# Preliminary Drainage Report
# For
# Trails at Overland Ranch Filing 1

**Prepared For:**

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APPROVED FOR ONE YEAR FROM THIS DATE

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City Engineer Date

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Aurora Water Department Date

July 13th, 2023

## Engineer's Certification

I hereby affirm that this report and plan for the drainage design of the Trails at Overland Ranch Filing 1 was prepared by me (or under my direct supervision) in accordance with the provision of the *City of Aurora Storm Drainage Design and Technical Criteria Manual* for the owners thereof.

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Kurtis W. Williams, P.E Date
State of Colorado No. 34270
For and on Behalf of JR Engineering

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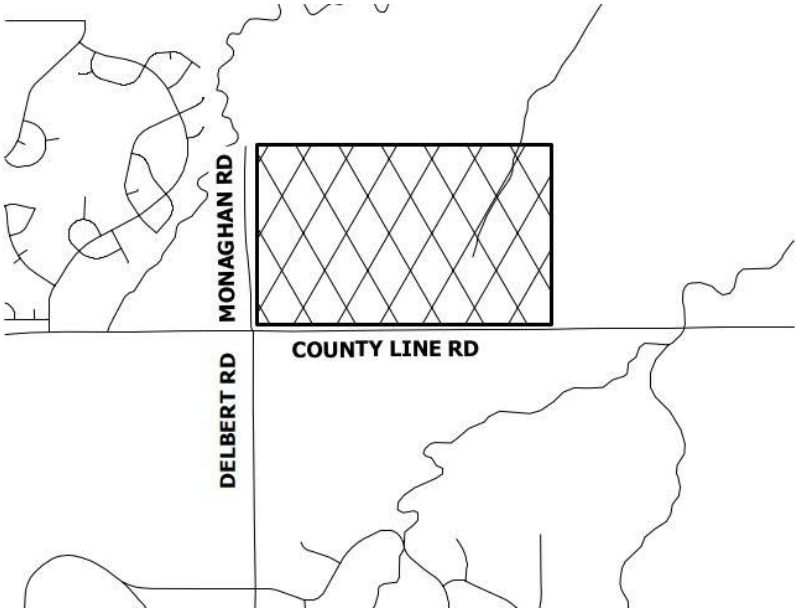
# INTRODUCTION

## 1. Location

The site is bounded to the west by S. Monaghan Road, to the north and east by undeveloped land, and to the south by E. County Line Road. The undeveloped land to the north and east is owned by the State of Colorado. The Trails at Overland Ranch Subdivision is approximately 375 acres, which includes the proposed site and half of the right-of-way for the adjacent streets. The Filing 1 portion of this subdivision comprises approximately 171 acres.

The site is located in the south half of Section 34, Township 5 South, Range 65 West of the 6th Principal Meridian within the City of Aurora, Arapahoe County, Colorado.

A vicinity map is provided below and in the appendix.




## 2. Proposed Development

Trails at Overland Ranch Filing 1 is currently undeveloped, covered with native grass, and sparsely distributed brush. The site's topography has multiple ridges and has one unregulated drainageway that runs through the site. The existing topography generally slopes towards this existing drainageway and has slopes that range between 3 to 20 percent. The proposed drainage patterns will generally follow the existing condition and will utilize the existing drainageway as a conveyance system.

The proposed site will consist of proposed roads, single-family development, a future amenity center located near the center of the site, and tracts with proposed detention ponds.

# HISTORIC DRAINAGE

## 1. Overall Basin Description

The soils for the site have been classified by the USDA-NRCS soil survey as Bresser-Stapleton sandy loams, Buick Loam, Renohill-Litle-Thedalund complex, and Fondis-Colby silt loams. These soils are classified as Type B & C Soils. A soils map can be found in Appendix A.

The site historically drains off-site to the northwest and predominantly north through the existing drainageway. A portion of the site also sheet flows directly onto Monaghan Road, and is captured by existing inlets. Runoff from the site continues north through Mutchie Creek where it ultimately outfalls into Coal Creek. The site is located within Zone X (areas outside of the 100-year floodplain) as defined by FEMA Flood Insurance Rate Map, FIRM panels 08005C0508K and 08005C0509K, dated December 17, 2010. The FEMA Firm panels can be found in Appendix A.

There is one main drainageway associated with the Filing 1 development. This drainageway does not have a regulated or unregulated floodplain associated with it at this time. This drainageway is a natural channel with well established vegetation and the southern portion shows no signs of erosion. After a site visit by Mile High Flood District and Aurora Water, it was determined that the drainageway, in general, requires no improvements at this time. The eroded areas located in the northern portion of the drainageway will be improved and protected with the proposed Pond B inline detention pond. The southern portion of this drainageway will be used as a stormwater conveyance system. All proposed storm outfalls into this drainageway will utilize impact stilling basins, riprap, and other erosion prevention measures in order prevent erosion and to keep the drainageway operational.

## 2. Drainage Patterns Through Property

The existing drainage patterns are generally sloping toward the existing drainageway located onsite. Multiple ridgelines located throughout the site force drainage into these natural drainageways and channels. The proposed drainage patterns will also typically follow these ridgelines, and will utilize the existing drainageway and site low points for pond placements and drainage conveyance.

Sub-basins OS3-OS5 are set to drain off of the property. These sub-basins will consist primarily of open space and proposed Monaghan Road improvements. Due to the topography of the site, these basins were not able to be captured and routed to a detention pond.

## 3. Outfalls Downstream From Property

Sub-Basins OS1 and OS2 located just south of the site along County Line Road are proposed to be developed, and will be directed to Detention Pond B. With the development of these basins, the offsite areas will be required to provide 100-year detention to reduce the flows to historic conditions per Delbert County drainage criteria. Because the runoff will

mix with the on-site untreated runoff, water quality treatment for these offsite basins will be provided by the proposed Pond B. The off-site 100-year flow will be routed through Pond B undetained. More detailed routing for these basins will be discussed later in this report.

### 4. Previously Approved Reports

Drainage for this site has been previously analyzed in the *Master Drainage Report Trails at Overland Ranch*, by Innovative Land Consultants, Inc, Revised July 26, 2022. The previous report analyzed the drainage characteristics of this site, and calculated the required detention and WQCV for detention ponds A-C. This preliminary drainage report has maintained drainage patterns and other various drainage design aspects from the master drainage report.

## C. DESIGN CRITERIA

### 1. List References

1. *High Plains Country Club Filing No. 3 Final Drainage Report*, by Bowman Consulting Group, dated February 17, 2017 EDN 216080

2. *Coal Creek (E. Yale Avenue to E. County Line Road) Flood Hazard Area Delineation*, by Matrix Design Group, dated August, 2014

3. *City of Aurora Storm Drainage Design and Technical Criteria*, City of Aurora, October 11, 2010

4. *Urban Storm Drainage Criteria Manual Volumes 1, 2, & 3, Mile High Flood District, current version*

5. *Master Drainage Report Trails at Overland Ranch*, by Innovative Land Consultants, Inc, Revised April 15, 2022

### 2. Hydrologic Criteria

Rainfall intensities were determined by the equations set forth in the Criteria Manual. P1 values were determined from the charts contained within the NOAA Atlas 14 and the *City of Aurora Storm Drainage Design & Technical Criteria Manual*. One-hour point precipitation values of 0.83 inches and 2.38 inches were used for the 2-Year and 100-year events respectively. The NOAA Atlas 14 point precipitation frequency can be found in Appendix A.

As per the previous report *Master Drainage Report Trails at Overland Ranch*, prepared by Innovative Land Consultants, Inc., water quality for the proposed site as well as off-site Sub-Basins OS1 & OS2 will be provided in Detention Ponds A-D. Due to a watershed area larger than 90 acres for Pond B, the 10-year and 100-year detention volumes were analyzed using Colorado Urban Hydrograph Procedure (CUHP) in conjunction with hydrograph and reservoir routing through EPA's Storm Water Management Model (SWMM) as per criteria from City of Aurara (COA) Storm Drainage Design & Technical Criteria (SDDTC)-Section

6.33. As can be seen on the overall basin map in Appendix E, onsite sub basins for Basin B were consolidated into a single larger basin for the CUHP analysis. Because the road profiles and overlot grading differs slightly from the *Master Drainage Report Trails at Overland Ranch* prepared by Innovative Land Consultants, Inc., the tributary area and composite impervious percentage for Pond B have been slightly modified. Thus, the CUHP/SWMM analysis was performed to verify Pond B's required volume.

MHFD-Detention Workbook (Version 4.05, February 2022) was also utilized to complete the designs for the proposed detention ponds. All ponds had 20% added to the required WCQV values and ½ of the EURV was added to the required 100-year storage volume for each pond. The outlet structure for each pond was also designed to target the 0.23 cfs/acre release rate for a 10-year storm, and the 0.85 cfs/acre release rate for the 100-year storm for Type B soils, as stated in Section 6.33 of the *City of Aurora Storm Drainage and Technical Criteria Manual.* 1 foot of freeboard above the computed 100-year water surface elevation, as it is being conveyed by the emergency overflow weir, was also provided per MHFD requirements.

The Rational Method was utilized to determine runoff values for the proposed site. These flows were used to size the storm inlets and storm pipes throughout the site. The minor storm was analyzed as the 2-year event. The major storm was analyzed as the 100-year event. All Rational Method calculations can be found in Appendix B.

## 3. Hydraulic Criteria

All inlets and pipes will be designed for the 100-year storm. The latest version of Mile High Flood District's workbook "MHFD-Inlet)" shall be used to size the inlets. Street capacities shall also be calculated with the Mile High Flood District's workbook "MHFD-Inlet". These street capacities will be based on street geometry, allowable flow spread, and the maximum depth of flow at the street flowline. These street capacities and inlet calculations shall be part of the Final Drainage Report.

GeoHECRAS software was utilized to verify the stabilization of Drainageway 1, and to calculate the 100-year WSEL within the channel to verify drainageway capacity and to ensure minimum finished floor elevations for the proposed lots along this drainageway could be met. The 100-year storm was modeled with the flows obtained from the Rational Method. Manning's roughness coefficients were taken from the *City of Aurora Storm Drainage and Technical Criteria Manual*. Hydraulic calculations and results can be found in Appendix C.

All storm sewer for the proposed development will be public and maintained by the city. Ponds, swales, and the Type C inlets shall be private and maintained by the HOA. Cross sections of the swales have been analyzed and added to appendix C. A minimum of one foot freeboard has been provided between the WSEL of the major storm event in the swales and the adjacent top of foundations.

*Master Drainage Report Trails at Overland Ranch*, prepared by Innovative Land Consultants, Inc. as well as the *City of Aurora Storm Drainage and Technical Criteria Manual* were also referenced in the preparation of this report.

### 4. Stormwater Quality Control Plan

The project meets requirements set forth in Section 3.70 from COA SDDTC. Methods include, but are not limited to, detached sidewalk within public ROW to provide water quality treatment of runoff prior to stormwater flows entering the public ROW, roof drains discharged to grass lined swales between homes, and storm water will discharge into full spectrum detention ponds within the site to provide additional stormwater treatment measures.

## D. DRAINAGE PLAN

### 1. General Concept

All drainage patterns established with the *Master Drainage Report Trails at Overland Ranch* will remain as designed to the greatest extent possible.

Water quality and detention will be provided on-site in the proposed full spectrum detention ponds.

### 2. Specific Details

***Onsite Basins***

**Basin A**

The runoff from the proposed Basin A will be collected by proposed storm sewer infrastructure. Flows from this basin will be routed through the site to the proposed Detention Pond A. The routing for Basin A can be found below.

Basin A1 (1.39 acres, 2.0% impervious) consists entirely of landscaping area. The runoff from this sub-basin will be captured by a Type C inlet located at Design Point 71. It will then be routed via storm sewer to Design Point 7.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 72.

Basin A2 (1.32 acres, 60.3% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 72. It will then be routed via storm sewer to Design Point 7.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 73.

Basin A3 (0.45 acres, 74.7% impervious) is comprised of proposed roadway and open space. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 73. It will then be routed via storm sewer to Design Point 7.1. If this inlet clogs,

developed runoff from this basin will overflow into Monaghan Road to the proposed inlet at Design Point 75.

Basin A4 (6.00 acres, 30.3% impervious) is comprised of open space and existing Monaghan Road. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 74. It will then be routed via storm sewer to Design Point 7.2. Carry-over flows from this inlet are conveyed via curb and gutter to the proposed sump inlet at Design Point 72.

Basin A5 (1.03 acres, 37.2% impervious) is comprised of open space and existing Monaghan Road. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 75. It will then be routed via storm sewer to Design Point 7.3. If this inlet clogs, developed runoff from this basin will overflow into an existing inlet along Monaghan Road, located approximately 340 feet north of the site.

Basin A6 (1.09 acres, 14.6% impervious) is comprised of open space and the proposed Pond A. The runoff from this sub-basin will overland flow into the proposed pond where it will conveyed to the outlet structure located at Design Point 7.4. From here, the flows generated from Basin A will be released into the existing storm sewer infrastructure located in Monaghan Road.

**Basin B**

The runoff from the proposed Basin B will be routed through the site to the proposed Detention Pond B. The runoff will be collected by proposed storm sewer infrastructure and an existing drainageway. The routing for Basin B can be found below.

Basin B1 (1.36 acres, 76.9% impervious) is comprised of open space and existing County Line Road. The runoff from this sub-basin will be captured by a future Type R sump inlet located at Design Point 1. It will then be routed via storm sewer to DP 1.0. Flows from this sub-basin will then be routed via grass lined swale to a proposed culvert located at Design Point 1.2. If this future inlet clogs, developed runoff from this basin will overflow into a proposed swale where it will be conveyed to Design Point 3.

Basin B2 (1.54 acres, 76.6.% impervious) is comprised of open space and existing County Line Road. The runoff from this sub-basin will be captured by a future Type R sump inlet located at Design Point 2. It will then be routed via storm sewer to DP 1.1. Flows from this sub-basin will then be routed via grass lined swale to a proposed culvert located at Design Point 1.2. If this future inlet clogs, developed runoff from this basin will overflow into a proposed swale where it will be conveyed to Design Point 3.

Basin B3 (8.43 acres, 14.5% impervious) is comprised of single-family residential lots and open space. The runoff from this sub-basin will be captured by various grass-lined swales and conveyed to a culvert located at Design Point 1.2. It will then be routed via storm sewer to Design Point 1.5.

Basin B4 (2.30 acres, 58.4% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 4. It will then be routed via storm sewer to Design Point 1.3. If this inlet clogs, developed runoff from this basin will overflow directly into Drainageway 1.

Basin B5 (1.50 acres, 58.5% impervious is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 5. It will then be routed via storm sewer to Design Point 1.3. If this inlet clogs, developed runoff from this basin will overflow directly into Drainageway 1.

Basin B6 (1.46 acres, 57.3% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 6. It will then be routed via storm sewer to Design Point 1.4. If this inlet clogs, developed runoff from this basin will overflow into the existing draineway located just north of the inlet. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 4.

Basin B7 (2.66 acres, 55.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 7. It will then be routed via storm sewer to Design Point 1.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 4.

Basin B8 (1.76 acres, 56.9% impervious) is comprised of future single-family residential and future roadway that will be constructed with the Filing 2 improvements. It also consists of proposed roadway. The runoff from this sub-basin will be captured by a temporary Type C inlet located at Design Point 8. It will then be routed via storm sewer to Design Point 1.6.

Basin B9 (1.53 acres, 55.2% impervious is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 9. It will then be routed via storm sewer to Design Point 1.6. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 10.

Basin B10 (2.40 acres, 56.5% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 10. It will then be routed via storm sewer to Design Point 1.7. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 45.

Basin B11 (0.44 acres, 60.1% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 11. It will then be routed via storm sewer to DP 1.7. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 45.

Basin B12 (0.48 acres, 69.8% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 12. It will then be routed via storm sewer to DP 1.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 4.

Basin B13 (2.33 acres, 36.3% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 13. It will then be routed via storm sewer to DP 1.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 18.

Basin B14 (1.54 acres, 80.9% impervious) is comprised of the existing Monaghan Road. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 14. It will then be routed via storm sewer to Design Point 2.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 16.

Basin B15 (2.20 acres, 5.0% impervious) consists entirely of landscaped area. The runoff from this sub-basin will be captured by a Type C inlet located at Design Point 15. It will then be routed via storm sewer to Design Point 2.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 16.

Basin B16 (0.66 acres, 67.9% impervious is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 16. It will then be routed via storm sewer to Design Point 2.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 24.

Basin B17 (037 acres, 82.0% impervious) is comprised solely of proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 17. It will then be routed via storm sewer to Design Point 2.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 24.

Basin B18 (1.97 acres, 52.4% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 18. It will then be routed via storm sewer to Design Point 2.2. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 16.

Basin B19 (1.28 acres, 58.1% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 19. It will then be routed via storm sewer to Design Point 2.2. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 16.

Basin B20 (0.66 acres, 62.4% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 20. It will then be routed via storm sewer to Design Point 2.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 26.

Basin B21 (2.61 acres, 52.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 2. It will then be routed via storm sewer to Design Point 2.5. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 20.

Basin B22 (1.45 acres, 58.8% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 22. It will then be routed via storm sewer to Design Point 2.5. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 27.

Basin B23 (22.95 acres, 14.4% impervious) is comprised of single-family residential lots, open space, and an existing drainageway. The runoff from this sub-basin will overland flow into the existing drainageway. It will then be routed by the drainageway to Design Point 2.8.

Basin B24 (3.41 acres, 50.2% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 24. It will then be routed via storm sewer to Design Point 2.9. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 30.

Basin B25 (2.35 acres, 53.1% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 25. It will then be routed via storm sewer to Design Point 2.9. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 28.

Basin B26 (3.57 acres, 51.2% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 26. It will then be routed via storm sewer to Design Point 3.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 28.

Basin B27 (1.47 acres, 61.4% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 27. It will then be routed via storm sewer to Design Point 3.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 29.

Basin B28 (1.62 acres, 55.7% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet

located at Design Point 28. It will then be routed via storm sewer to Design Point 3.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 32.

Basin B29 (1.19 acres, 54.5% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 29. It will then be routed via storm sewer to Design Point 3.1. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 32.

Basin B30 (2.80 acres, 46.6% impervious is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 30. It will then be routed via storm sewer to Design Point 3.2. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 33.

Basin B31 (1.87 acres, 53.4% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 31. It will then be routed via storm sewer to Design Point 3.2. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 33.

Basin B32 (0.20 acres, 77.5% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 32. It will then be routed via storm sewer to Design Point 3.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 38.

Basin B33 (0.21 acres, 74.0% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 33. It will then be routed via storm sewer to Design Point 3.4. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 38.

Basin B33A (0.41 acres, 49.0% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 33A. It will then be routed via storm sewer to Design Point 3.5A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 33.

Basin B33B (0.21 acres, 68.3% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 33B. It will then be routed via storm sewer to Design Point 3.5A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 39.

Basin B34 (1.53 acres, 50.0% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a

Type R sump inlet located at Design Point 34. It will then be routed via storm sewer to Design Point 3.5. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 73.

Basin B35 (0.98 acres, 60.9% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 35. It will then be routed via storm sewer to Design Point 3.5. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 73.

Basin B36 (1.24 acres, 57.5% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 36. It will then be routed via storm sewer to Design Point 3.6. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 37.

Basin B37 (1.74 acres, 53.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 37. It will then be routed via storm sewer to Design Point 3.6. If this inlet clogs, developed runoff from this basin will overflow into the proposed overflow spillway into Pond B.

Basin B38 (1.12 acres, 51.3% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 38. It will then be routed via storm sewer to Design Point 3.9. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 39.

Basin B39 (0.78 acres, 53.7% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 39. It will then be routed via storm sewer to Design Point 3.9. If this inlet clogs, developed runoff from this basin will overflow directly into the proposed Pond B.

Basin B39A (0.23 acres, 62.8% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 39A. It will then be routed via storm sewer to Design Point 5.3A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 39.

Basin B39B (0.26 acres, 81.7% impervious) is comprised solely of proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 39B. It will then be routed via storm sewer to Design Point 5.3A. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 47.

Basin B40 (1.94 acres, 57.3% impervious) is comprised of future single-family residential and future roadway that will be constructed with the Filing 2 improvements. It also consists of proposed roadway. The runoff from this sub-basin will be captured by a temporary Type

C inlet located at Design Point 40. It will then be routed via storm sewer to Design Point 4.0.

Basin B41 (0.80 acres, 59.7% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 41. It will then be routed via storm sewer to Design Point 4.0. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 42.

Basin B42 (2.98 acres, 54.7% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 42. It will then be routed via storm sewer to Design Point 4.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 55.

Basin B43 (1.40 acres, 61.0% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 43. It will then be routed via storm sewer to Design Point 4.2. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 47.

