6.4	15.2
DC-E1	16.72	8.1%	0.10	0.52	23.3	4.5	40.8
DC-E2	13.96	16.4%	0.17	0.55	17.0	7.4	42.7
DC-E3	34.07	12.9%	0.14	0.54	28.1	11.4	77.6
DC-E4	3.75	21.2%	0.21	0.57	5.0	3.9	18.9
DC-E5	9.47	7.2%	0.09	0.51	19.2	2.6	25.4
DC-E6	7.71	5.7%	0.08	0.51	30.7	1.4	15.7
DC-E7	4.05	10.8%	0.12	0.53	7.7	2.2	16.6
DC-E8	3.59	10.7%	0.12	0.53	21.5	1.2	9.3
DC-E8.1	4.43	7.3%	0.09	0.51	15.9	1.4	13.1
DC-E9	5.53	5.0%	0.08	0.50	28.2	1.0	11.8
DC-E9.1	9.68	10.4%	0.12	0.53	21.6	3.2	25.0
MODIFIED EXISTING BIG DRY CREEK TRIBUTARY	112.96	10.9%	---	---	---	40.1	296.8
W-E1	9.48	8.6%	0.10	0.52	26.6	2.4	21.6
MODIFIED EXISTING WILLOW CREEK TRIBUTARY	9.48	8.6%	---	---	---	2.4	21.6
CW-E1	21.46	5.9%	0.08	0.51	11.2	6.8	73.3
CW-E2	20.57	8.2%	0.10	0.52	24.0	5.5	49.3
CW-E3	34.33	14.3%	0.15	0.54	29.5	12.1	76.8
CW-E4	8.09	6.8%	0.09	0.51	17.6	2.2	22.6
CW-E5	5.56	6.5%	0.09	0.51	18.0	1.5	15.3
MODIFIED EXISTING COTTONWOOD CREEK TRIUBTARY	90.01	9.8%	---	---	---	28.2	237.4
HC-E1	12.92	6.5%	0.09	0.51	18.8	3.4	34.9
HC-E2	5.90	5.0%	0.08	0.50	15.6	1.5	17.2
HC-E3	5.91	19.0%	0.19	0.56	19.9	3.2	17.0
HC-E4	21.85	25.7%	0.25	0.59	26.7	13.2	56.2
HC-E5	3.28	18.0%	0.18	0.56	21.1	1.7	9.1
HC-E6	1.27	22.1%	0.22	0.57	5.0	1.4	6.4
HC-E7	1.80	21.5%	0.21	0.57	5.0	1.9	9.1
HC-E8	3.01	8.1%	0.10	0.52	5.0	1.5	13.7
HC-E9	6.82	28.3%	0.27	0.60	8.5	7.6	30.6
HC-E10	1.93	23.1%	0.22	0.58	13.0	1.5	7.1
MODIFIED EXISTING HAPPY CANYON CREEK TRIUBTARY	64.69	18.2%	---	---	---	36.8	201.3
E-OS1	26.90	8.1%	0.10	0.52	27.7	6.6	59.4
E-OS2	39.78	5.0%	0.08	0.50	41.1	5.7	67.6
E-OS3	1.70	5.0%	0.08	0.50	24.3	0.3	3.9
E-OS4	4.18	7.9%	0.10	0.52	35.5	0.9	8.0
MODIFIED OFFSITE TOTAL	72.56	6.3%	---	---	---	13.5	138.9
E-UD1	3.60	8.1%	0.10	0.52	20.7	1.0	9.4
E-UD2	23.35	5.0%	0.08	0.50	28.8	4.2	49.2
E-UD3	10.17	9.8%	0.12	0.52	14.7	3.9	31.8
MODIFIED UNDETAINED TOTAL	37.12	6.6%	---	---	---	9.1	90.3
SITE Total	560.27	20.6%	---	---	---	298.0	1500.7

DESIGN POINT TABLE		
Design Point	Q _s (cfs)	Q ₁₀₀ (cfs)
P1	4.5	40.8
P2	7.4	42.7
P13	1.0	9.4
P14	2.5	21.5
A1	5.9	18.7
A2	6.0	18.4
A3.1	10.2	31.9
A	0.3	8.4
P15	6.8	73.2
P15.1	7.1	81.6
B1	20.8	65.6
B2	3.4	15.9
B3.1	22.8	74.4
B	0.6	3.8
P16	5.5	49.4
P16.1	6.1	53.2
P17	12.1	76.8
P18	2.2	22.6
P19	1.5	15.3
P20	0.3	4.0
P21	3.4	34.8
P33	3.9	31.8
P34	7.6	30.6
P35	1.5	7.1
G1	13.1	38.0
G2	6.8	23.6
G3.1	18.6	57.0
G	0.5	22.8
P23	3.2	17.0
P23.1	3.7	39.8
H1	26.3	76.7
H	0.6	23.1
P24	0.9	8.0
E2	1.9	4.8
E3.1	1.8	10.3
E4	15.5	43.8
E4.1	13.1	42.4
E5	6.0	19.4
E6.1	16.1	51.8
E	0.5	24.1
P25	13.2	56.2
P26.1	13.8	79.3
D1	9.5	25.5
D	2.2	4.9
P27	1.7	9.1
DE	2.7	29.0
P27.1	4.4	38.1
P30	1.5	13.8
P22	1.5	17.2
P28	1.3	6.4
P29	1.9	9.1
P31	4.2	49.2
P32.1	27.9	225.8
K1	6.8	21.1
K2	9.0	26.7
K3.1	15.7	47.5
K	0.3	20.0
P36.1	0.3	20.0
J1	6.3	21.5
J	0.3	15.8
P3	11.4	77.6
P3.1	11.7	93.4
P4	3.9	18.9
F1	8.7	30.9
F1.1	3.0	3.0
F2	27.6	81.0
F2.1	23.9	23.9
F3.1	26.9	26.9
P5	2.6	25.4
P5.1	29.5	52.3
P6	6.6	59.4
P7	1.4	15.7
P8.1	7.6	71.6
P10	1.2	9.3
P11	1.0	11.8
I1	6.2	20.2
I2.1	7.6	37.8
I	17.8	17.8
P11.2	23.5	85.4
P12	5.7	67.6
P9	2.2	16.6
P10.1	1.4	13.1
P11.1	3.2	25.0

PROPOSED DRAINAGE MAPS
HILLCAMP SUBDIVISION
JOB NO. 15950.12
2025-12-12
SHEET 5 OF 5