Basin B44 (0.22 acres, 77.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 44. It will then be routed via storm sewer to Design Point 4.2. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 47.

Basin B45 (2.01 acres, 50.9% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 45. It will then be routed via storm sewer to Design Point 4.3. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 43.

Basin B46 (1.56 acres, 61.8% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 46. It will then be routed via storm sewer to Design Point 4.3. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 48.

Basin B47 (2.80 acres, 51.3% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 47. It will then be routed via storm sewer to Design Point 4.5. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 38.

Basin B48 (1.29 acres, 61.7% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 48. It will then be routed via storm sewer to

Design Point 4.5. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 38.

Basin B49 (6.16 acres, 5.0% impervious) is comprised solely of proposed park. The runoff from this sub-basin will be captured by future storm sewer. It will then be routed via storm sewer to Design Point 4.6.

Basin B50 (0.46 acres, 81.4% impervious) is comprised of future and proposed roadway. The runoff from this sub-basin will be captured by a future Type R on-grade inlet located at Design Point 50. It will then be routed via storm sewer to Design Point 4.6. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 51.

Basin B51 (0.85 acres, 81.0% impervious) is comprised solely of proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 51. It will then be routed via storm sewer to Design Point 4.7. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 55.

Basin B52 (0.96 acres, 60.0% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 52. It will then be routed via storm sewer to Design Point 4.7. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 55.

Basin B53 (1.39 acres, 58.5% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 53. It will then be routed via storm sewer to Design Point 4.8. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 59.

Basin B54 (0.61 acres, 59.8% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 54. It will then be routed via storm sewer to Design Point 4.8. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 59.

Basin B55 (3.16 acres, 54.4% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 55. It will then be routed via storm sewer to Design Point 5.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 39B.

Basin B56 (1.09 acres, 59.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 56. It will then be routed via storm sewer to Design Point 5.0. If this inlet clogs, developed runoff from this basin will overflow into the proposed inlet at Design Point 39B.

Basin B57 (0.79 acres, 60.1% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 57. It will then be routed via storm sewer to Design Point 5.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 58.

Basin B58 (2.16 acres, 65.0% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 58. It will then be routed via storm sewer to Design Point 5.2. If this inlet clogs, developed runoff from this basin will overflow into a proposed emergency overflow directly into Pond B.

Basin B58A (0.98 acres, 32.7% impervious) is comprised of open space and proposed roadway. The runoff from this sub-basin will be captured by a Type C inlet located at Design Point 58A. It will then be routed via storm sewer to Design Point 5.2A. If this inlet clogs, developed runoff from this basin will overflow directly into Pond B.

Basin B59 (3.96 acres, 50.9% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 59. It will then be routed via storm sewer to Design Point 5.1. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 57.

Basin B61 (2.43 acres, 85.0% impervious) is a proposed community center and associated parking lot. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 61. It will then be routed via storm sewer to Design Point 5.5. If this inlet clogs, developed runoff from this basin will overflow directly into Pond B.

Basin B62 (12.96 acres, 36.7% impervious) is comprised of single-family lots, open space, and the proposed Pond B. The runoff from this sub-basin will overland flow into the proposed pond where it will be conveyed to the outlet structure located at Design Point 5.7. From here, the flows generated from Basin B will be released into the existing drainageway located just north of the pond.

**Basin C**

The runoff from the proposed Basin C will be collected by proposed storm sewer infrastructure. Flows from this basin will be routed through the site to the proposed Detention Pond C. The routing for Basin C can be found below.

Basin C1 (1.51 acres, 40.7% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 81. It will then be routed via storm sewer to Design Point 8.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 57.

Basin C2 (1.39 acres, 58.5% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 82. It will then be routed via storm sewer to Design Point 8.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 57.

Basin C3 (1.74 acres, 51.6% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 83. It will then be routed via storm sewer to Design Point 8.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 85.

Basin C4 (3.68 acres, 50.3% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R on-grade inlet located at Design Point 84. It will then be routed via storm sewer to Design Point 8.1. Carry-over flows from this inlet are conveyed via curb and gutter to Design Point 83.

Basin C5 (2.03 acres, 56.9% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 85. It will then be routed via storm sewer to Design Point 8.2. If this inlet clogs, developed runoff from this basin will overflow directly into Pond C.

Basin C6 (1.05 acres, 36.2% impervious) is comprised of single-family residential lots and open space. The runoff from this sub-basin will be captured by a proposed swale and conveyed to a Type C inlet located at Design Point 86. It will then be routed via storm sewer to Design Point 8.3. If this inlet clogs, developed runoff from this basin will overflow directly into Pond C.

Basin C7 (9.17 acres, 59.7% impervious) is comprised of future single-family residential lots and future roadways to be completed with the Filing 2 improvements. The runoff from this sub-basin will be captured by future storm sewer infrastructure and conveyed to Design Point 87. It will then be routed via storm sewer and proposed Pond C to Design Point 8.4.

Basin C8 (3.03 acres, 59.3% impervious) is comprised of future single-family residential lots and future roadways to be completed with the Filing 2 improvements. The runoff from this sub-basin will be captured by future storm sewer infrastructure and conveyed to Design Point 88. It will then be routed via storm sewer and proposed Pond C to Design Point 8.4.

Basin C9 (4.93 acres, 40.2% impervious) is comprised of single-family lots, open space, and the proposed Pond C. The runoff from this sub-basin will overland flow into the proposed pond where it will be conveyed to the outlet structure located at Design Point 8.4. From here, the flows generated from Basin C will be released into the existing drainageway located just north of the pond.

**Basin D**

The runoff from the proposed Basin D will be collected by proposed storm sewer infrastructure and temporary swales. Flows from this basin will be routed through the site to the proposed temporary Detention Pond D. The routing for Basin D can be found below.

Basin D1 (3.06 acres, 54.9% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 91. It will then be routed via storm sewer to Design Point 9.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 94.

Basin D2 (3.07 acres, 56.8% impervious) is comprised of single-family residential lots, open space, and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 92. It will then be routed via storm sewer to Design Point 9.0. If this inlet clogs, developed runoff from this basin will overflow into a proposed inlet located at Design Point 94.

Basin D3 (1.77 acres, 54.2% impervious) is comprised of single-family residential lots and proposed roadway. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 93. It will then be routed via storm sewer to Design Point 9.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed swale and conveyed to Design Point 95.

Basin D4 (1.65 acres, 60.8% impervious) is comprised of open space, the existing County Line Road, and a future roadway that will be constructed with the Filing 2 improvements. The runoff from this sub-basin will be captured by a Type R sump inlet located at Design Point 94. It will then be routed via storm sewer to Design Point 9.1. If this inlet clogs, developed runoff from this basin will overflow into a proposed swale and conveyed to Design Point 95.

Basin D5 (11.36 acres, 5.7% impervious) is comprised of undeveloped land and the proposed temporary Pond D. The runoff from this sub-basin will be captured by a temporary grass-lined swale and conveyed to Design Point 95. It will then be conveyed by Pond D to the proposed outlet structure at Design Point 9.2. From here, the flows generated from Basin D will be released into the existing drainageway located just north of the pond.

**Offsite Basins**

Basin OS1 (21.79 acres, 17.3% impervious) is anticipated to be "High Density Rural Residential" with a 15% imperviousness. The runoff from this sub-basin will follow historic drainage patterns to a low point along County Line Road ad Design Point OS1. With the development of this basin, the offsite areas will be required to provide 100-year detention to

reduce the flows to historic conditions per Delbert County drainage criteria. From here, the runoff will be conveyed north to Design Point 1.2. It will then be routed via storm sewer infrastructure to Pond B. Because this runoff will mix with the onsite untreated runoff, water quality treatment for this offsite basin will be provided by the proposed Pond B. The offsite 100-year flow will be routed undetained.

Basin OS2 (13.65 acres, 17.5% impervious) is anticipated to be "High Density Rural Residential" with a 15% imperviousness. The runoff from this sub-basin will follow historic drainage patterns to a low point along County Line Road ad Design Point OS2. With the development of this basin, the offsite areas will be required to provide 100-year detention to reduce the flows to historic conditions per Delbert County drainage criteria. From here, the runoff will be conveyed north to Design Point 1.2. It will then be routed via storm sewer infrastructure to Pond B. Because this runoff will mix with the onsite untreated runoff, water quality treatment for this offsite basin will be provided by the proposed Pond B. The offsite 100-year flow will be routed undetained.

Basin OS3 (0.14 acres, 65.0% impervious) is comprised of open space and future roadway. The runoff from this sub-basin will overland flow offsite, at Design Point OS3, into an existing inlet along Monaghan Road, located approximately 340 feet north of the site.

Basin OS4 (0.72 acres, 2.0% impervious) is comprised solely of open space. The runoff from this sub-basin will overland flow offsite into an existing drainageway at Design Point OS4.

Basin OS5 (1.69 acres, 15.7% impervious) is comprised of open space and single-family residential lots. The runoff from this sub-basin will overland flow offsite into an existing drainageway at Design Point OS5.

## 3. Detention Pond Design

Storm water flood detention and storm water quality management for this development will be provided within the proposed detention ponds denoted as Ponds A-D. The location of these ponds can be found on the overall drainage map located in Appendix F. Sediment and erosion control, Best Management Practices, as presented in the Urban Storm Drainage Criteria Manual, Volume III, will be implemented for the site.

As previously stated, Detention Pond B was evaluated in this report using CUHP with SWMM routing, results for this analysis can be found in Appendix C. The storm inflow hydrographs that were generated in SWMM were then inputted into the MHFD-Detention workbook in order to properly size the outlet structure. The values for the pond stage, pond volume, and outflows for ponds A-D were also designed using the latest MHFD-Detention workbooks. These pond designs and pond calculations can be found in Appendix D.

In accordance with City of Aurora standards, 20% has been added to WQCV to account for sedimentation. The total pond volumes have also been designed to detain the 100-year stormwater event plus ½ EURV as defined by the COA. For Pond A, the 100-year + ½ EURV water surface elevation is targeted to be at elevation 6071.91' and stage depth of 5.74

feet. The emergency spillway will be installed at an elevation of 6073.00'; 1.09 feet higher than the 100-yr + ½ EURV water surface elevation. For Pond B, the 100-year + ½ EURV water surface elevation is targeted to be at elevation 6049.26' and stage depth of 9.59 feet. The emergency spillway will be installed at an elevation of 6049.33'; 0.08 feet higher than the 100-yr + ½ EURV water surface elevation. For Pond C, the 100-year + ½ EURV water surface elevation is targeted to be at elevation 6085.49' and stage depth of 7.82 feet. The emergency spillway will be installed at an elevation of 6085.50'; 0.01 feet higher than the 100-yr + ½ EURV water surface elevation. For Pond D, the 100-year + ½ EURV water surface elevation is targeted to be at elevation 6104.18' and stage depth of 5.01 feet. The emergency spillway will be installed at an elevation of 6104.50'; 0.32 feet higher than the 100-yr + ½ EURV water surface elevation.

The following tables summarize the total volume and depth for the 100-year stormwater event plus ½ EURV, the total volumes provided for each pond, and the stage of each pond's spillway:

| POND A | | |
|---|---|---|
| EURV from UDFCD Spreadsheet | 0.349 | AC-FT |
| 1/2 EURV | 0.175 | AC-FT |
| 100-Year Volume from UDFCD Spreadsheet | 0.682 | AC-FT |
| 100-Year Volume + 1/2 EURV | 0.851 | AC-FT |
| Total Volume Provided | 0.877 | AC-FT |
| 100-Year Volume + 1/2 EURV Depth | 5.74 | FT |
| Spillway Stage | 6.83 | FT |

| POND B | | |
|---|---|---|
| EURV from UDFCD Spreadsheet | 6.400 | AC-FT |
| 1/2 EURV | 3.200 | AC-FT |
| 100-Year Volume from SWMM | 11.496 | AC-FT |
| 100-Year Volume + 1/2 EURV | 15.883 | AC-FT |
| Total Volume Provided | 16.111 | AC-FT |
| 100-Year Volume + 1/2 EURV Depth | 9.59 | FT |
| Spillway Stage | 9.67 | FT |

| POND C | | |
|---|---|---|
| EURV from UDFCD Spreadsheet | 1.536 | AC-FT |
| 1/2 EURV | 0.768 | AC-FT |
| 100-Year Volume from UDFCD Spreadsheet | 2.989 | AC-FT |
| 100-Year Volume + 1/2 EURV | 3.761 | AC-FT |
| Total Volume Provided | 3.770 | AC-FT |
| 100-Year Volume + 1/2 EURV Depth | 7.82 | FT |
| Spillway Stage | 7.83 | FT |

| POND D | | |
|---|---|---|
| EURV from UDFCD Spreadsheet | 0.579 | AC-FT |
| 1/2 EURV | 0.290 | AC-FT |
| 100-Year Volume from UDFCD Spreadsheet | 1.575 | AC-FT |
| 100-Year Volume + 1/2 EURV | 1.857 | AC-FT |
| Total Volume Provided | 2.132 | AC-FT |
| 100-Year Volume + 1/2 EURV Depth | 5.01 | FT |
| Spillway Stage | 5.33 | FT |

Each pond outlet structure was also designed to target the allowable release rate for the 10-year and 100-year storm event. For the proposed site, a Type B soil was used for each pond in order to be conservative. Per Section 6.33 of the SDDTC, Type B soils can release at 0.23 cfs/acre and 0.85 cfs/acre respectively. The proposed outlet structure release rates for each pond were designed to be equal to or lower than the allowable release rates provided. The following table summarizes the release rate results for each pond:

| DETENTION POND RELEASE RATES | | | | | |
|---|---|---|---|---|---|
| POND ID | TRIBUTARY AREA (ACRES) | 10-YR ALLOWABLE (CFS) | 10-YR PROPOSED (CFS) | 100-YR ALLOWABLE (CFS) | 100-YR PROPOSED (CFS) |
| POND A | 11.28 | 2.6 | 1.2 | 9.6 | 9.6 |
| POND B | 143.92 | 41.3* | 14.9 | 152.4* | 152.4* |
| POND C | 28.53 | 6.6 | 1.1 | 24.3 | 24.2 |
| POND D | 20.91 | 4.8 | 1.5 | 17.8 | 16.8 |
| *Includes undetained release from offsite basins OS1 & OS2. | | | | | |

Pond A will outfall into existing storm infrastructure located in Monaghans Road. Per the *High Plains Country Club – Filing No. 3 Final Drainage report EDN 216080*, Pond A is part of Basin 131A. Basin 131A is captured by an existing inlet at Design Point 181A. The anticipated flows from Basin 131A were set to be 3.3 cfs and 11.9 cfs for the 2-year and 100-year storms respectively. With the addition of Pond A, the storm sewer is set to receive 1.2 cfs and 9.6 cfs for the 2-year and 100-year storms respectively. This reduction in flows will ensure the storm sewer along Monaghans Road functions as intended.

Ponds B and C will utilize existing the drainageway and topography to convey storm water north to Mutchie Creek. With the release rate reductions, the drainageway and downstream conveyance systems will not require stabilization and will continue to convey storm water as intended at a reduced rate.

Pond D is a temporary detention pond, and will utilize the second on-site drainageway associated with the Filing 2 portion of the Trails at Overland Ranch Subdivision. The drainagway does not have a regulated or unregulated floodplain associated with it at this time, and will convey the runoff from Pond D north to Mutchie Creek. Pond D will still utilize a forebay, trickle channel, and outlet structure in the temporary condition. Once the storm infrastructure for Filing 2 is complete, the temporary Pond D will be removed. Stormwater will then be piped to the future pond associated with the Filing 2 improvements, where it will be conveyed by the second drainageway north to Mutchie Creek as intended.

## 4. Drainageway Stabilization

The site will utilize Drainageway 1, an existing natural drainageway, as the primary stormwater conveyance method for proposed runoff. This existing natural drainageway is well vegetated and shows no signs of erosion in the existing condition. In order to determine the drainageway's stability in the proposed condition, a GeoHECRAS model was completed for the 100-year storm event. This model determined velocities through the drainageway and was also used to determine the 100-year WSEL within the channel. From this 100-year WSEL, minimum finished floor elevations were determined for the lots adjacent to this drainageway.

Due to the condition and vegetation of the existing drainageway, a design max velocity of 7 ft/s was utilized per MHFD criteria. Roughness coefficients for the channel were taken from Table 2 of the SDDTC. A roughness coefficient of 0.035 was used for the channel to account for the dense vegetation. This roughness coefficient table can be found in Appendix A. In the proposed condition model, all velocities within the drainageway were around 5 ft/s with a few locations reaching 6 ft/s. The drainageway also had plenty of capacity as the 100-year WSEL was contained within the drainageway with around 20' of freeboard. As a result of this analysis, no improvements to the drainageway are currently proposed and the finished floor elevations for the lots adjacent to the drainageway will not be impacted. All model results and sections can be found in Appendix C.

## 5. Maintenance

The city will be responsible for ensuring that stormwater facilities installed on their property are properly maintained and function as design. Preventative measures to reduce maintenance costs include but are not limited to educating residents to be aware of how their actions affect water quality, keeping properties, streets and gutters free of trash, sweep paved surfaces regularly, maintaining vegetative stabilization, and cleaning out storm inlets. All stormwater management facilities shall be inspected by a qualified individual at a minimum of once per year. See the *City of Aurora Storm Drainage Design & Technical Criteria Manual* for general guidelines for an inspector. Requirements for the inspection and maintenance of stormwater facilities, as well as reporting requirements will be included in the Stormwater Management Facility Inspection and Maintenance (I&M) Plan. Pond maintenance trails will provide access to all of the drainage structures within the proposed detention ponds to ensure easy access for maintenance. Detention ponds, swales, and Type C inlets shall be maintained by the HOA. Maintenance of this infrastructure will include, but is not limited to scheduled mowing, trash pickup, removal of debris that may be clogging the outlet structure or inlet, weed control, and mosquito and algae treatment.

# E. CONCLUSIONS

## 1. Compliance with Standards

This report is in compliance with the standards set forth in the *City of Aurora Storm Drainage Design and Technical Criteria Manual* as well as *Urban Storm Drainage Criteria Manual*, by Mile High Flood District.

## 2. Summary of Concept

The proposed design has taken into account all flows from on-site and offsite tributary areas. All proposed drainage patterns conform to both historic and previously-approved patterns. Water quality and detention have been incorporated into the ponds located onsite. Adequate on-site drainage is provided by the streets, gutters, inlets, storm sewer pipes, and swales designed for the site.

The proposed project site will not have any adverse effects on the adjacent upstream or downstream areas. The drainage design generally follows the historic patterns and existing conveyances have been utilized wherever possible. The net effect of this development will result in a decrease in runoff, as all ponds will release at 0.85 cfs/acre per Aurora criteria. This reduction will result in a release much lower than historic conditions. This drainage report analyzed the site to show proposed development is in accordance with the previously-approved master drainage report, and is therefore in compliance with City of Aurora criteria.

# REFERENCES

1. *City of Aurora Storm Drainage Design and Technical Criteria Manual*, City of Aurora, October 11, 2010.

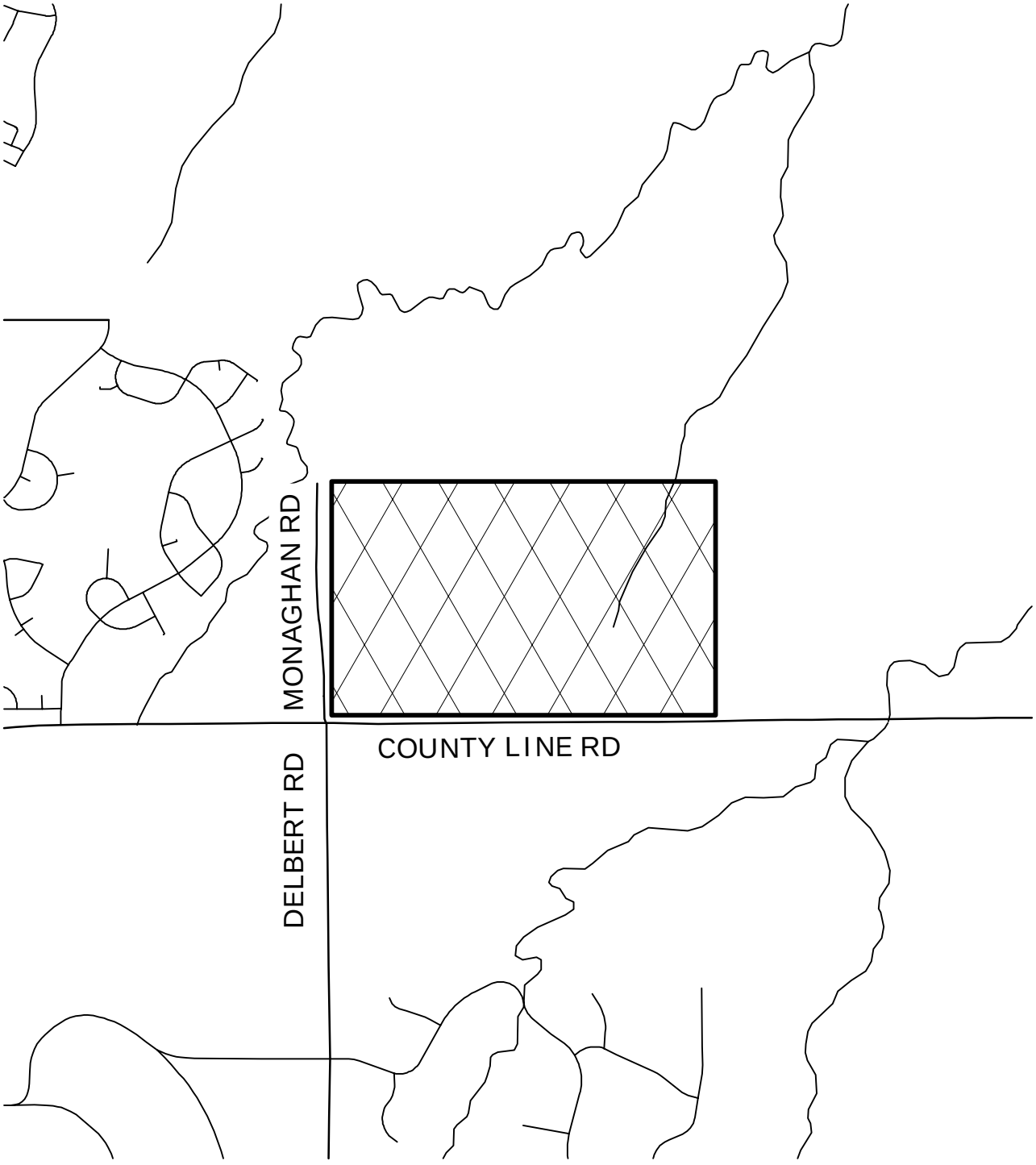
2. *Federal Emergency Management Agency Flood Insurance Rate Map*, Community Panels 08005C0508K & 08005C0509K, Revised December 17, 2010.

3. *Urban Storm Drainage Criteria Manual, Volume 1, Volume 2. & Volume 3*, Mile High Flood District, Current Version.

4. *High Plains Country Club Filing No. 3 Final Drainage Report*, by Bowman Consulting Group, February 17, 2017. EDN 216080

5. *Master Drainage Report Trails at Overland Ranch*, by Innovative Land Consultants, Inc., April 15, 2022.

# APPENDIX A
# FIGURES AND EXHIBITS



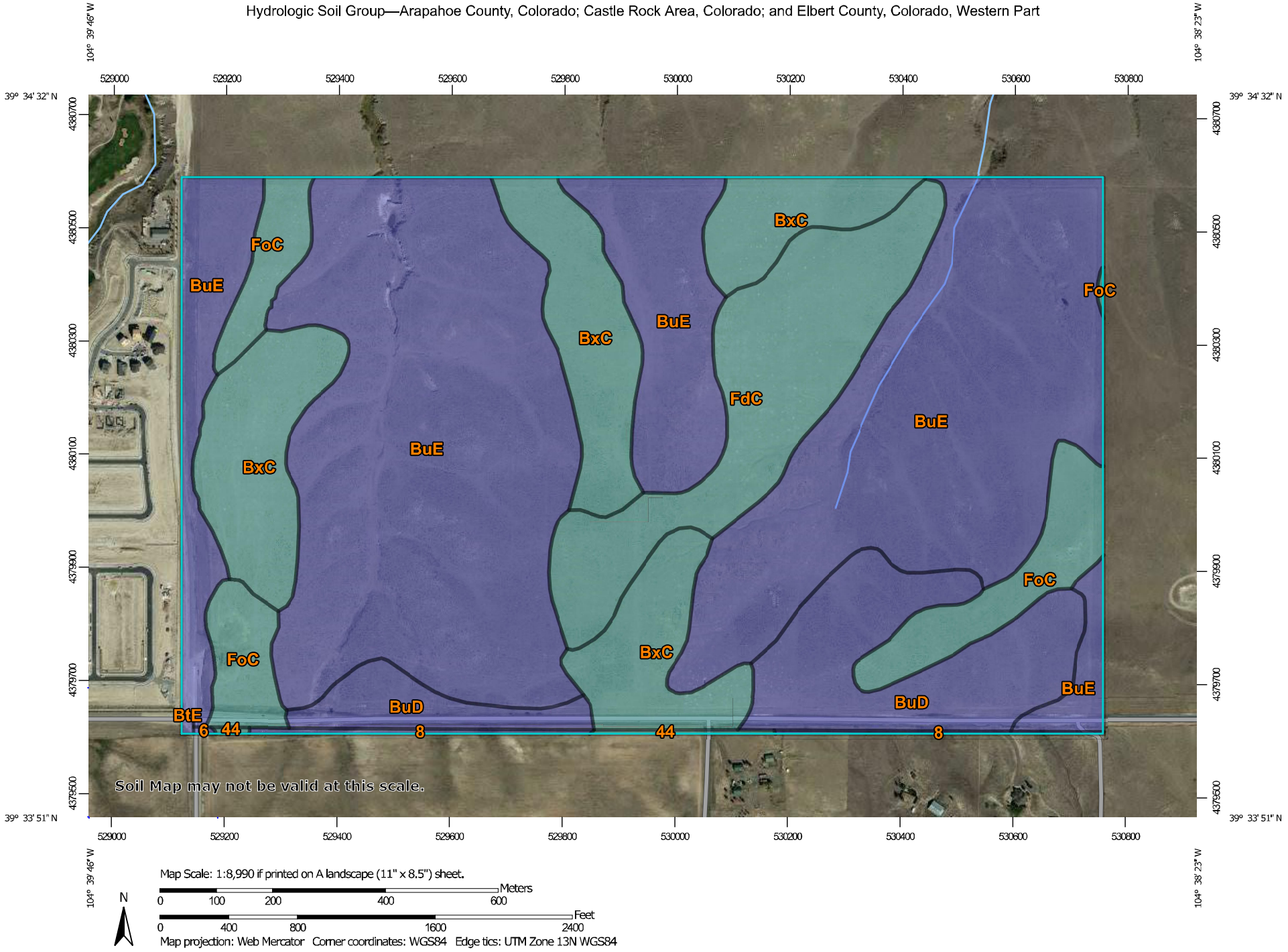

2000 1000 0 2000 4000

ORIGINAL SCALE: 1" = 2000'

FIGURE 1 – VACINITY MAP
TRAILS AT OVERLAND RANCH
JOB NO. 16118.00
6/28/22
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303–740–9393 • Colorado Springs 719–593–2593
Fort Collins 970–491–9888 • www.jrengineering.com


104° 39' 46" W
104° 38' 23" W
529000
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39° 34' 32" N
39° 33' 51" N
4380700
4380500
4380300
4380100
4379900
4379700
4379500
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6
44
8
44
8
Soil Map may not be valid at this scale.
Map Scale: 1:8,990 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0
100
200
400
600
Feet
0
400
800
1600
2400
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

## MAP LEGEND

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

**Soils**

**Soil 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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Arapahoe County, Colorado
Survey Area Data: Version 16, Jun 4, 2020

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 13, Jun 5, 2020

Soil Survey Area: Elbert County, Colorado, Western Part
Survey Area Data: Version 16, Jun 5, 2020

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.

## MAP LEGEND

## MAP INFORMATION

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

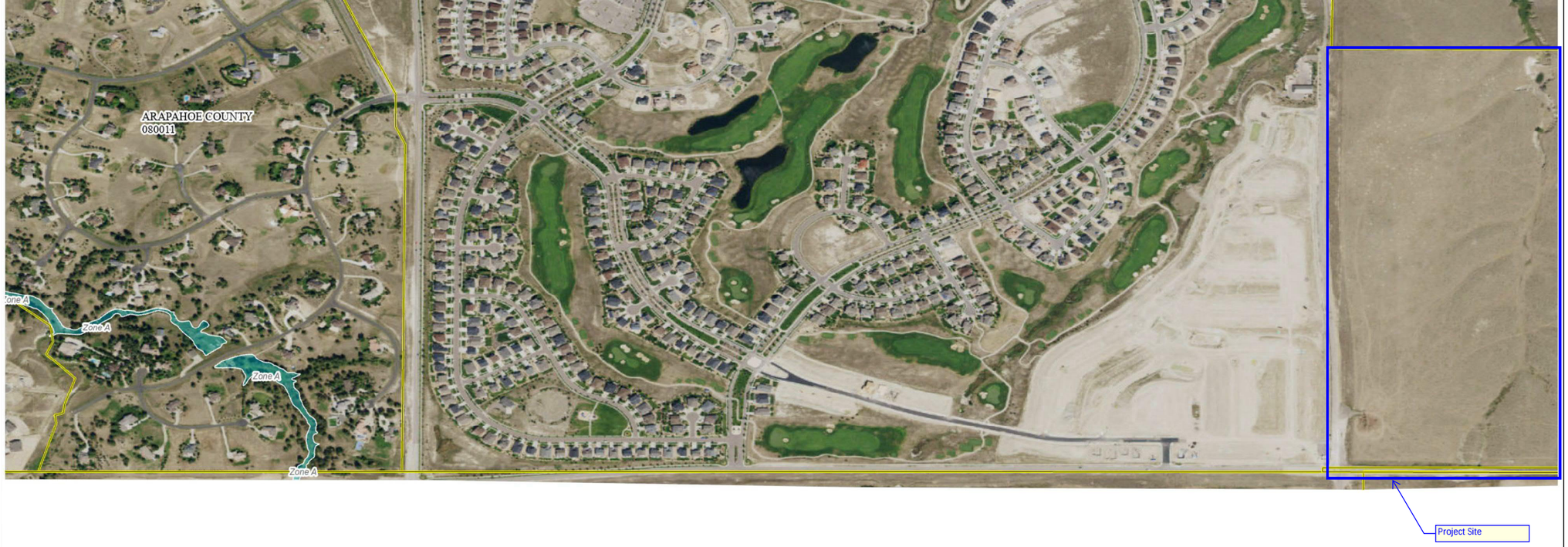
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| BuD | Bresser-Stapleton sandy loams, 3 to 9 percent slopes | B | 38.0 | 9.5% |
| BuE | Bresser-Stapleton sandy loams, 9 to 20 percent slopes | B | 228.5 | 57.2% |
| BxC | Buick loam, 3 to 5 percent slopes | C | 63.7 | 15.9% |
| FdC | Fondis silt loam, 3 to 5 percent slopes | C | 39.0 | 9.8% |
| FoC | Fondis-Colby silt loams, 3 to 5 percent slopes | C | 26.7 | 6.7% |
| **Subtotals for Soil Survey Area** | | | **395.9** | **99.2%** |
| **Totals for Area of Interest** | | | **399.2** | **100.0%** |

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| BtE | Bresser-Truckton sandy loams, 5 to 25 percent slopes | B | 0.2 | 0.0% |
| **Subtotals for Soil Survey Area** | | | **0.2** | **0.0%** |
| **Totals for Area of Interest** | | | **399.2** | **100.0%** |

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 6 | Bresser sandy loam, cool, 5 to 9 percent slopes | B | 0.1 | 0.0% |
| 8 | Bresser-Stapleton sandy loams, 8 to 25 percent slopes | B | 2.3 | 0.6% |
| 44 | Weld loam, 4 to 8 percent slopes | C | 0.8 | 0.2% |
| **Subtotals for Soil Survey Area** | | | **3.2** | **0.8%** |
| **Totals for Area of Interest** | | | **399.2** | **100.0%** |




104°39'22.11"W 39°33'43.94"N

## 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) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

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

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

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

**OTHER FEATURES**
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 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 (1-877-336-2627) 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.

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Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **8/6/2021 12:10 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

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## SCALE

**Map Projection:**
**GCS, Geodetic Reference System 1980;**
**Vertical Datum: No elevation features on this FIRM**
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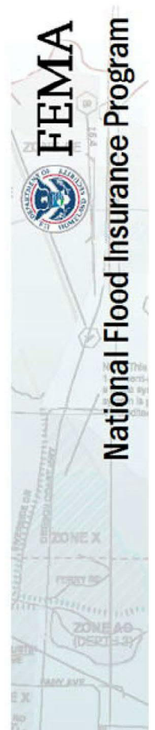
N

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

FLOOD INSURANCE RATE MAP

PANEL **508** OF **675**

Panel Contains:

| COMMUNITY | NUMBER | PANEL |
|---|---|---|
| ARAPAHOE COUNTY | 080011 | 0508 |
| CITY OF AURORA | 080002 | 0508 |
| ELBERT COUNTY | 080055 | 0508 |
| DOUGLAS COUNTY | 080049 | 0508 |

MAP NUMBER
**08005C0508K**
EFFECTIVE DATE
**December 17, 2010**


104°37'29.61"W 39°33'44.07"N

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

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## SCALE

**Map Projection:**
**GCS, Geodetic Reference System 1980;**
**Vertical Datum: No elevation features on this FIRM**
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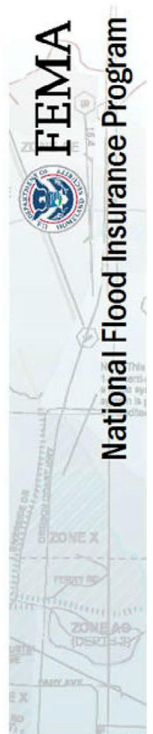
N

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

FLOOD INSURANCE RATE MAP

PANEL **509** OF **675**

Panel Contains:

| COMMUNITY | NUMBER | PANEL |
|---|---|---|
| CITY OF AURORA | 080002 | 0509 |
| ELBERT COUNTY | 080055 | 0509 |
| ARAPAHOE COUNTY | 080011 | 0509 |

MAP NUMBER
**08005C0509K**
EFFECTIVE DATE
**December 17, 2010**

**NOAA Atlas 14, Volume 8, Version 2**
**Location name: Parker, Colorado, USA***
**Latitude: 39.5713°, Longitude: -104.6529°**
**Elevation: m/ft****
* source: ESRI Maps
** source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]**

| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | **0.230** (0.189-0.282) | **0.289** (0.238-0.354) | **0.391** (0.320-0.480) | **0.481** (0.391-0.592) | **0.611** (0.482-0.783) | **0.718** (0.551-0.927) | **0.830** (0.614-1.09) | **0.949** (0.672-1.28) | **1.11** (0.757-1.53) | **1.25** (0.821-1.73) |
| 10-min | **0.337** (0.277-0.413) | **0.424** (0.348-0.519) | **0.573** (0.468-0.703) | **0.704** (0.572-0.867) | **0.895** (0.706-1.15) | **1.05** (0.807-1.36) | **1.22** (0.899-1.60) | **1.39** (0.984-1.87) | **1.63** (1.11-2.24) | **1.82** (1.20-2.53) |
| 15-min | **0.411** (0.338-0.504) | **0.517** (0.424-0.633) | **0.698** (0.571-0.857) | **0.858** (0.698-1.06) | **1.09** (0.861-1.40) | **1.28** (0.984-1.66) | **1.48** (1.10-1.95) | **1.69** (1.20-2.28) | **1.99** (1.35-2.74) | **2.22** (1.47-3.08) |
| 30-min | **0.535** (0.440-0.655) | **0.673** (0.552-0.824) | **0.910** (0.744-1.12) | **1.12** (0.910-1.38) | **1.42** (1.12-1.82) | **1.67** (1.28-2.16) | **1.93** (1.43-2.54) | **2.21** (1.56-2.97) | **2.59** (1.76-3.56) | **2.90** (1.91-4.01) |
| 60-min | **0.665** (0.546-0.814) | **0.827** (0.679-1.01) | **1.11** (0.910-1.37) | **1.37** (1.11-1.68) | **1.74** (1.38-2.24) | **2.05** (1.58-2.65) | **2.38** (1.76-3.14) | **2.73** (1.94-3.68) | **3.23** (2.19-4.44) | **3.62** (2.39-5.02) |
| 2-hr | **0.794** (0.656-0.966) | **0.982** (0.810-1.20) | **1.31** (1.08-1.60) | **1.61** (1.32-1.97) | **2.06** (1.64-2.63) | **2.43** (1.88-3.13) | **2.83** (2.11-3.71) | **3.26** (2.33-4.36) | **3.86** (2.65-5.28) | **4.35** (2.89-5.98) |
| 3-hr | **0.887** (0.735-1.07) | **1.09** (0.899-1.32) | **1.44** (1.19-1.75) | **1.77** (1.45-2.15) | **2.26** (1.80-2.87) | **2.67** (2.07-3.42) | **3.11** (2.33-4.06) | **3.58** (2.57-4.78) | **4.26** (2.93-5.81) | **4.81** (3.21-6.59) |
| 6-hr | **1.08** (0.902-1.30) | **1.31** (1.09-1.58) | **1.72** (1.43-2.07) | **2.09** (1.72-2.53) | **2.65** (2.13-3.35) | **3.12** (2.44-3.98) | **3.63** (2.74-4.71) | **4.18** (3.02-5.53) | **4.95** (3.43-6.70) | **5.58** (3.75-7.59) |
| 12-hr | **1.33** (1.12-1.59) | **1.61** (1.34-1.92) | **2.08** (1.74-2.49) | **2.51** (2.08-3.01) | **3.14** (2.53-3.92) | **3.66** (2.87-4.61) | **4.21** (3.19-5.41) | **4.80** (3.49-6.30) | **5.63** (3.93-7.55) | **6.29** (4.26-8.49) |
| 24-hr | **1.62** (1.37-1.92) | **1.94** (1.63-2.30) | **2.47** (2.07-2.94) | **2.95** (2.45-3.52) | **3.63** (2.94-4.48) | **4.18** (3.30-5.22) | **4.76** (3.63-6.06) | **5.38** (3.93-6.98) | **6.23** (4.37-8.27) | **6.90** (4.70-9.24) |
| 2-day | **1.92** (1.63-2.26) | **2.26** (1.91-2.67) | **2.84** (2.40-3.36) | **3.34** (2.80-3.96) | **4.06** (3.30-4.97) | **4.64** (3.68-5.73) | **5.24** (4.01-6.60) | **5.87** (4.31-7.55) | **6.73** (4.75-8.86) | **7.41** (5.09-9.84) |
| 3-day | **2.09** (1.78-2.45) | **2.45** (2.08-2.88) | **3.06** (2.59-3.60) | **3.59** (3.01-4.23) | **4.34** (3.53-5.27) | **4.93** (3.92-6.06) | **5.55** (4.26-6.95) | **6.19** (4.56-7.93) | **7.07** (5.01-9.26) | **7.76** (5.35-10.3) |
| 4-day | **2.22** (1.89-2.60) | **2.60** (2.21-3.04) | **3.23** (2.74-3.79) | **3.77** (3.18-4.44) | **4.55** (3.71-5.51) | **5.17** (4.12-6.32) | **5.80** (4.47-7.24) | **6.46** (4.77-8.24) | **7.36** (5.23-9.61) | **8.06** (5.58-10.6) |
| 7-day | **2.53** (2.17-2.95) | **2.94** (2.51-3.42) | **3.63** (3.09-4.23) | **4.21** (3.57-4.93) | **5.05** (4.14-6.08) | **5.71** (4.58-6.95) | **6.39** (4.95-7.93) | **7.10** (5.28-9.01) | **8.07** (5.77-10.5) | **8.83** (6.15-11.6) |
| 10-day | **2.82** (2.42-3.27) | **3.25** (2.78-3.77) | **3.97** (3.39-4.62) | **4.59** (3.90-5.35) | **5.47** (4.50-6.56) | **6.17** (4.96-7.48) | **6.89** (5.35-8.51) | **7.64** (5.70-9.65) | **8.66** (6.21-11.2) | **9.45** (6.61-12.3) |
| 20-day | **3.69** (3.18-4.24) | **4.19** (3.61-4.82) | **5.03** (4.31-5.80) | **5.74** (4.90-6.64) | **6.74** (5.58-8.01) | **7.53** (6.09-9.05) | **8.34** (6.52-10.2) | **9.17** (6.89-11.5) | **10.3** (7.44-13.2) | **11.2** (7.86-14.5) |
| 30-day | **4.44** (3.84-5.08) | **5.04** (4.35-5.77) | **6.02** (5.18-6.91) | **6.84** (5.85-7.88) | **7.97** (6.60-9.40) | **8.85** (7.17-10.6) | **9.73** (7.63-11.8) | **10.6** (8.00-13.2) | **11.8** (8.57-15.0) | **12.7** (9.00-16.4) |
| 45-day | **5.42** (4.70-6.18) | **6.18** (5.35-7.05) | **7.40** (6.39-8.46) | **8.39** (7.21-9.63) | **9.73** (8.06-11.4) | **10.7** (8.71-12.7) | **11.7** (9.21-14.2) | **12.7** (9.59-15.7) | **14.0** (10.2-17.6) | **14.9** (10.6-19.1) |
| 60-day | **6.27** (5.45-7.13) | **7.19** (6.25-8.19) | **8.66** (7.49-9.87) | **9.83** (8.46-11.2) | **11.4** (9.43-13.2) | **12.5** (10.2-14.7) | **13.6** (10.7-16.3) | **14.6** (11.1-18.0) | **16.0** (11.6-20.1) | **16.9** (12.0-21.6) |

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

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

Please refer to NOAA Atlas 14 document for more information.

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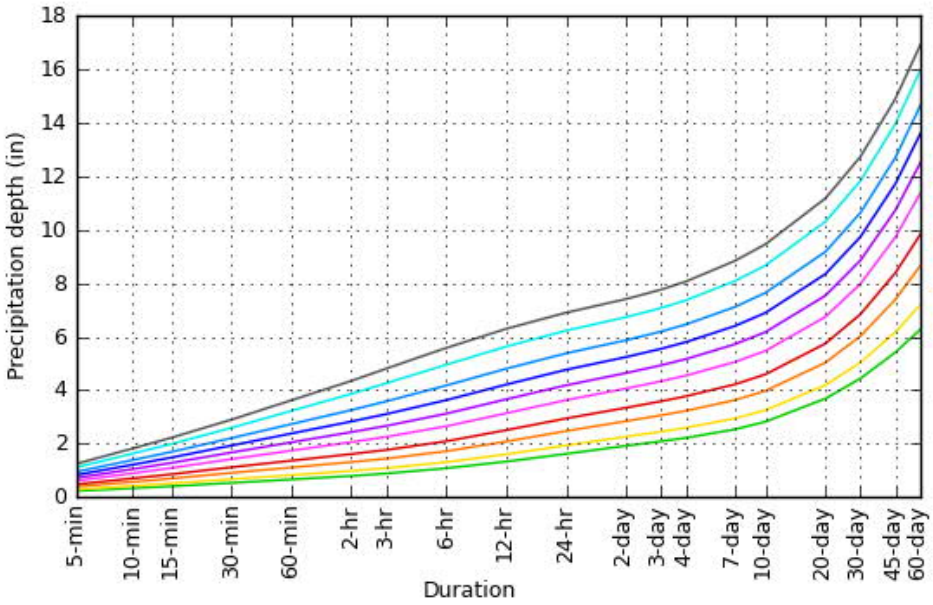
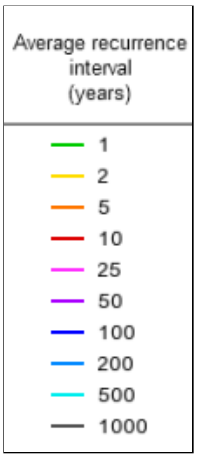
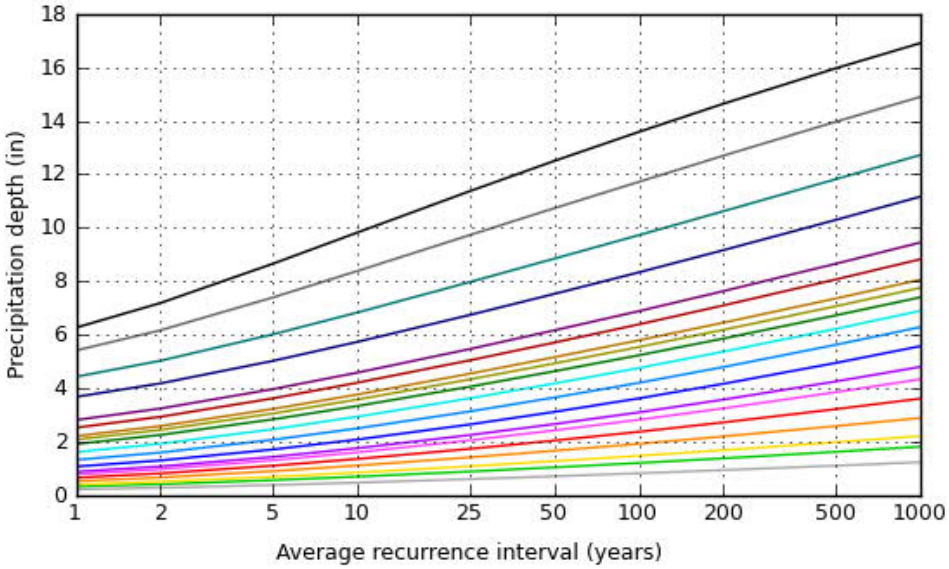
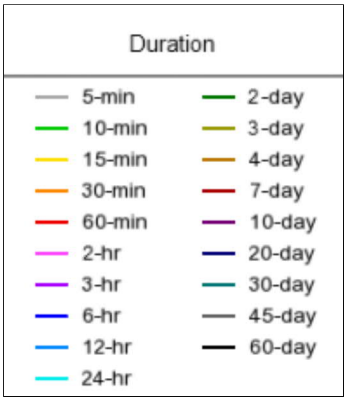
## PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.5713°, Longitude: -104.6529°




NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Mon Sep 19 18:16:41 2022

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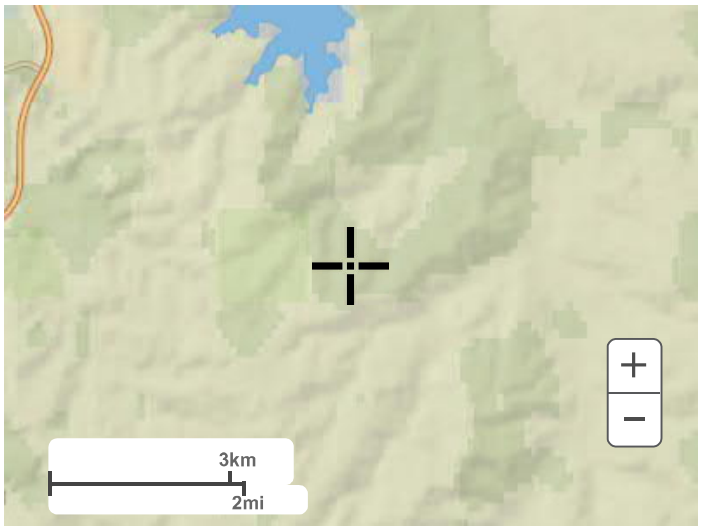
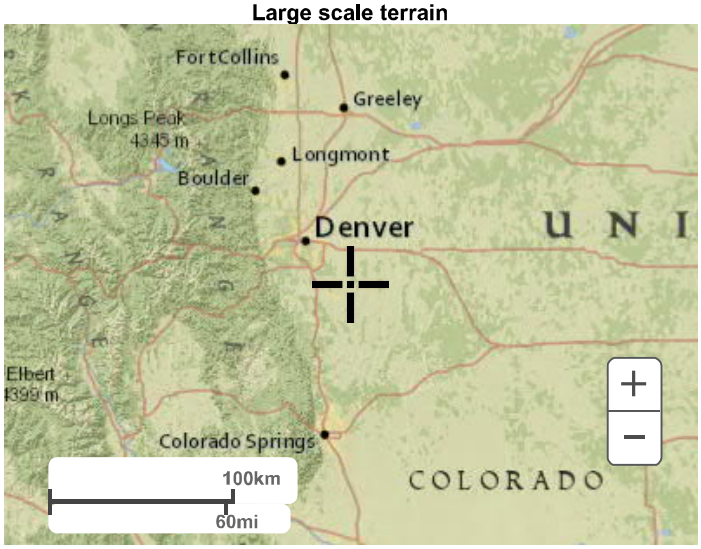
## Maps & aerials

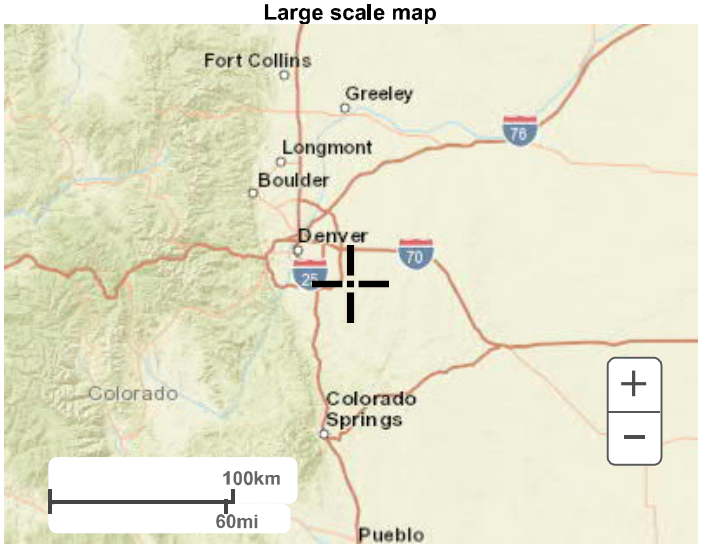
**Small scale terrain**



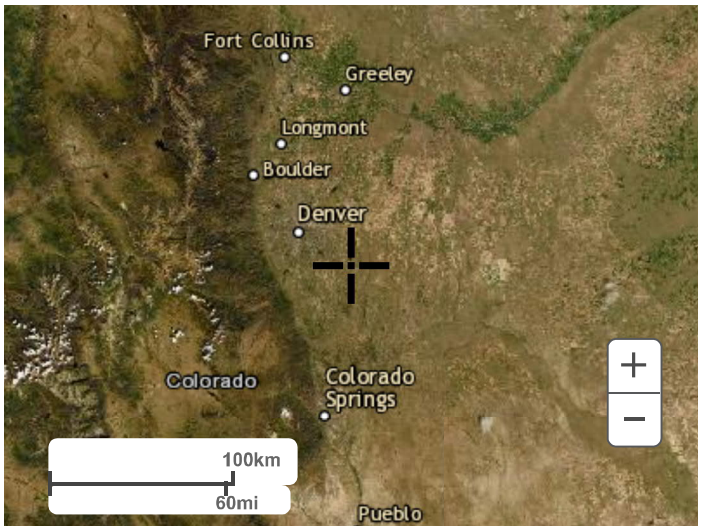

**Large scale terrain**




**Large scale map**




**Large scale aerial**

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

# TABLE 1
# RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Business: | | | | | |
| Commercial Areas | 95 | .87 | .87 | .88 | .89 |
| Neighborhood Areas | 85 | .60 | .65 | .70 | .80 |
| Residential: | | | | | |
| Single-Family (**) | (*) | .40 | .45 | .50 | .60 |
| Multi-Unit (detached) | 60 | .45 | .50 | .60 | .70 |
| Multi-Unit (attached) | 75 | .60 | .65 | .70 | .80 |
| 1/2 Acre Lot or Larger | (*) | .30 | .35 | .40 | .60 |
| Apartments | 80 | .65 | .70 | .70 | .80 |
| Industrial: | | | | | |
| Light Areas | 80 | .71 | .72 | .76 | .82 |
| Heavy Areas | 90 | .80 | .80 | .85 | .90 |
| Parks, Cemeteries | 5 | .10 | .10 | .35 | .60 |
| Playgrounds | 10 | .15 | .25 | .35 | .65 |
| Schools | 50 | .45 | .50 | .60 | .70 |
| Railroad Yard Areas | 15 | .40 | .45 | .50 | .60 |
| Undeveloped Areas: | | | | | |
| Historic Flow Analysis, Greenbelts, Agricultural | 2 | (See "Lawns") | | | |
| Off-Site Flow Analysis (when land use not defined) | 45 | .43 | .47 | .55 | .65 |

**TABLE 1** (continued)

## RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Streets: | | | | | |
| Paved | 100 | .87 | .88 | .90 | .93 |
| Gravel | 40 | .15 | .25 | .35 | .65 |
| *Concrete* Drive and Walks | 96 | .87 | .87 | .88 | .89 |
| Roofs | 90 | .80 | .85 | .90 | .90 |
| Lawns, Sandy Soil (A and B Soils): | 2 | | | | |
| 2% Slope | | .05 | .06 | .08 | .10 |
| 2-7% Slope | | .10 | .11 | .13 | .15 |
| >7% Slope | | .15 | .16 | .18 | .20 |
| Lawns, Clay Soil (C and D Soils): | 5 | | | | |
| 2% Slope | | .13 | .14 | .15 | .17 |
| 2-7% Slope | | .18 | .19 | .20 | .22 |
| >7% Slope | | .25 | .27 | .30 | .35 |

NOTE: These Rational Formula coefficients may not be valid for large basins

(*)See Figures *RO-3 through RO-5* of USDCM Volume 1 for percent impervious.

(**)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached

.

# TABLE 2

Roughness Coefficients ("*n*") for Channel Design

(after Chow 1959)

| Channel Type | Roughness Coefficient (*n*) | | |
|---|---|---|---|
| | Minimum | Typical | Maximum |
| I. Excavated or Dredged | | | |
| 1. Earth, straight and uniform | | | |
| a. Gravel, uniform section, clean | 0.022 | 0.025 | 0.030 |
| b. With short grass, few weeds | 0.022 | 0.027 | 0.033 |
| 2. Earth, winding and sluggish | | | |
| a. Grass, some weeds | 0.025 | 0.030 | 0.033 |
| b. Dense weeds or aquatic plants | 0.030 | 0.035 | 0.040 |
| c. Earthy bottom and rubble/riprap sides | 0.028 | 0.030 | 0.035 |
| 3. Channels not maintained, weeds and brush uncut | | | |
| a. Dense weeds, high as flow depth | 0.050 | 0.080 | 0.120 |
| b. Clean bottom, brush on sides | 0.040 | 0.050 | 0.080 |
| II. Natural streams (top width at flood stage 100 ft) | | | |
| 1. Streams on plain | | | |
| a. Clean, straight, full stage, no rifts or deep pools | 0.025 | 0.030 | 0.033 |
| b. Clean, winding, some pools and shoals, some weeds and stones | 0.035 | 0.045 | 0.050 |
| c. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush | 0.075 | 0.100 | 0.150 |
| III. Lined or Built-Up Channels | | | |
| 1. Concrete | | | |
| a. Towel/float finish | 0.011 | 0.015 | 0.016 |
| b. Shotcrete | 0.016 | 0.020 | 0.025 |
| 2. Gravel bottom with sides of: | | | |
| a. Formed concrete | 0.017 | 0.020 | 0.025 |
| b. Random stone in mortar | 0.020 | 0.023 | 0.026 |
| c. Dry rubble or riprap | 0.023 | 0.033 | 0.036 |
| 3. Wetland Bottom Channels | See Figure 6 | | |
| 4. Grass-Lined Channels and Swales | See Figure 7 | | |
| | | | |

*(Source: USDCM, Volume 1, Major Drainage, 04/2008)*

# APPENDIX B
# HYDROLOGIC CALCULATIONS

# COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision:
Location: Aurora

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Basin ID | Total Area (ac) | Paving, Drives, Walks, Ponds | | | Landscaping/Park | | | Use (Commercial, Residential) | | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| A1 | 1.39 | 100% | 0.00 | 0.0% | 2% | 1.39 | 2.0% | 45% | 0.00 | 0.0% | 2.0% |
| A2 | 1.32 | 100% | 0.65 | 49.2% | 5% | 0.39 | 1.5% | 45% | 0.28 | 9.5% | 60.3% |
| A3 | 0.45 | 100% | 0.33 | 73.3% | 5% | 0.12 | 1.3% | 45% | 0.00 | 0.0% | 74.7% |
| A4 | 6.00 | 100% | 1.60 | 26.7% | 5% | 4.40 | 3.7% | 45% | 0.00 | 0.0% | 30.3% |
| A5 | 1.03 | 100% | 0.37 | 35.9% | 2% | 0.66 | 1.3% | 45% | 0.00 | 0.0% | 37.2% |
| A6 | 1.09 | 100% | 0.14 | 12.8% | 2% | 0.95 | 1.7% | 45% | 0.00 | 0.0% | 14.6% |
| TOTAL A | 11.28 | | | | | | | | | | 31.2% |
| B1 | 1.36 | 100% | 1.03 | 75.7% | 5% | 0.33 | 1.2% | 45% | 0.00 | 0.0% | 76.9% |
| B2 | 1.54 | 100% | 1.16 | 75.3% | 5% | 0.38 | 1.2% | 45% | 0.00 | 0.0% | 76.6% |
| B3 | 8.43 | 100% | 0.00 | 0.0% | 5% | 6.42 | 3.8% | 45% | 2.01 | 10.7% | 14.5% |
| B4 | 2.30 | 100% | 0.78 | 33.9% | 5% | 0.30 | 0.7% | 45% | 1.22 | 23.9% | 58.4% |
| B5 | 1.50 | 100% | 0.60 | 40.0% | 5% | 0.32 | 1.1% | 45% | 0.58 | 17.4% | 58.5% |
| B6 | 1.46 | 100% | 0.40 | 27.4% | 5% | 0.10 | 0.3% | 45% | 0.96 | 29.6% | 57.3% |
| B7 | 2.66 | 100% | 0.60 | 22.6% | 5% | 0.15 | 0.3% | 45% | 1.91 | 32.3% | 55.2% |
| B8 | 1.76 | 100% | 0.46 | 26.1% | 5% | 0.11 | 0.3% | 45% | 1.19 | 30.4% | 56.9% |
| B9 | 1.53 | 100% | 0.35 | 22.9% | 5% | 0.09 | 0.3% | 45% | 1.09 | 32.1% | 55.2% |
| B10 | 2.40 | 100% | 0.61 | 25.4% | 5% | 0.15 | 0.3% | 45% | 1.64 | 30.8% | 56.5% |
| B11 | 0.44 | 100% | 0.15 | 34.1% | 5% | 0.04 | 0.5% | 45% | 0.25 | 25.6% | 60.1% |
| B12 | 0.48 | 100% | 0.26 | 54.2% | 5% | 0.06 | 0.6% | 45% | 0.16 | 15.0% | 69.8% |
| B13 | 2.33 | 100% | 0.22 | 9.4% | 5% | 0.81 | 1.7% | 45% | 1.30 | 25.1% | 36.3% |
| B14 | 1.54 | 100% | 1.23 | 79.9% | 5% | 0.31 | 1.0% | 45% | 0.00 | 0.0% | 80.9% |
| B15 | 2.20 | 100% | 0.00 | 0.0% | 5% | 2.20 | 5.0% | 45% | 0.00 | 0.0% | 5.0% |
| B16 | 0.66 | 100% | 0.34 | 51.5% | 5% | 0.09 | 0.7% | 45% | 0.23 | 15.7% | 67.9% |
| B17 | 0.37 | 100% | 0.30 | 81.1% | 5% | 0.07 | 0.9% | 45% | 0.00 | 0.0% | 82.0% |
| B18 | 1.97 | 100% | 0.36 | 18.3% | 5% | 0.13 | 0.3% | 45% | 1.48 | 33.8% | 52.4% |
| B19 | 1.28 | 100% | 0.37 | 28.9% | 5% | 0.09 | 0.4% | 45% | 0.82 | 28.8% | 58.1% |
| B20 | 0.66 | 100% | 0.26 | 39.4% | 5% | 0.07 | 0.5% | 45% | 0.33 | 22.5% | 62.4% |
| B21 | 2.61 | 100% | 0.42 | 16.1% | 5% | 0.11 | 0.2% | 45% | 2.08 | 35.9% | 52.2% |

Per Table 1, City of Aurora Storm Drainage and Technical Criteria Manual:

Paving, Drives, Walks: 100% impervious

Undeveloped Areas (Lawns): 2%-5% impervious

Commercial Areas: 95% impervious

Neighborhood Areas: 85% impervious

Single-Family Residential (0.25 Acres or Less): 45% impervious

| Basin ID | Total Area (ac) | Paving, Drives, Walks, Ponds | | | Landscaping/Park | | | Use (Commercial, Residential) | | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| B22 | 1.45 | 100% | 0.45 | 31.0% | 5% | 0.12 | 0.4% | 45% | 0.88 | 27.3% | 58.8% |
| B23 | 22.95 | 100% | 0.00 | 0.0% | 5% | 17.55 | 3.8% | 45% | 5.40 | 10.6% | 14.4% |
| B24 | 3.41 | 100% | 0.54 | 15.8% | 5% | 0.30 | 0.4% | 45% | 2.57 | 33.9% | 50.2% |
| B25 | 2.35 | 100% | 0.53 | 22.6% | 5% | 0.25 | 0.5% | 45% | 1.57 | 30.1% | 53.1% |
| B26 | 3.57 | 100% | 0.65 | 18.2% | 5% | 0.34 | 0.5% | 45% | 2.58 | 32.5% | 51.2% |
| B27 | 1.47 | 100% | 0.54 | 36.7% | 2% | 0.13 | 0.2% | 45% | 0.80 | 24.5% | 61.4% |
| B28 | 1.62 | 100% | 0.38 | 23.5% | 5% | 0.09 | 0.3% | 45% | 1.15 | 31.9% | 55.7% |
| B29 | 1.19 | 100% | 0.25 | 21.0% | 5% | 0.06 | 0.3% | 45% | 0.88 | 33.3% | 54.5% |
| B30 | 2.80 | 100% | 0.53 | 18.9% | 5% | 0.62 | 1.1% | 45% | 1.65 | 26.5% | 46.6% |
| B31 | 1.87 | 100% | 0.35 | 18.7% | 5% | 0.09 | 0.2% | 45% | 1.43 | 34.4% | 53.4% |
| B32 | 0.20 | 100% | 0.14 | 70.0% | 5% | 0.03 | 0.8% | 45% | 0.03 | 6.8% | 77.5% |
| B33 | 0.21 | 100% | 0.14 | 66.7% | 5% | 0.04 | 1.0% | 45% | 0.03 | 6.4% | 74.0% |
| B33A | 0.41 | 100% | 0.19 | 46.3% | 5% | 0.22 | 2.7% | 45% | 0.00 | 0.0% | 49.0% |
| B33B | 0.21 | 100% | 0.14 | 66.7% | 5% | 0.07 | 1.7% | 45% | 0.00 | 0.0% | 68.3% |
| B34 | 1.53 | 100% | 0.22 | 14.4% | 5% | 0.11 | 0.4% | 45% | 1.20 | 35.3% | 50.0% |
| B35 | 0.98 | 100% | 0.35 | 35.6% | 5% | 0.09 | 0.5% | 45% | 0.54 | 24.8% | 60.9% |
| B36 | 1.24 | 100% | 0.34 | 27.4% | 5% | 0.08 | 0.3% | 45% | 0.82 | 29.8% | 57.5% |
| B37 | 1.74 | 100% | 0.39 | 22.4% | 5% | 0.18 | 0.5% | 45% | 1.17 | 30.3% | 53.2% |
| B38 | 1.12 | 100% | 0.50 | 44.6% | 5% | 0.51 | 2.3% | 45% | 0.11 | 4.4% | 51.3% |
| B39 | 0.78 | 100% | 0.40 | 51.3% | 5% | 0.38 | 2.4% | 45% | 0.00 | 0.0% | 53.7% |
| B39A | 0.23 | 100% | 0.14 | 60.9% | 5% | 0.09 | 2.0% | 45% | 0.00 | 0.0% | 62.8% |
| B39B | 0.26 | 100% | 0.21 | 80.8% | 5% | 0.05 | 1.0% | 45% | 0.00 | 0.0% | 81.7% |
| B40 | 1.94 | 100% | 0.53 | 27.3% | 5% | 0.13 | 0.3% | 45% | 1.28 | 29.7% | 57.3% |
| B41 | 0.80 | 100% | 0.26 | 32.5% | 2% | 0.06 | 0.2% | 45% | 0.48 | 27.0% | 59.7% |
| B42 | 2.98 | 100% | 0.66 | 22.1% | 2% | 0.17 | 0.1% | 45% | 2.15 | 32.5% | 54.7% |
| B43 | 1.40 | 100% | 0.51 | 36.4% | 2% | 0.13 | 0.2% | 45% | 0.76 | 24.4% | 61.0% |
| B44 | 0.22 | 100% | 0.16 | 72.7% | 2% | 0.04 | 0.4% | 45% | 0.02 | 4.1% | 77.2% |
| B45 | 2.01 | 100% | 0.27 | 13.4% | 2% | 0.07 | 0.1% | 45% | 1.67 | 37.4% | 50.9% |
| B46 | 1.56 | 100% | 0.57 | 36.5% | 2% | 0.12 | 0.2% | 45% | 0.87 | 25.1% | 61.8% |
| B47 | 2.80 | 100% | 0.40 | 14.3% | 2% | 0.10 | 0.1% | 45% | 2.30 | 37.0% | 51.3% |
| B48 | 1.29 | 100% | 0.47 | 36.4% | 2% | 0.10 | 0.2% | 45% | 0.72 | 25.1% | 61.7% |
| B49 | 6.16 | 100% | 0.00 | 0.0% | 5% | 6.16 | 5.0% | 45% | 0.00 | 0.0% | 5.0% |
| B50 | 0.46 | 100% | 0.37 | 80.4% | 5% | 0.09 | 1.0% | 45% | 0.00 | 0.0% | 81.4% |
| B51 | 0.85 | 100% | 0.68 | 80.0% | 5% | 0.17 | 1.0% | 45% | 0.00 | 0.0% | 81.0% |
| B52 | 0.96 | 100% | 0.32 | 33.3% | 5% | 0.08 | 0.4% | 45% | 0.56 | 26.3% | 60.0% |

| Basin ID | Total Area (ac) | Paving, Drives, Walks, Ponds | | | Landscaping/Park | | | Use (Commercial, Residential) | | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| B53 | 1.33 | 100% | 0.40 | 30.1% | 5% | 0.10 | 0.4% | 45% | 0.83 | 28.1% | 58.5% |
| B54 | 0.56 | 100% | 0.18 | 32.1% | 5% | 0.04 | 0.4% | 45% | 0.34 | 27.3% | 59.8% |
| B55 | 3.16 | 100% | 0.71 | 22.5% | 5% | 0.23 | 0.4% | 45% | 2.22 | 31.6% | 54.4% |
| B56 | 1.09 | 100% | 0.34 | 31.2% | 5% | 0.08 | 0.4% | 45% | 0.67 | 27.7% | 59.2% |
| B57 | 0.79 | 100% | 0.26 | 32.9% | 5% | 0.06 | 0.4% | 45% | 0.47 | 26.8% | 60.1% |
| B58 | 2.16 | 100% | 0.98 | 45.4% | 5% | 0.27 | 0.6% | 45% | 0.91 | 19.0% | 65.0% |
| B58A | 0.98 | 100% | 0.00 | 0.0% | 2% | 0.28 | 0.6% | 45% | 0.70 | 32.1% | 32.7% |
| B59 | 3.96 | 100% | 0.69 | 17.4% | 5% | 0.36 | 0.5% | 45% | 2.91 | 33.1% | 50.9% |
| B61 | 2.43 | 100% | 0.00 | 0.0% | 5% | 0.00 | 0.0% | 85% | 2.43 | 85.0% | 85.0% |
| B62 | 12.96 | 100% | 3.57 | 27.5% | 5% | 7.61 | 2.9% | 45% | 1.78 | 6.2% | 36.7% |
| TOTAL B | 143.92 | | | | | | | | | | 43.0% |
| C1 | 1.51 | 100% | 0.17 | 11.3% | 2% | 0.37 | 0.5% | 45% | 0.97 | 28.9% | 40.7% |
| C2 | 1.39 | 100% | 0.45 | 32.4% | 5% | 0.15 | 0.5% | 45% | 0.79 | 25.6% | 58.5% |
| C3 | 1.74 | 100% | 0.26 | 14.9% | 5% | 0.07 | 0.2% | 45% | 1.41 | 36.5% | 51.6% |
| C4 | 3.68 | 100% | 0.55 | 14.9% | 5% | 0.27 | 0.4% | 45% | 2.86 | 35.0% | 50.3% |
| C5 | 2.03 | 100% | 0.65 | 32.0% | 5% | 0.29 | 0.7% | 45% | 1.09 | 24.2% | 56.9% |
| C6 | 1.05 | 100% | 0.00 | 0.0% | 5% | 0.23 | 1.1% | 45% | 0.82 | 35.1% | 36.2% |
| C7 | 9.17 | 100% | 2.99 | 32.6% | 5% | 0.75 | 0.4% | 45% | 5.43 | 26.6% | 59.7% |
| C8 | 3.03 | 100% | 0.97 | 32.0% | 5% | 0.25 | 0.4% | 45% | 1.81 | 26.9% | 59.3% |
| C9 | 4.93 | 100% | 1.02 | 20.7% | 2% | 1.86 | 0.8% | 45% | 2.05 | 18.7% | 40.2% |
| TOTAL C | 28.53 | | | | | | | | | | 52.4% |
| D1 | 3.06 | 100% | 0.73 | 23.9% | 5% | 0.25 | 0.4% | 45% | 2.08 | 30.6% | 54.9% |
| D2 | 3.07 | 100% | 0.78 | 25.4% | 5% | 0.17 | 0.3% | 45% | 2.12 | 31.1% | 56.8% |
| D3 | 1.77 | 100% | 0.36 | 20.3% | 5% | 0.09 | 0.3% | 45% | 1.32 | 33.6% | 54.2% |
| D4 | 1.65 | 100% | 0.97 | 58.8% | 5% | 0.68 | 2.1% | 45% | 0.00 | 0.0% | 60.8% |
| D5 | 11.36 | 100% | 0.43 | 3.8% | 2% | 10.93 | 1.9% | 45% | 0.00 | 0.0% | 5.7% |
| TOTAL D | 20.91 | | | | | | | | | | 28.8% |
| OS1 | 21.79 | 100% | 0.60 | 2.8% | 5% | 0.00 | 0.0% | 15% | 21.19 | 14.6% | 17.3% |
| OS2 | 13.65 | 100% | 0.40 | 2.9% | 5% | 0.00 | 0.0% | 15% | 13.25 | 14.6% | 17.5% |
| OS3 | 0.14 | 100% | 0.09 | 64.3% | 2% | 0.05 | 0.7% | 45% | 0.00 | 0.0% | 65.0% |
| OS4 | 0.72 | 100% | 0.00 | 0.0% | 2% | 0.72 | 2.0% | 45% | 0.00 | 0.0% | 2.0% |
| OS5 | 1.69 | 100% | 0.00 | 0.0% | 2% | 1.15 | 1.4% | 45% | 0.54 | 14.4% | 15.7% |
| TOTAL OS | 37.99 | | | | | | | | | | 17.2% |

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: _____ Project Name: Trails at Overland Ranch
Location: Aurora Project No.: 16118.00
Calculated By: AAM
Checked By: _____
C-Value - 2-Year Date: 6/10/22

| Basin ID | Total Area (ac) | Paved/Pond Roads/Walks/Walls | | | Landscaping | | | Use (Commercial or Single Family Residential) | | | Basins Total Weighted $C_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $C_2$ | Area (ac) | Weighted $C_2$ | $C_2$ | Area (ac) | Weighted $C_2$ | $C_2$ | Area (ac) | Weighted $C_2$ | |
| A1 | 1.39 | 0.87 | 0.00 | 0.00 | 0.10 | 1.39 | 0.10 | 0.40 | 0.00 | 0.00 | 0.10 |
| A2 | 1.32 | 0.87 | 0.65 | 0.43 | 0.10 | 0.39 | 0.03 | 0.40 | 0.28 | 0.08 | 0.54 |
| A3 | 0.45 | 0.87 | 0.33 | 0.64 | 0.10 | 0.12 | 0.03 | 0.40 | 0.00 | 0.00 | 0.66 |
| A4 | 6.00 | 0.87 | 1.60 | 0.23 | 0.18 | 4.40 | 0.13 | 0.40 | 0.00 | 0.00 | 0.36 |
| A5 | 1.03 | 0.87 | 0.37 | 0.31 | 0.10 | 0.66 | 0.06 | 0.40 | 0.00 | 0.00 | 0.38 |
| A6 | 1.09 | 0.87 | 0.14 | 0.11 | 0.10 | 0.95 | 0.09 | 0.40 | 0.00 | 0.00 | 0.20 |
| B1 | 1.36 | 0.87 | 1.03 | 0.66 | 0.18 | 0.33 | 0.04 | 0.40 | 0.00 | 0.00 | 0.70 |
| B2 | 1.54 | 0.87 | 1.16 | 0.66 | 0.18 | 0.38 | 0.04 | 0.40 | 0.00 | 0.00 | 0.70 |
| B3 | 8.43 | 0.87 | 0.00 | 0.00 | 0.18 | 6.42 | 0.14 | 0.40 | 2.01 | 0.10 | 0.23 |
| B4 | 2.30 | 0.87 | 0.78 | 0.30 | 0.18 | 0.30 | 0.02 | 0.40 | 1.22 | 0.21 | 0.53 |
| B5 | 1.50 | 0.87 | 0.60 | 0.35 | 0.18 | 0.32 | 0.04 | 0.40 | 0.58 | 0.15 | 0.54 |
| B6 | 1.46 | 0.87 | 0.40 | 0.24 | 0.18 | 0.10 | 0.01 | 0.40 | 0.96 | 0.26 | 0.51 |
| B7 | 2.66 | 0.87 | 0.60 | 0.20 | 0.18 | 0.15 | 0.01 | 0.40 | 1.91 | 0.29 | 0.49 |
| B8 | 1.76 | 0.87 | 0.46 | 0.23 | 0.18 | 0.11 | 0.01 | 0.40 | 1.19 | 0.27 | 0.51 |
| B9 | 1.53 | 0.87 | 0.35 | 0.20 | 0.18 | 0.09 | 0.01 | 0.40 | 1.09 | 0.28 | 0.49 |
| B10 | 2.40 | 0.87 | 0.61 | 0.22 | 0.18 | 0.15 | 0.01 | 0.40 | 1.64 | 0.27 | 0.51 |
| B11 | 0.44 | 0.87 | 0.15 | 0.30 | 0.18 | 0.04 | 0.02 | 0.40 | 0.25 | 0.23 | 0.54 |
| B12 | 0.48 | 0.87 | 0.26 | 0.47 | 0.18 | 0.06 | 0.02 | 0.40 | 0.16 | 0.13 | 0.63 |
| B13 | 2.33 | 0.87 | 0.22 | 0.08 | 0.18 | 0.81 | 0.06 | 0.40 | 1.30 | 0.22 | 0.37 |
| B14 | 1.54 | 0.87 | 1.23 | 0.69 | 0.18 | 0.31 | 0.04 | 0.40 | 0.00 | 0.00 | 0.73 |
| B15 | 2.20 | 0.87 | 0.00 | 0.00 | 0.18 | 2.20 | 0.18 | 0.40 | 0.00 | 0.00 | 0.18 |
| B16 | 0.66 | 0.87 | 0.34 | 0.45 | 0.18 | 0.09 | 0.02 | 0.40 | 0.23 | 0.14 | 0.61 |
| B17 | 0.37 | 0.87 | 0.30 | 0.71 | 0.18 | 0.07 | 0.03 | 0.40 | 0.00 | 0.00 | 0.74 |
| B18 | 1.97 | 0.87 | 0.36 | 0.16 | 0.18 | 0.13 | 0.01 | 0.40 | 1.48 | 0.30 | 0.47 |
| B19 | 1.28 | 0.87 | 0.37 | 0.25 | 0.18 | 0.09 | 0.01 | 0.40 | 0.82 | 0.26 | 0.52 |
| B20 | 0.66 | 0.87 | 0.26 | 0.34 | 0.18 | 0.07 | 0.02 | 0.40 | 0.33 | 0.20 | 0.56 |
| B21 | 2.61 | 0.87 | 0.42 | 0.14 | 0.18 | 0.11 | 0.01 | 0.40 | 2.08 | 0.32 | 0.47 |
| B22 | 1.45 | 0.87 | 0.45 | 0.27 | 0.18 | 0.12 | 0.01 | 0.40 | 0.88 | 0.24 | 0.53 |

**TABLE 1**
**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Business: | | | | | |
| Commercial Areas | 95 | .87 | .87 | .88 | .89 |
| Neighborhood Areas | 85 | .60 | .65 | .70 | .80 |
| Residential: | | | | | |
| Single-Family (**) | (*) | .40 | .45 | .50 | .60 |
| Multi-Unit (detached) | 60 | .45 | .50 | .60 | .70 |
| Multi-Unit (attached) | 75 | .60 | .65 | .70 | .80 |
| 1/2 Acre Lot or Larger | (*) | .30 | .35 | .40 | .60 |
| Apartments | 80 | .65 | .70 | .70 | .80 |
| Industrial: | | | | | |
| Light Areas | 80 | .71 | .72 | .76 | .82 |
| Heavy Areas | 90 | .80 | .80 | .85 | .90 |
| Parks, Cemeteries | 5 | .10 | .10 | .35 | .60 |
| Playgrounds | 10 | .15 | .25 | .35 | .65 |
| Schools | 50 | .45 | .50 | .60 | .70 |
| Railroad Yard Areas | 15 | .40 | .45 | .50 | .60 |
| Undeveloped Areas: | | | | | |
| Historic Flow Analysis, Greenbelts, Agricultural | 2 | (See "Lawns") | | | |
| Off-Site Flow Analysis (when land use not defined) | 45 | .43 | .47 | .55 | .65 |

**TABLE 1** (continued)

**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Streets: | | | | | |
| Paved | 100 | .87 | .88 | .90 | .93 |
| Gravel | 40 | .15 | .25 | .35 | .65 |
| *Concrete* Drive and Walks | 96 | .87 | .87 | .88 | .89 |
| Roofs | 90 | .80 | .85 | .90 | .90 |
| Lawns, Sandy Soil (A and B Soils): | 2 | | | | |
| 2% Slope | | .05 | .06 | .08 | .10 |
| 2-7% Slope | | .10 | .11 | .13 | .15 |
| >7% Slope | | .15 | .16 | .18 | .20 |
| Lawns, Clay Soil (C and D Soils): | 5 | | | | |
| 2% Slope | | .13 | .14 | .15 | .17 |
| 2-7% Slope | | .18 | .19 | .20 | .22 |
| >7% Slope | | .25 | .27 | .30 | .35 |

NOTE: These Rational Formula coefficients may not be valid for large basins

(*)See Figures *RO-3 through RO-5* of USDCM Volume 1 for percent impervious.

(**)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B23 | 22.95 | 0.87 | 0.00 | 0.00 | 0.25 | 17.55 | 0.19 | 0.40 | 5.40 | 0.09 | 0.29 |
| B24 | 3.41 | 0.87 | 0.54 | 0.14 | 0.18 | 0.30 | 0.02 | 0.40 | 2.57 | 0.30 | 0.46 |
| B25 | 2.35 | 0.87 | 0.53 | 0.20 | 0.18 | 0.25 | 0.02 | 0.40 | 1.57 | 0.27 | 0.48 |
| B26 | 3.57 | 0.87 | 0.65 | 0.16 | 0.18 | 0.34 | 0.02 | 0.40 | 2.58 | 0.29 | 0.46 |
| B27 | 1.47 | 0.87 | 0.54 | 0.32 | 0.18 | 0.13 | 0.02 | 0.40 | 0.80 | 0.22 | 0.55 |
| B28 | 1.62 | 0.87 | 0.38 | 0.20 | 0.18 | 0.09 | 0.01 | 0.40 | 1.15 | 0.28 | 0.50 |
| B29 | 1.19 | 0.87 | 0.25 | 0.18 | 0.18 | 0.06 | 0.01 | 0.40 | 0.88 | 0.30 | 0.49 |
| B30 | 2.80 | 0.87 | 0.53 | 0.16 | 0.18 | 0.62 | 0.04 | 0.40 | 1.65 | 0.24 | 0.44 |
| B31 | 1.87 | 0.87 | 0.35 | 0.16 | 0.18 | 0.09 | 0.01 | 0.40 | 1.43 | 0.31 | 0.48 |
| B32 | 0.20 | 0.87 | 0.14 | 0.61 | 0.18 | 0.03 | 0.03 | 0.40 | 0.03 | 0.06 | 0.70 |
| B33 | 0.21 | 0.87 | 0.14 | 0.58 | 0.18 | 0.04 | 0.03 | 0.40 | 0.03 | 0.06 | 0.67 |
| B33A | 0.41 | 0.87 | 0.19 | 0.40 | 0.18 | 0.22 | 0.10 | 0.40 | 0.00 | 0.00 | 0.50 |
| B33B | 0.21 | 0.87 | 0.14 | 0.58 | 0.18 | 0.07 | 0.06 | 0.40 | 0.00 | 0.00 | 0.64 |
| B34 | 1.53 | 0.87 | 0.22 | 0.13 | 0.18 | 0.11 | 0.01 | 0.40 | 1.20 | 0.31 | 0.45 |
| B35 | 0.98 | 0.87 | 0.35 | 0.31 | 0.18 | 0.09 | 0.02 | 0.40 | 0.54 | 0.22 | 0.55 |
| B36 | 1.24 | 0.87 | 0.34 | 0.24 | 0.18 | 0.08 | 0.01 | 0.40 | 0.82 | 0.26 | 0.51 |
| B37 | 1.74 | 0.87 | 0.39 | 0.20 | 0.18 | 0.18 | 0.02 | 0.40 | 1.17 | 0.27 | 0.48 |
| B38 | 1.12 | 0.87 | 0.50 | 0.39 | 0.18 | 0.51 | 0.08 | 0.40 | 0.11 | 0.04 | 0.51 |
| B39 | 0.78 | 0.87 | 0.40 | 0.45 | 0.18 | 0.38 | 0.09 | 0.40 | 0.00 | 0.00 | 0.53 |
| B39A | 0.23 | 0.87 | 0.14 | 0.53 | 0.18 | 0.09 | 0.07 | 0.40 | 0.00 | 0.00 | 0.60 |
| B39B | 0.26 | 0.87 | 0.21 | 0.70 | 0.18 | 0.05 | 0.03 | 0.40 | 0.00 | 0.00 | 0.74 |
| B40 | 1.94 | 0.87 | 0.53 | 0.24 | 0.18 | 0.13 | 0.01 | 0.40 | 1.28 | 0.26 | 0.51 |
| B41 | 0.80 | 0.87 | 0.26 | 0.28 | 0.18 | 0.06 | 0.01 | 0.40 | 0.48 | 0.24 | 0.54 |
| B42 | 2.98 | 0.87 | 0.66 | 0.19 | 0.18 | 0.17 | 0.01 | 0.40 | 2.15 | 0.29 | 0.49 |
| B43 | 1.40 | 0.87 | 0.51 | 0.32 | 0.18 | 0.13 | 0.02 | 0.40 | 0.76 | 0.22 | 0.55 |
| B44 | 0.22 | 0.87 | 0.16 | 0.63 | 0.18 | 0.04 | 0.03 | 0.40 | 0.02 | 0.04 | 0.70 |
| B45 | 2.01 | 0.87 | 0.27 | 0.12 | 0.18 | 0.07 | 0.01 | 0.40 | 1.67 | 0.33 | 0.46 |
| B46 | 1.56 | 0.87 | 0.57 | 0.32 | 0.18 | 0.12 | 0.01 | 0.40 | 0.87 | 0.22 | 0.55 |
| B47 | 2.80 | 0.87 | 0.40 | 0.12 | 0.18 | 0.10 | 0.01 | 0.40 | 2.30 | 0.33 | 0.46 |
| B48 | 1.29 | 0.87 | 0.47 | 0.32 | 0.18 | 0.10 | 0.01 | 0.40 | 0.72 | 0.22 | 0.55 |
| B49 | 6.16 | 0.87 | 0.00 | 0.00 | 0.18 | 6.16 | 0.18 | 0.40 | 0.00 | 0.00 | 0.18 |
| B50 | 0.46 | 0.87 | 0.37 | 0.70 | 0.18 | 0.09 | 0.04 | 0.40 | 0.00 | 0.00 | 0.74 |
| B51 | 0.85 | 0.87 | 0.68 | 0.70 | 0.18 | 0.17 | 0.04 | 0.40 | 0.00 | 0.00 | 0.73 |
| B52 | 0.96 | 0.87 | 0.32 | 0.29 | 0.18 | 0.08 | 0.02 | 0.40 | 0.56 | 0.23 | 0.54 |
| B53 | 1.33 | 0.87 | 0.40 | 0.26 | 0.18 | 0.10 | 0.01 | 0.40 | 0.83 | 0.25 | 0.52 |
| B54 | 0.56 | 0.87 | 0.18 | 0.28 | 0.18 | 0.04 | 0.01 | 0.40 | 0.34 | 0.24 | 0.54 |
| B55 | 3.16 | 0.87 | 0.71 | 0.20 | 0.18 | 0.23 | 0.01 | 0.40 | 2.22 | 0.28 | 0.49 |
| B56 | 1.09 | 0.87 | 0.34 | 0.27 | 0.18 | 0.08 | 0.01 | 0.40 | 0.67 | 0.25 | 0.53 |
| B57 | 0.79 | 0.87 | 0.26 | 0.29 | 0.18 | 0.06 | 0.01 | 0.40 | 0.47 | 0.24 | 0.54 |
| B58 | 2.16 | 0.87 | 0.98 | 0.39 | 0.18 | 0.27 | 0.02 | 0.40 | 0.91 | 0.17 | 0.59 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B58A | 0.98 | 0.87 | 0.00 | 0.00 | 0.10 | 0.28 | 0.03 | 0.40 | 0.70 | 0.29 | 0.31 |
| B59 | 3.96 | 0.87 | 0.69 | 0.15 | 0.18 | 0.36 | 0.02 | 0.40 | 2.91 | 0.29 | 0.46 |
| B61 | 2.43 | 0.87 | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.60 | 2.43 | 0.60 | 0.60 |
| B62 | 12.96 | 0.87 | 3.57 | 0.24 | 0.18 | 7.61 | 0.11 | 0.40 | 1.78 | 0.05 | 0.40 |
| C1 | 1.51 | 0.87 | 0.17 | 0.10 | 0.18 | 0.37 | 0.04 | 0.40 | 0.97 | 0.26 | 0.40 |
| C2 | 1.39 | 0.87 | 0.45 | 0.28 | 0.18 | 0.15 | 0.02 | 0.40 | 0.79 | 0.23 | 0.53 |
| C3 | 1.74 | 0.87 | 0.26 | 0.13 | 0.18 | 0.07 | 0.01 | 0.40 | 1.41 | 0.32 | 0.46 |
| C4 | 3.68 | 0.87 | 0.55 | 0.13 | 0.18 | 0.27 | 0.01 | 0.40 | 2.86 | 0.31 | 0.45 |
| C5 | 2.03 | 0.87 | 0.65 | 0.28 | 0.18 | 0.29 | 0.03 | 0.40 | 1.09 | 0.21 | 0.52 |
| C6 | 1.05 | 0.87 | 0.00 | 0.00 | 0.18 | 0.23 | 0.04 | 0.40 | 0.82 | 0.31 | 0.35 |
| C7 | 9.17 | 0.87 | 2.99 | 0.28 | 0.18 | 0.75 | 0.01 | 0.40 | 5.43 | 0.24 | 0.54 |
| C8 | 3.03 | 0.87 | 0.97 | 0.28 | 0.18 | 0.25 | 0.01 | 0.40 | 1.81 | 0.24 | 0.53 |
| C9 | 4.93 | 0.87 | 1.02 | 0.18 | 0.18 | 1.86 | 0.07 | 0.40 | 2.05 | 0.17 | 0.41 |
| D1 | 3.06 | 0.87 | 0.73 | 0.21 | 0.18 | 0.25 | 0.01 | 0.40 | 2.08 | 0.27 | 0.49 |
| D2 | 3.07 | 0.87 | 0.78 | 0.22 | 0.18 | 0.17 | 0.01 | 0.40 | 2.12 | 0.28 | 0.51 |
| D3 | 1.77 | 0.87 | 0.36 | 0.18 | 0.18 | 0.09 | 0.01 | 0.40 | 1.32 | 0.30 | 0.48 |
| D4 | 1.65 | 0.87 | 0.97 | 0.51 | 0.18 | 0.68 | 0.07 | 0.40 | 0.00 | 0.00 | 0.59 |
| D5 | 11.36 | 0.87 | 0.43 | 0.03 | 0.15 | 10.93 | 0.14 | 0.40 | 0.00 | 0.00 | 0.18 |
| OS1 | 21.79 | 0.87 | 0.60 | 0.02 | 0.18 | 0.00 | 0.00 | 0.30 | 21.19 | 0.29 | 0.32 |
| OS2 | 13.65 | 0.87 | 0.40 | 0.03 | 0.18 | 0.00 | 0.00 | 0.30 | 13.25 | 0.29 | 0.32 |
| OS3 | 0.14 | 0.87 | 0.09 | 0.56 | 0.10 | 0.05 | 0.04 | 0.40 | 0.00 | 0.00 | 0.60 |
| OS4 | 0.72 | 0.87 | 0.00 | 0.00 | 0.15 | 0.72 | 0.15 | 0.40 | 0.00 | 0.00 | 0.15 |
| OS5 | 1.69 | 0.87 | 0.00 | 0.00 | 0.15 | 1.15 | 0.10 | 0.40 | 0.54 | 0.13 | 0.23 |
| TOTAL | 242.63 | | | | | | | | | | 0.41 |

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: _____ Project Name: Trails at Overland Ranch
Location: Aurora Project No.: 16118.00
Calculated By: AAM
Checked By: _____
C-Value - 5-Year Date: 6/10/22

| Basin ID | Total Area (ac) | Paved Roads/Walks/Walls | | | Landscaping | | | Use (Commercial or Single Family Residential) | | | Basins Total Weighted $C_5$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $C_5$ | Area (ac) | Weighted $C_5$ | $C_5$ | Area (ac) | Weighted $C_5$ | $C_5$ | Area (ac) | Weighted $C_5$ | |
| A1 | 1.39 | 0.88 | 0.00 | 0.00 | 0.11 | 1.39 | 0.11 | 0.45 | 0.00 | 0.00 | 0.11 |
| A2 | 1.32 | 0.88 | 0.65 | 0.43 | 0.11 | 0.39 | 0.03 | 0.45 | 0.28 | 0.10 | 0.56 |
| A3 | 0.45 | 0.88 | 0.33 | 0.65 | 0.11 | 0.12 | 0.03 | 0.45 | 0.00 | 0.00 | 0.67 |
| A4 | 6.00 | 0.88 | 1.60 | 0.23 | 0.19 | 4.40 | 0.14 | 0.45 | 0.00 | 0.00 | 0.37 |
| A5 | 1.03 | 0.88 | 0.37 | 0.32 | 0.11 | 0.66 | 0.07 | 0.45 | 0.00 | 0.00 | 0.39 |
| A6 | 1.09 | 0.88 | 0.14 | 0.11 | 0.11 | 0.95 | 0.10 | 0.45 | 0.00 | 0.00 | 0.21 |
| B1 | 1.36 | 0.88 | 1.03 | 0.67 | 0.19 | 0.33 | 0.05 | 0.45 | 0.00 | 0.00 | 0.71 |
| B2 | 1.54 | 0.88 | 1.16 | 0.66 | 0.19 | 0.38 | 0.05 | 0.45 | 0.00 | 0.00 | 0.71 |
| B3 | 8.43 | 0.88 | 0.00 | 0.00 | 0.19 | 6.42 | 0.14 | 0.45 | 2.01 | 0.11 | 0.25 |
| B4 | 2.30 | 0.88 | 0.78 | 0.30 | 0.19 | 0.30 | 0.02 | 0.45 | 1.22 | 0.24 | 0.56 |
| B5 | 1.50 | 0.88 | 0.60 | 0.35 | 0.19 | 0.32 | 0.04 | 0.45 | 0.58 | 0.17 | 0.57 |
| B6 | 1.46 | 0.88 | 0.40 | 0.24 | 0.19 | 0.10 | 0.01 | 0.45 | 0.96 | 0.30 | 0.55 |
| B7 | 2.66 | 0.88 | 0.60 | 0.20 | 0.19 | 0.15 | 0.01 | 0.45 | 1.91 | 0.32 | 0.53 |
| B8 | 1.76 | 0.88 | 0.46 | 0.23 | 0.19 | 0.11 | 0.01 | 0.45 | 1.19 | 0.30 | 0.55 |
| B9 | 1.53 | 0.88 | 0.35 | 0.20 | 0.19 | 0.09 | 0.01 | 0.45 | 1.09 | 0.32 | 0.53 |
| B10 | 2.40 | 0.88 | 0.61 | 0.22 | 0.19 | 0.15 | 0.01 | 0.45 | 1.64 | 0.31 | 0.54 |
| B11 | 0.44 | 0.88 | 0.15 | 0.30 | 0.19 | 0.04 | 0.02 | 0.45 | 0.25 | 0.26 | 0.57 |
| B12 | 0.48 | 0.88 | 0.26 | 0.48 | 0.19 | 0.06 | 0.02 | 0.45 | 0.16 | 0.15 | 0.65 |
| B13 | 2.33 | 0.88 | 0.22 | 0.08 | 0.19 | 0.81 | 0.07 | 0.45 | 1.30 | 0.25 | 0.40 |
| B14 | 1.54 | 0.88 | 1.23 | 0.70 | 0.19 | 0.31 | 0.04 | 0.45 | 0.00 | 0.00 | 0.74 |
| B15 | 2.20 | 0.88 | 0.00 | 0.00 | 0.19 | 2.20 | 0.19 | 0.45 | 0.00 | 0.00 | 0.19 |
| B16 | 0.66 | 0.88 | 0.34 | 0.45 | 0.19 | 0.09 | 0.03 | 0.45 | 0.23 | 0.16 | 0.64 |
| B17 | 0.37 | 0.88 | 0.30 | 0.71 | 0.19 | 0.07 | 0.04 | 0.45 | 0.00 | 0.00 | 0.75 |
| B18 | 1.97 | 0.88 | 0.36 | 0.16 | 0.19 | 0.13 | 0.01 | 0.45 | 1.48 | 0.34 | 0.51 |
| B19 | 1.28 | 0.88 | 0.37 | 0.25 | 0.19 | 0.09 | 0.01 | 0.45 | 0.82 | 0.29 | 0.56 |
| B20 | 0.66 | 0.88 | 0.26 | 0.35 | 0.19 | 0.07 | 0.02 | 0.45 | 0.33 | 0.23 | 0.59 |
| B21 | 2.61 | 0.88 | 0.42 | 0.14 | 0.19 | 0.11 | 0.01 | 0.45 | 2.08 | 0.36 | 0.51 |
| B22 | 1.45 | 0.88 | 0.45 | 0.27 | 0.19 | 0.12 | 0.02 | 0.45 | 0.88 | 0.27 | 0.56 |

**TABLE 1**
**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Business: | | | | | |
| Commercial Areas | 95 | .87 | .87 | .88 | .89 |
| Neighborhood Areas | 85 | .60 | .65 | .70 | .80 |
| Residential: | | | | | |
| Single-Family (**) | (*) | .40 | .45 | .50 | .60 |
| Multi-Unit (detached) | 60 | .45 | .50 | .60 | .70 |
| Multi-Unit (attached) | 75 | .60 | .65 | .70 | .80 |
| 1/2 Acre Lot or Larger | (*) | .30 | .35 | .40 | .60 |
| Apartments | 80 | .65 | .70 | .70 | .80 |
| Industrial: | | | | | |
| Light Areas | 80 | .71 | .72 | .76 | .82 |
| Heavy Areas | 90 | .80 | .80 | .85 | .90 |
| Parks, Cemeteries | 5 | .10 | .10 | .35 | .60 |
| Playgrounds | 10 | .15 | .25 | .35 | .65 |
| Schools | 50 | .45 | .50 | .60 | .70 |
| Railroad Yard Areas | 15 | .40 | .45 | .50 | .60 |
| Undeveloped Areas: | | | | | |
| Historic Flow Analysis, Greenbelts, Agricultural | 2 | (See "Lawns") | | | |
| Off-Site Flow Analysis (when land use not defined) | 45 | .43 | .47 | .55 | .65 |

**TABLE 1** (continued)

**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Streets: | | | | | |
| Paved | 100 | .87 | .88 | .90 | .93 |
| Gravel | 40 | .15 | .25 | .35 | .65 |
| *Concrete* Drive and Walks | 96 | .87 | .87 | .88 | .89 |
| Roofs | 90 | .80 | .85 | .90 | .90 |
| Lawns, Sandy Soil (A and B Soils): | 2 | | | | |
| 2% Slope | | .05 | .06 | .08 | .10 |
| 2-7% Slope | | .10 | .11 | .13 | .15 |
| >7% Slope | | .15 | .16 | .18 | .20 |
| Lawns, Clay Soil (C and D Soils): | 5 | | | | |
| 2% Slope | | .13 | .14 | .15 | .17 |
| 2-7% Slope | | .18 | .19 | .20 | .22 |
| >7% Slope | | .25 | .27 | .30 | .35 |

NOTE: These Rational Formula coefficients may not be valid for large basins

(*)See Figures *RO-3 through RO-5* of USDCM Volume 1 for percent impervious.

(**)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B23 | 22.95 | 0.88 | 0.00 | 0.00 | 0.27 | 17.55 | 0.21 | 0.45 | 5.40 | 0.11 | 0.31 |
| B24 | 3.41 | 0.88 | 0.54 | 0.14 | 0.19 | 0.30 | 0.02 | 0.45 | 2.57 | 0.34 | 0.50 |
| B25 | 2.35 | 0.88 | 0.53 | 0.20 | 0.19 | 0.25 | 0.02 | 0.45 | 1.57 | 0.30 | 0.52 |
| B26 | 3.57 | 0.88 | 0.65 | 0.16 | 0.19 | 0.34 | 0.02 | 0.45 | 2.58 | 0.33 | 0.50 |
| B27 | 1.47 | 0.88 | 0.54 | 0.32 | 0.19 | 0.13 | 0.02 | 0.45 | 0.80 | 0.24 | 0.58 |
| B28 | 1.62 | 0.88 | 0.38 | 0.21 | 0.19 | 0.09 | 0.01 | 0.45 | 1.15 | 0.32 | 0.54 |
| B29 | 1.19 | 0.88 | 0.25 | 0.18 | 0.19 | 0.06 | 0.01 | 0.45 | 0.88 | 0.33 | 0.53 |
| B30 | 2.80 | 0.88 | 0.53 | 0.17 | 0.19 | 0.62 | 0.04 | 0.45 | 1.65 | 0.27 | 0.47 |
| B31 | 1.87 | 0.88 | 0.35 | 0.16 | 0.19 | 0.09 | 0.01 | 0.45 | 1.43 | 0.34 | 0.52 |
| B32 | 0.20 | 0.88 | 0.14 | 0.62 | 0.19 | 0.03 | 0.03 | 0.45 | 0.03 | 0.07 | 0.71 |
| B33 | 0.21 | 0.88 | 0.14 | 0.59 | 0.19 | 0.04 | 0.04 | 0.45 | 0.03 | 0.06 | 0.69 |
| B33A | 0.41 | 0.88 | 0.19 | 0.41 | 0.19 | 0.22 | 0.10 | 0.45 | 0.00 | 0.00 | 0.51 |
| B33B | 0.21 | 0.88 | 0.14 | 0.59 | 0.19 | 0.07 | 0.06 | 0.45 | 0.00 | 0.00 | 0.65 |
| B34 | 1.53 | 0.88 | 0.22 | 0.13 | 0.19 | 0.11 | 0.01 | 0.45 | 1.20 | 0.35 | 0.49 |
| B35 | 0.98 | 0.88 | 0.35 | 0.31 | 0.19 | 0.09 | 0.02 | 0.45 | 0.54 | 0.25 | 0.58 |
| B36 | 1.24 | 0.88 | 0.34 | 0.24 | 0.19 | 0.08 | 0.01 | 0.45 | 0.82 | 0.30 | 0.55 |
| B37 | 1.74 | 0.88 | 0.39 | 0.20 | 0.19 | 0.18 | 0.02 | 0.45 | 1.17 | 0.30 | 0.52 |
| B38 | 1.12 | 0.88 | 0.50 | 0.39 | 0.19 | 0.51 | 0.09 | 0.45 | 0.11 | 0.04 | 0.52 |
| B39 | 0.78 | 0.88 | 0.40 | 0.45 | 0.19 | 0.38 | 0.09 | 0.45 | 0.00 | 0.00 | 0.54 |
| B39A | 0.23 | 0.88 | 0.14 | 0.54 | 0.19 | 0.09 | 0.07 | 0.45 | 0.00 | 0.00 | 0.61 |
| B39B | 0.26 | 0.88 | 0.21 | 0.71 | 0.19 | 0.05 | 0.04 | 0.45 | 0.00 | 0.00 | 0.75 |
| B40 | 1.94 | 0.88 | 0.53 | 0.24 | 0.19 | 0.13 | 0.01 | 0.45 | 1.28 | 0.30 | 0.55 |
| B41 | 0.80 | 0.88 | 0.26 | 0.29 | 0.19 | 0.06 | 0.01 | 0.45 | 0.48 | 0.27 | 0.57 |
| B42 | 2.98 | 0.88 | 0.66 | 0.19 | 0.19 | 0.17 | 0.01 | 0.45 | 2.15 | 0.32 | 0.53 |
| B43 | 1.40 | 0.88 | 0.51 | 0.32 | 0.19 | 0.13 | 0.02 | 0.45 | 0.76 | 0.24 | 0.58 |
| B44 | 0.22 | 0.88 | 0.16 | 0.64 | 0.19 | 0.04 | 0.03 | 0.45 | 0.02 | 0.04 | 0.72 |
| B45 | 2.01 | 0.88 | 0.27 | 0.12 | 0.19 | 0.07 | 0.01 | 0.45 | 1.67 | 0.37 | 0.50 |
| B46 | 1.56 | 0.88 | 0.57 | 0.32 | 0.19 | 0.12 | 0.01 | 0.45 | 0.87 | 0.25 | 0.59 |
| B47 | 2.80 | 0.88 | 0.40 | 0.13 | 0.19 | 0.10 | 0.01 | 0.45 | 2.30 | 0.37 | 0.50 |
| B48 | 1.29 | 0.88 | 0.47 | 0.32 | 0.19 | 0.10 | 0.01 | 0.45 | 0.72 | 0.25 | 0.59 |
| B49 | 6.16 | 0.88 | 0.00 | 0.00 | 0.19 | 6.16 | 0.19 | 0.45 | 0.00 | 0.00 | 0.19 |
| B50 | 0.46 | 0.88 | 0.37 | 0.71 | 0.19 | 0.09 | 0.04 | 0.45 | 0.00 | 0.00 | 0.75 |
| B51 | 0.85 | 0.88 | 0.68 | 0.70 | 0.19 | 0.17 | 0.04 | 0.45 | 0.00 | 0.00 | 0.74 |
| B52 | 0.96 | 0.88 | 0.32 | 0.29 | 0.19 | 0.08 | 0.02 | 0.45 | 0.56 | 0.26 | 0.57 |
| B53 | 1.33 | 0.88 | 0.40 | 0.26 | 0.19 | 0.10 | 0.01 | 0.45 | 0.83 | 0.28 | 0.56 |
| B54 | 0.56 | 0.88 | 0.18 | 0.28 | 0.19 | 0.04 | 0.01 | 0.45 | 0.34 | 0.27 | 0.57 |
| B55 | 3.16 | 0.88 | 0.71 | 0.20 | 0.19 | 0.23 | 0.01 | 0.45 | 2.22 | 0.32 | 0.53 |
| B56 | 1.09 | 0.88 | 0.34 | 0.27 | 0.19 | 0.08 | 0.01 | 0.45 | 0.67 | 0.28 | 0.57 |
| B57 | 0.79 | 0.88 | 0.26 | 0.29 | 0.19 | 0.06 | 0.01 | 0.45 | 0.47 | 0.27 | 0.57 |
| B58 | 2.16 | 0.88 | 0.98 | 0.40 | 0.19 | 0.27 | 0.02 | 0.45 | 0.91 | 0.19 | 0.61 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B58A | 0.98 | 0.88 | 0.00 | 0.00 | 0.11 | 0.28 | 0.03 | 0.45 | 0.70 | 0.32 | 0.35 |
| B59 | 3.96 | 0.88 | 0.69 | 0.15 | 0.19 | 0.36 | 0.02 | 0.45 | 2.91 | 0.33 | 0.50 |
| B61 | 2.43 | 0.88 | 0.00 | 0.00 | 0.19 | 0.00 | 0.00 | 0.65 | 2.43 | 0.65 | 0.65 |
| B62 | 12.96 | 0.88 | 3.57 | 0.24 | 0.19 | 7.61 | 0.11 | 0.45 | 1.78 | 0.06 | 0.42 |
| C1 | 1.51 | 0.88 | 0.17 | 0.10 | 0.19 | 0.37 | 0.05 | 0.45 | 0.97 | 0.29 | 0.43 |
| C2 | 1.39 | 0.88 | 0.45 | 0.28 | 0.19 | 0.15 | 0.02 | 0.45 | 0.79 | 0.26 | 0.56 |
| C3 | 1.74 | 0.88 | 0.26 | 0.13 | 0.19 | 0.07 | 0.01 | 0.45 | 1.41 | 0.36 | 0.50 |
| C4 | 3.68 | 0.88 | 0.55 | 0.13 | 0.19 | 0.27 | 0.01 | 0.45 | 2.86 | 0.35 | 0.50 |
| C5 | 2.03 | 0.88 | 0.65 | 0.28 | 0.19 | 0.29 | 0.03 | 0.45 | 1.09 | 0.24 | 0.55 |
| C6 | 1.05 | 0.88 | 0.00 | 0.00 | 0.19 | 0.23 | 0.04 | 0.45 | 0.82 | 0.35 | 0.39 |
| C7 | 9.17 | 0.88 | 2.99 | 0.29 | 0.19 | 0.75 | 0.02 | 0.45 | 5.43 | 0.27 | 0.57 |
| C8 | 3.03 | 0.88 | 0.97 | 0.28 | 0.19 | 0.25 | 0.02 | 0.45 | 1.81 | 0.27 | 0.57 |
| C9 | 4.93 | 0.88 | 1.02 | 0.18 | 0.19 | 1.86 | 0.07 | 0.45 | 2.05 | 0.19 | 0.44 |
| D1 | 3.06 | 0.88 | 0.73 | 0.21 | 0.19 | 0.25 | 0.02 | 0.45 | 2.08 | 0.31 | 0.53 |
| D2 | 3.07 | 0.88 | 0.78 | 0.22 | 0.19 | 0.17 | 0.01 | 0.45 | 2.12 | 0.31 | 0.54 |
| D3 | 1.77 | 0.88 | 0.36 | 0.18 | 0.19 | 0.09 | 0.01 | 0.45 | 1.32 | 0.34 | 0.52 |
| D4 | 1.65 | 0.88 | 0.97 | 0.52 | 0.19 | 0.68 | 0.08 | 0.45 | 0.00 | 0.00 | 0.60 |
| D5 | 11.36 | 0.88 | 0.43 | 0.03 | 0.16 | 10.93 | 0.15 | 0.45 | 0.00 | 0.00 | 0.19 |
| OS1 | 21.79 | 0.88 | 0.60 | 0.02 | 0.19 | 0.00 | 0.00 | 0.35 | 21.19 | 0.34 | 0.36 |
| OS2 | 13.65 | 0.88 | 0.40 | 0.03 | 0.19 | 0.00 | 0.00 | 0.35 | 13.25 | 0.34 | 0.37 |
| OS3 | 0.14 | 0.88 | 0.09 | 0.57 | 0.11 | 0.05 | 0.04 | 0.45 | 0.00 | 0.00 | 0.61 |
| OS4 | 0.72 | 0.88 | 0.00 | 0.00 | 0.16 | 0.72 | 0.16 | 0.45 | 0.00 | 0.00 | 0.16 |
| OS5 | 1.69 | 0.88 | 0.00 | 0.00 | 0.16 | 1.15 | 0.11 | 0.45 | 0.54 | 0.14 | 0.25 |
| | | | | | | | | | | | |
| TOTAL | 242.63 | | | | | | | | | | 0.44 |

# COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: _____ Project Name: Trails at Overland Ranch
Location: Aurora Project No.: 16118.00
Calculated By: AAM
Checked By: _____
C-Value - 100-Year Date: 6/10/22

| Basin ID | Total Area (ac) | Paved Roads/Walks/Walls | | | Landscaping | | | Use (Commercial or Single Family Residential) | | | Basins Total Weighted $C_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $C_{100}$ | Area (ac) | Weighted $C_{100}$ | $C_{100}$ | Area (ac) | Weighted $C_{100}$ | $C_{100}$ | Area (ac) | Weighted $C_{100}$ | |
| A1 | 1.39 | 0.93 | 0.00 | 0.00 | 0.15 | 1.39 | 0.15 | 0.60 | 0.00 | 0.00 | 0.15 |
| A2 | 1.32 | 0.93 | 0.65 | 0.46 | 0.15 | 0.39 | 0.04 | 0.60 | 0.28 | 0.13 | 0.63 |
| A3 | 0.45 | 0.93 | 0.33 | 0.68 | 0.15 | 0.12 | 0.04 | 0.60 | 0.00 | 0.00 | 0.72 |
| A4 | 6.00 | 0.93 | 1.60 | 0.25 | 0.22 | 4.40 | 0.16 | 0.60 | 0.00 | 0.00 | 0.41 |
| A5 | 1.03 | 0.93 | 0.37 | 0.33 | 0.15 | 0.66 | 0.10 | 0.60 | 0.00 | 0.00 | 0.43 |
| A6 | 1.09 | 0.93 | 0.14 | 0.12 | 0.20 | 0.95 | 0.17 | 0.60 | 0.00 | 0.00 | 0.29 |
| B1 | 1.36 | 0.93 | 1.03 | 0.70 | 0.22 | 0.33 | 0.05 | 0.60 | 0.00 | 0.00 | 0.76 |
| B2 | 1.54 | 0.93 | 1.16 | 0.70 | 0.22 | 0.38 | 0.05 | 0.60 | 0.00 | 0.00 | 0.75 |
| B3 | 8.43 | 0.93 | 0.00 | 0.00 | 0.22 | 6.42 | 0.17 | 0.60 | 2.01 | 0.14 | 0.31 |
| B4 | 2.30 | 0.93 | 0.78 | 0.32 | 0.22 | 0.30 | 0.03 | 0.60 | 1.22 | 0.32 | 0.66 |
| B5 | 1.50 | 0.93 | 0.60 | 0.37 | 0.22 | 0.32 | 0.05 | 0.60 | 0.58 | 0.23 | 0.65 |
| B6 | 1.46 | 0.93 | 0.40 | 0.25 | 0.22 | 0.10 | 0.02 | 0.60 | 0.96 | 0.39 | 0.66 |
| B7 | 2.66 | 0.93 | 0.60 | 0.21 | 0.22 | 0.15 | 0.01 | 0.60 | 1.91 | 0.43 | 0.65 |
| B8 | 1.76 | 0.93 | 0.46 | 0.24 | 0.22 | 0.11 | 0.01 | 0.60 | 1.19 | 0.41 | 0.66 |
| B9 | 1.53 | 0.93 | 0.35 | 0.21 | 0.22 | 0.09 | 0.01 | 0.60 | 1.09 | 0.43 | 0.65 |
| B10 | 2.40 | 0.93 | 0.61 | 0.24 | 0.22 | 0.15 | 0.01 | 0.60 | 1.64 | 0.41 | 0.66 |
| B11 | 0.44 | 0.93 | 0.15 | 0.32 | 0.22 | 0.04 | 0.02 | 0.60 | 0.25 | 0.34 | 0.68 |
| B12 | 0.48 | 0.93 | 0.26 | 0.50 | 0.22 | 0.06 | 0.03 | 0.60 | 0.16 | 0.20 | 0.73 |
| B13 | 2.33 | 0.93 | 0.22 | 0.09 | 0.22 | 0.81 | 0.08 | 0.60 | 1.30 | 0.33 | 0.50 |
| B14 | 1.54 | 0.93 | 1.23 | 0.74 | 0.22 | 0.31 | 0.04 | 0.60 | 0.00 | 0.00 | 0.79 |
| B15 | 2.20 | 0.93 | 0.00 | 0.00 | 0.22 | 2.20 | 0.22 | 0.60 | 0.00 | 0.00 | 0.22 |
| B16 | 0.66 | 0.93 | 0.34 | 0.48 | 0.22 | 0.09 | 0.03 | 0.60 | 0.23 | 0.21 | 0.72 |
| B17 | 0.37 | 0.93 | 0.30 | 0.75 | 0.22 | 0.07 | 0.04 | 0.60 | 0.00 | 0.00 | 0.80 |
| B18 | 1.97 | 0.93 | 0.36 | 0.17 | 0.22 | 0.13 | 0.01 | 0.60 | 1.48 | 0.45 | 0.64 |
| B19 | 1.28 | 0.93 | 0.37 | 0.27 | 0.22 | 0.09 | 0.02 | 0.60 | 0.82 | 0.38 | 0.67 |
| B20 | 0.66 | 0.93 | 0.26 | 0.37 | 0.22 | 0.07 | 0.02 | 0.60 | 0.33 | 0.30 | 0.69 |
| B21 | 2.61 | 0.93 | 0.42 | 0.15 | 0.22 | 0.11 | 0.01 | 0.60 | 2.08 | 0.48 | 0.64 |
| B22 | 1.45 | 0.93 | 0.45 | 0.29 | 0.22 | 0.12 | 0.02 | 0.60 | 0.88 | 0.36 | 0.67 |

**TABLE 1**
**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Business: | | | | | |
| Commercial Areas | 95 | .87 | .87 | .88 | .89 |
| Neighborhood Areas | 85 | .60 | .65 | .70 | .80 |
| Residential: | | | | | |
| Single-Family (**) | (*) | .40 | .45 | .50 | .60 |
| Multi-Unit (detached) | 60 | .45 | .50 | .60 | .70 |
| Multi-Unit (attached) | 75 | .60 | .65 | .70 | .80 |
| 1/2 Acre Lot or Larger | (*) | .30 | .35 | .40 | .60 |
| Apartments | 80 | .65 | .70 | .70 | .80 |
| Industrial: | | | | | |
| Light Areas | 80 | .71 | .72 | .76 | .82 |
| Heavy Areas | 90 | .80 | .80 | .85 | .90 |
| Parks, Cemeteries | 5 | .10 | .10 | .35 | .60 |
| Playgrounds | 10 | .15 | .25 | .35 | .65 |
| Schools | 50 | .45 | .50 | .60 | .70 |
| Railroad Yard Areas | 15 | .40 | .45 | .50 | .60 |
| Undeveloped Areas: | | | | | |
| Historic Flow Analysis, Greenbelts, Agricultural | 2 | (See "Lawns") | | | |
| Off-Site Flow Analysis (when land use not defined) | 45 | .43 | .47 | .55 | .65 |

**TABLE 1** (continued)

**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

| LAND USE OR SURFACE CHARACTERISTICS | PERCENT IMPERVIOUS | FREQUENCY | | | |
|---|---|---|---|---|---|
| | | 2 | 5 | 10 | 100 |
| Streets: | | | | | |
| Paved | 100 | .87 | .88 | .90 | .93 |
| Gravel | 40 | .15 | .25 | .35 | .65 |
| *Concrete* Drive and Walks | 96 | .87 | .87 | .88 | .89 |
| Roofs | 90 | .80 | .85 | .90 | .90 |
| Lawns, Sandy Soil (A and B Soils): | 2 | | | | |
| 2% Slope | | .05 | .06 | .08 | .10 |
| 2-7% Slope | | .10 | .11 | .13 | .15 |
| >7% Slope | | .15 | .16 | .18 | .20 |
| Lawns, Clay Soil (C and D Soils): | 5 | | | | |
| 2% Slope | | .13 | .14 | .15 | .17 |
| 2-7% Slope | | .18 | .19 | .20 | .22 |
| >7% Slope | | .25 | .27 | .30 | .35 |

NOTE: These Rational Formula coefficients may not be valid for large basins

(*)See Figures *RO-3 through RO-5* of USDCM Volume 1 for percent impervious.

(**)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B23 | 22.95 | 0.93 | 0.00 | 0.00 | 0.35 | 17.55 | 0.27 | 0.60 | 5.40 | 0.14 | 0.41 |
| B24 | 3.41 | 0.93 | 0.54 | 0.15 | 0.22 | 0.30 | 0.02 | 0.60 | 2.57 | 0.45 | 0.62 |
| B25 | 2.35 | 0.93 | 0.53 | 0.21 | 0.22 | 0.25 | 0.02 | 0.60 | 1.57 | 0.40 | 0.63 |
| B26 | 3.57 | 0.93 | 0.65 | 0.17 | 0.22 | 0.34 | 0.02 | 0.60 | 2.58 | 0.43 | 0.62 |
| B27 | 1.47 | 0.93 | 0.54 | 0.34 | 0.22 | 0.13 | 0.02 | 0.60 | 0.80 | 0.33 | 0.69 |
| B28 | 1.62 | 0.93 | 0.38 | 0.22 | 0.22 | 0.09 | 0.01 | 0.60 | 1.15 | 0.43 | 0.66 |
| B29 | 1.19 | 0.93 | 0.25 | 0.20 | 0.22 | 0.06 | 0.01 | 0.60 | 0.88 | 0.44 | 0.65 |
| B30 | 2.80 | 0.93 | 0.53 | 0.18 | 0.22 | 0.62 | 0.05 | 0.60 | 1.65 | 0.35 | 0.58 |
| B31 | 1.87 | 0.93 | 0.35 | 0.17 | 0.22 | 0.09 | 0.01 | 0.60 | 1.43 | 0.46 | 0.64 |
| B32 | 0.20 | 0.93 | 0.14 | 0.65 | 0.22 | 0.03 | 0.03 | 0.60 | 0.03 | 0.09 | 0.77 |
| B33 | 0.21 | 0.93 | 0.14 | 0.62 | 0.22 | 0.04 | 0.04 | 0.60 | 0.03 | 0.09 | 0.75 |
| B33A | 0.41 | 0.93 | 0.19 | 0.43 | 0.22 | 0.22 | 0.12 | 0.60 | 0.00 | 0.00 | 0.55 |
| B33B | 0.21 | 0.93 | 0.14 | 0.62 | 0.22 | 0.07 | 0.07 | 0.60 | 0.00 | 0.00 | 0.69 |
| B34 | 1.53 | 0.93 | 0.22 | 0.13 | 0.22 | 0.11 | 0.02 | 0.60 | 1.20 | 0.47 | 0.62 |
| B35 | 0.98 | 0.93 | 0.35 | 0.33 | 0.22 | 0.09 | 0.02 | 0.60 | 0.54 | 0.33 | 0.68 |
| B36 | 1.24 | 0.93 | 0.34 | 0.26 | 0.22 | 0.08 | 0.01 | 0.60 | 0.82 | 0.40 | 0.67 |
| B37 | 1.74 | 0.93 | 0.39 | 0.21 | 0.22 | 0.18 | 0.02 | 0.60 | 1.17 | 0.40 | 0.63 |
| B38 | 1.12 | 0.93 | 0.50 | 0.42 | 0.22 | 0.51 | 0.10 | 0.60 | 0.11 | 0.06 | 0.57 |
| B39 | 0.78 | 0.93 | 0.40 | 0.48 | 0.22 | 0.38 | 0.11 | 0.60 | 0.00 | 0.00 | 0.58 |
| B39A | 0.23 | 0.93 | 0.14 | 0.57 | 0.22 | 0.09 | 0.09 | 0.60 | 0.00 | 0.00 | 0.65 |
| B39B | 0.26 | 0.93 | 0.21 | 0.75 | 0.22 | 0.05 | 0.04 | 0.60 | 0.00 | 0.00 | 0.79 |
| B40 | 1.94 | 0.93 | 0.53 | 0.25 | 0.22 | 0.13 | 0.01 | 0.60 | 1.28 | 0.40 | 0.66 |
| B41 | 0.80 | 0.93 | 0.26 | 0.30 | 0.22 | 0.06 | 0.02 | 0.60 | 0.48 | 0.36 | 0.68 |
| B42 | 2.98 | 0.93 | 0.66 | 0.21 | 0.22 | 0.17 | 0.01 | 0.60 | 2.15 | 0.43 | 0.65 |
| B43 | 1.40 | 0.93 | 0.51 | 0.34 | 0.22 | 0.13 | 0.02 | 0.60 | 0.76 | 0.33 | 0.68 |
| B44 | 0.22 | 0.93 | 0.16 | 0.68 | 0.22 | 0.04 | 0.04 | 0.60 | 0.02 | 0.05 | 0.77 |
| B45 | 2.01 | 0.93 | 0.27 | 0.12 | 0.22 | 0.07 | 0.01 | 0.60 | 1.67 | 0.50 | 0.63 |
| B46 | 1.56 | 0.93 | 0.57 | 0.34 | 0.22 | 0.12 | 0.02 | 0.60 | 0.87 | 0.33 | 0.69 |
| B47 | 2.80 | 0.93 | 0.40 | 0.13 | 0.22 | 0.10 | 0.01 | 0.60 | 2.30 | 0.49 | 0.63 |
| B48 | 1.29 | 0.93 | 0.47 | 0.34 | 0.22 | 0.10 | 0.02 | 0.60 | 0.72 | 0.33 | 0.69 |
| B49 | 6.16 | 0.93 | 0.00 | 0.00 | 0.22 | 6.16 | 0.22 | 0.60 | 0.00 | 0.00 | 0.22 |
| B50 | 0.46 | 0.93 | 0.37 | 0.75 | 0.22 | 0.09 | 0.04 | 0.60 | 0.00 | 0.00 | 0.79 |
| B51 | 0.85 | 0.93 | 0.68 | 0.74 | 0.22 | 0.17 | 0.04 | 0.60 | 0.00 | 0.00 | 0.79 |
| B52 | 0.96 | 0.93 | 0.32 | 0.31 | 0.22 | 0.08 | 0.02 | 0.60 | 0.56 | 0.35 | 0.68 |
| B53 | 1.33 | 0.93 | 0.40 | 0.28 | 0.22 | 0.10 | 0.02 | 0.60 | 0.83 | 0.37 | 0.67 |
| B54 | 0.56 | 0.93 | 0.18 | 0.30 | 0.22 | 0.04 | 0.02 | 0.60 | 0.34 | 0.36 | 0.68 |
| B55 | 3.16 | 0.93 | 0.71 | 0.21 | 0.22 | 0.23 | 0.02 | 0.60 | 2.22 | 0.42 | 0.65 |
| B56 | 1.09 | 0.93 | 0.34 | 0.29 | 0.22 | 0.08 | 0.02 | 0.60 | 0.67 | 0.37 | 0.68 |
| B57 | 0.79 | 0.93 | 0.26 | 0.31 | 0.22 | 0.06 | 0.02 | 0.60 | 0.47 | 0.36 | 0.68 |
| B58 | 2.16 | 0.93 | 0.98 | 0.42 | 0.22 | 0.27 | 0.03 | 0.60 | 0.91 | 0.25 | 0.70 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B58A | 0.98 | 0.93 | 0.00 | 0.00 | 0.15 | 0.28 | 0.04 | 0.60 | 0.70 | 0.43 | 0.47 |
| B59 | 3.96 | 0.93 | 0.69 | 0.16 | 0.22 | 0.36 | 0.02 | 0.60 | 2.91 | 0.44 | 0.62 |
| B61 | 2.43 | 0.93 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.80 | 2.43 | 0.80 | 0.80 |
| B62 | 12.96 | 0.93 | 3.57 | 0.26 | 0.22 | 7.61 | 0.13 | 0.60 | 1.78 | 0.08 | 0.47 |
| C1 | 1.51 | 0.93 | 0.17 | 0.10 | 0.15 | 0.37 | 0.04 | 0.60 | 0.97 | 0.39 | 0.53 |
| C2 | 1.39 | 0.93 | 0.45 | 0.30 | 0.22 | 0.15 | 0.02 | 0.60 | 0.79 | 0.34 | 0.67 |
| C3 | 1.74 | 0.93 | 0.26 | 0.14 | 0.22 | 0.07 | 0.01 | 0.60 | 1.41 | 0.49 | 0.63 |
| C4 | 3.68 | 0.93 | 0.55 | 0.14 | 0.22 | 0.27 | 0.02 | 0.60 | 2.86 | 0.47 | 0.62 |
| C5 | 2.03 | 0.93 | 0.65 | 0.30 | 0.22 | 0.29 | 0.03 | 0.60 | 1.09 | 0.32 | 0.65 |
| C6 | 1.05 | 0.93 | 0.00 | 0.00 | 0.22 | 0.23 | 0.05 | 0.60 | 0.82 | 0.47 | 0.52 |
| C7 | 9.17 | 0.93 | 2.99 | 0.30 | 0.22 | 0.75 | 0.02 | 0.60 | 5.43 | 0.36 | 0.68 |
| C8 | 3.03 | 0.93 | 0.97 | 0.30 | 0.15 | 0.25 | 0.01 | 0.60 | 1.81 | 0.36 | 0.67 |
| C9 | 4.93 | 0.93 | 1.02 | 0.19 | 0.20 | 1.86 | 0.08 | 0.60 | 2.05 | 0.25 | 0.52 |
| D1 | 3.06 | 0.93 | 0.73 | 0.22 | 0.22 | 0.25 | 0.02 | 0.60 | 2.08 | 0.41 | 0.65 |
| D2 | 3.07 | 0.93 | 0.78 | 0.24 | 0.22 | 0.17 | 0.01 | 0.60 | 2.12 | 0.41 | 0.66 |
| D3 | 1.77 | 0.93 | 0.36 | 0.19 | 0.22 | 0.09 | 0.01 | 0.60 | 1.32 | 0.45 | 0.65 |
| D4 | 1.65 | 0.93 | 0.97 | 0.55 | 0.22 | 0.68 | 0.09 | 0.60 | 0.00 | 0.00 | 0.64 |
| D5 | 11.36 | 0.93 | 0.43 | 0.04 | 0.20 | 10.93 | 0.19 | 0.60 | 0.00 | 0.00 | 0.23 |
| OS1 | 21.79 | 0.93 | 0.60 | 0.03 | 0.22 | 0.00 | 0.00 | 0.60 | 21.19 | 0.58 | 0.61 |
| OS2 | 13.65 | 0.93 | 0.40 | 0.03 | 0.22 | 0.00 | 0.00 | 0.60 | 13.25 | 0.58 | 0.61 |
| OS3 | 0.14 | 0.93 | 0.09 | 0.60 | 0.15 | 0.05 | 0.05 | 0.60 | 0.00 | 0.00 | 0.65 |
| OS4 | 0.72 | 0.93 | 0.00 | 0.00 | 0.20 | 0.72 | 0.20 | 0.60 | 0.00 | 0.00 | 0.20 |
| OS5 | 1.69 | 0.93 | 0.00 | 0.00 | 0.20 | 1.15 | 0.14 | 0.60 | 0.54 | 0.19 | 0.33 |
| | | | | | | | | | | | |
| TOTAL | 242.63 | | | | | | | | | | 0.55 |

# STANDARD FORM SF-2
# TIME OF CONCENTRATION

Subdivision: _____ Project Name: Trails at Overland Ranch
Location: Aurora Project No.: 16118.00
Calculated By: AAM
Checked By: _____
Date: 6/10/22

| SUB-BASIN DATA | | | | | | | INITIAL/OVERLAND ($T_i$) | | | TRAVEL TIME ($T_t$) | | | | | *tc* CHECK (URBANIZED BASINS) | | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN | D.A. | Hydrologic | Impervious | $C_2$ | $C_5$ | $C_{100}$ | $L$ | $S_o$ | $t_i$ | $L_t$ | $S_t$ | $K$ | VEL. (ft/s) | $t_t$ (min) | COMP. $t_c$ (min) | TOTAL LENGTH (ft) | Urbanized $t_c$ (min) | $t_c$ (min) |
| A1 | 1.39 | B | 2.0% | 0.10 | 0.11 | 0.15 | 116.00 | 2.5% | 14.2 | 345.00 | 4.3% | 15.00 | 3.1 | 1.8 | 16.1 | 461.00 | 12.6 | 12.6 |
| A2 | 1.32 | B | 60.3% | 0.54 | 0.56 | 0.63 | 102.00 | 3.3% | 6.6 | 189.00 | 1.9% | 20.00 | 2.8 | 1.1 | 7.8 | 291.00 | 11.6 | 7.8 |
| A3 | 0.45 | B | 74.7% | 0.66 | 0.67 | 0.72 | 62.00 | 2.0% | 4.8 | 126.00 | 1.9% | 20.00 | 2.8 | 0.8 | 5.6 | 188.00 | 11.0 | 5.6 |
| A4 | 6.00 | C | 30.3% | 0.36 | 0.37 | 0.41 | 165.00 | 2.0% | 13.4 | 1332.00 | 3.2% | 20.00 | 3.6 | 6.2 | 19.6 | 1497.00 | 18.3 | 18.3 |
| A5 | 1.03 | B | 37.2% | 0.38 | 0.39 | 0.43 | 182.00 | 3.6% | 11.4 | 316.00 | 4.0% | 20.00 | 4.0 | 1.3 | 12.7 | 498.00 | 12.8 | 12.7 |
| A6 | 1.09 | B | 14.6% | 0.20 | 0.21 | 0.29 | 118.00 | 16.2% | 7.0 | 84.00 | 0.5% | 20.00 | 1.4 | 1.0 | 8.0 | 202.00 | 11.1 | 8.0 |
| B1 | 1.36 | B | 76.9% | 0.70 | 0.71 | 0.76 | 51.00 | 2.0% | 4.0 | 649.00 | 4.0% | 20.00 | 4.0 | 2.7 | 6.7 | 700.00 | 13.9 | 6.7 |
| B2 | 1.54 | B | 76.6% | 0.70 | 0.71 | 0.75 | 39.00 | 2.0% | 3.5 | 836.00 | 3.5% | 20.00 | 3.7 | 3.7 | 7.2 | 875.00 | 14.9 | 7.2 |
| B3 | 8.43 | B | 14.5% | 0.23 | 0.25 | 0.31 | 90.00 | 13.9% | 6.1 | 1311.00 | 3.4% | 15.00 | 2.8 | 7.9 | 14.0 | 1401.00 | 17.8 | 14.0 |
| B4 | 2.30 | B | 58.4% | 0.53 | 0.56 | 0.66 | 156.00 | 2.5% | 9.0 | 877.00 | 2.9% | 20.00 | 3.4 | 4.3 | 13.3 | 1033.00 | 15.7 | 13.3 |
| B5 | 1.50 | B | 58.5% | 0.54 | 0.57 | 0.65 | 71.00 | 2.5% | 6.0 | 837.00 | 2.9% | 20.00 | 3.4 | 4.1 | 10.1 | 908.00 | 15.0 | 10.1 |
| B6 | 1.46 | B | 57.3% | 0.51 | 0.55 | 0.66 | 75.00 | 2.5% | 6.4 | 569.00 | 2.9% | 20.00 | 3.4 | 2.8 | 9.1 | 644.00 | 13.6 | 9.1 |
| B7 | 2.66 | B | 55.2% | 0.49 | 0.53 | 0.65 | 135.00 | 2.5% | 8.8 | 448.00 | 1.4% | 20.00 | 2.4 | 3.2 | 12.0 | 583.00 | 13.2 | 12.0 |
| B8 | 1.76 | C | 56.9% | 0.51 | 0.55 | 0.66 | 137.00 | 2.5% | 8.7 | 133.00 | 1.0% | 20.00 | 2.0 | 1.1 | 9.8 | 270.00 | 11.5 | 9.8 |
| B9 | 1.53 | B | 55.2% | 0.49 | 0.53 | 0.65 | 220.00 | 6.0% | 8.4 | 163.00 | 3.2% | 20.00 | 3.6 | 0.8 | 9.2 | 383.00 | 12.1 | 9.2 |
| B10 | 2.40 | B | 56.5% | 0.51 | 0.54 | 0.66 | 61.00 | 2.5% | 5.8 | 744.00 | 3.9% | 20.00 | 3.9 | 3.1 | 8.9 | 805.00 | 14.5 | 8.9 |
| B11 | 0.44 | B | 60.1% | 0.54 | 0.57 | 0.68 | 65.00 | 2.5% | 5.7 | 135.00 | 1.5% | 20.00 | 2.4 | 0.9 | 6.6 | 200.00 | 11.1 | 6.6 |
| B12 | 0.48 | C | 69.8% | 0.63 | 0.65 | 0.73 | 75.00 | 2.5% | 5.2 | 266.00 | 2.8% | 20.00 | 3.3 | 1.3 | 6.5 | 341.00 | 11.9 | 6.5 |
| B13 | 2.33 | C | 36.3% | 0.37 | 0.40 | 0.50 | 231.00 | 5.9% | 10.7 | 223.00 | 2.8% | 20.00 | 3.3 | 1.1 | 11.8 | 454.00 | 12.5 | 11.8 |
| B14 | 1.54 | B | 80.9% | 0.73 | 0.74 | 0.79 | 23.00 | 2.0% | 2.5 | 1060.00 | 4.0% | 20.00 | 4.0 | 4.4 | 6.9 | 1083.00 | 16.0 | 6.9 |
| B15 | 2.20 | C | 5.0% | 0.18 | 0.19 | 0.22 | 156.00 | 7.9% | 10.4 | 546.00 | 4.6% | 15.00 | 3.2 | 2.8 | 13.2 | 702.00 | 13.9 | 13.2 |
| B16 | 0.66 | C | 67.9% | 0.61 | 0.64 | 0.72 | 146.00 | 2.5% | 7.5 | 186.00 | 3.8% | 20.00 | 3.9 | 0.8 | 8.3 | 332.00 | 11.8 | 8.3 |
| B17 | 0.37 | C | 82.0% | 0.74 | 0.75 | 0.80 | 30.00 | 2.0% | 2.8 | 186.00 | 1.4% | 20.00 | 2.3 | 1.3 | 4.1 | 216.00 | 11.2 | 5.0 |
| B18 | 1.97 | C | 52.4% | 0.47 | 0.51 | 0.64 | 146.00 | 2.5% | 9.5 | 447.00 | 4.0% | 20.00 | 4.0 | 1.9 | 11.4 | 593.00 | 13.3 | 11.4 |
| B19 | 1.28 | C | 58.1% | 0.52 | 0.56 | 0.67 | 81.00 | 2.1% | 6.9 | 529.00 | 4.0% | 20.00 | 4.0 | 2.2 | 9.1 | 610.00 | 13.4 | 9.1 |
| B20 | 0.66 | C | 62.4% | 0.56 | 0.59 | 0.69 | 81.00 | 2.5% | 6.1 | 308.00 | 1.9% | 20.00 | 2.7 | 1.9 | 8.0 | 389.00 | 12.2 | 8.0 |
| B21 | 2.61 | C | 52.2% | 0.47 | 0.51 | 0.64 | 88.00 | 2.5% | 7.4 | 608.00 | 4.0% | 20.00 | 4.0 | 2.5 | 9.9 | 696.00 | 13.9 | 9.9 |
| B22 | 1.45 | B | 58.8% | 0.53 | 0.56 | 0.67 | 103.00 | 2.5% | 7.3 | 655.00 | 4.0% | 20.00 | 4.0 | 2.7 | 10.0 | 758.00 | 14.2 | 10.0 |
| B23 | 22.95 | B | 14.4% | 0.29 | 0.31 | 0.41 | 192.00 | 13.9% | 8.3 | 1574.00 | 3.1% | 15.00 | 2.6 | 9.9 | 18.2 | 1766.00 | 19.8 | 18.2 |
| B24 | 3.41 | C | 50.2% | 0.46 | 0.50 | 0.62 | 146.00 | 2.5% | 9.8 | 825.00 | 4.4% | 20.00 | 4.2 | 3.3 | 13.0 | 971.00 | 15.4 | 13.0 |

# STANDARD FORM SF-2
# TIME OF CONCENTRATION

Subdivision: _____ Project Name: Trails at Overland Ranch
Location: Aurora Project No.: 16118.00
Calculated By: AAM
Checked By: _____
Date: 6/10/22

| SUB-BASIN DATA | | | | | | | INITIAL/OVERLAND ($T_i$) | | | TRAVEL TIME ($T_t$) | | | | | *tc* CHECK (URBANIZED BASINS) | | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN | D.A. | Hydrologic | Impervious | $C_2$ | $C_5$ | $C_{100}$ | $L$ | $S_o$ | $t_i$ | $L_t$ | $S_t$ | $K$ | VEL. (ft/s) | $t_t$ (min) | COMP. $t_c$ (min) | TOTAL LENGTH (ft) | Urbanized $t_c$ (min) | $t_c$ (min) |
| B25 | 2.35 | C | 53.1% | 0.48 | 0.52 | 0.63 | 86.00 | 2.5% | 7.2 | 795.00 | 4.4% | 20.00 | 4.2 | 3.2 | 10.3 | 881.00 | 14.9 | 10.3 |
| B26 | 3.57 | C | 51.2% | 0.46 | 0.50 | 0.62 | 195.00 | 2.5% | 11.1 | 793.00 | 4.0% | 20.00 | 4.0 | 3.3 | 14.4 | 988.00 | 15.5 | 14.4 |
| B27 | 1.47 | B | 61.4% | 0.55 | 0.58 | 0.69 | 65.00 | 2.5% | 5.5 | 767.00 | 4.0% | 20.00 | 4.0 | 3.2 | 8.7 | 832.00 | 14.6 | 8.7 |
| B28 | 1.62 | C | 55.7% | 0.50 | 0.54 | 0.66 | 206.00 | 3.3% | 9.8 | 334.00 | 3.3% | 20.00 | 3.6 | 1.5 | 11.4 | 540.00 | 13.0 | 11.4 |
| B29 | 1.19 | B | 54.5% | 0.49 | 0.53 | 0.65 | 65.00 | 2.5% | 6.2 | 293.00 | 2.3% | 20.00 | 3.0 | 1.6 | 7.8 | 358.00 | 12.0 | 7.8 |
| B30 | 2.80 | C | 46.6% | 0.44 | 0.47 | 0.58 | 135.00 | 2.5% | 9.7 | 417.00 | 2.1% | 20.00 | 2.9 | 2.4 | 12.1 | 552.00 | 13.1 | 12.1 |
| B31 | 1.87 | B | 53.4% | 0.48 | 0.52 | 0.64 | 87.00 | 2.5% | 7.2 | 424.00 | 2.1% | 20.00 | 2.9 | 2.4 | 9.7 | 511.00 | 12.8 | 9.7 |
| B32 | 0.20 | B | 77.5% | 0.70 | 0.71 | 0.77 | 28.00 | 2.0% | 2.9 | 67.00 | 1.0% | 20.00 | 2.0 | 0.6 | 3.5 | 95.00 | 10.5 | 5.0 |
| B33 | 0.21 | B | 74.0% | 0.67 | 0.69 | 0.75 | 24.00 | 2.0% | 2.9 | 81.00 | 1.0% | 20.00 | 2.0 | 0.7 | 3.6 | 105.00 | 10.6 | 5.0 |
| B33A | 0.41 | B | 49.0% | 0.50 | 0.51 | 0.55 | 47.00 | 2.0% | 5.8 | 232.00 | 1.2% | 20.00 | 2.2 | 1.8 | 7.6 | 279.00 | 11.6 | 7.6 |
| B33B | 0.21 | B | 68.3% | 0.64 | 0.65 | 0.69 | 17.00 | 2.0% | 2.7 | 169.00 | 1.2% | 20.00 | 2.2 | 1.3 | 4.0 | 186.00 | 11.0 | 5.0 |
| B34 | 1.53 | B | 50.0% | 0.45 | 0.49 | 0.62 | 161.00 | 2.4% | 10.4 | 260.00 | 2.3% | 20.00 | 3.0 | 1.4 | 11.8 | 421.00 | 12.3 | 11.8 |
| B35 | 0.98 | C | 60.9% | 0.55 | 0.58 | 0.68 | 80.00 | 2.5% | 6.2 | 142.00 | 2.5% | 20.00 | 3.2 | 0.7 | 7.0 | 222.00 | 11.2 | 7.0 |
| B36 | 1.24 | C | 57.5% | 0.51 | 0.55 | 0.67 | 129.00 | 2.5% | 8.4 | 208.00 | 2.1% | 20.00 | 2.9 | 1.2 | 9.6 | 337.00 | 11.9 | 9.6 |
| B37 | 1.74 | B | 53.2% | 0.48 | 0.52 | 0.63 | 161.00 | 2.5% | 9.9 | 298.00 | 3.6% | 20.00 | 3.8 | 1.3 | 11.2 | 459.00 | 12.6 | 11.2 |
| B38 | 1.12 | B | 51.3% | 0.51 | 0.52 | 0.57 | 55.00 | 4.5% | 4.7 | 314.00 | 1.1% | 20.00 | 2.1 | 2.5 | 7.2 | 369.00 | 12.1 | 7.2 |
| B39 | 0.78 | B | 53.7% | 0.53 | 0.54 | 0.58 | 17.00 | 2.0% | 3.3 | 409.00 | 1.2% | 20.00 | 2.2 | 3.1 | 6.4 | 426.00 | 12.4 | 6.4 |
| B39A | 0.23 | B | 62.8% | 0.60 | 0.61 | 0.65 | 17.00 | 2.0% | 2.9 | 199.00 | 4.0% | 20.00 | 4.0 | 0.8 | 3.7 | 216.00 | 11.2 | 5.0 |
| B39B | 0.26 | B | 81.7% | 0.74 | 0.75 | 0.79 | 23.00 | 2.0% | 2.4 | 199.00 | 4.0% | 20.00 | 4.0 | 0.8 | 3.3 | 222.00 | 11.2 | 5.0 |
| B40 | 1.94 | C | 57.3% | 0.51 | 0.55 | 0.66 | 205.00 | 3.0% | 9.9 | 230.00 | 1.8% | 20.00 | 2.7 | 1.4 | 11.3 | 435.00 | 12.4 | 11.3 |
| B41 | 0.80 | B | 59.7% | 0.54 | 0.57 | 0.68 | 65.00 | 2.5% | 5.7 | 414.00 | 3.6% | 20.00 | 3.8 | 1.8 | 7.5 | 479.00 | 12.7 | 7.5 |
| B42 | 2.98 | B | 54.7% | 0.49 | 0.53 | 0.65 | 205.00 | 2.5% | 10.9 | 490.00 | 4.0% | 20.00 | 4.0 | 2.0 | 12.9 | 695.00 | 13.9 | 12.9 |
| B43 | 1.40 | B | 61.0% | 0.55 | 0.58 | 0.68 | 70.00 | 2.1% | 6.1 | 660.00 | 3.9% | 20.00 | 3.9 | 2.8 | 8.9 | 730.00 | 14.1 | 8.9 |
| B44 | 0.22 | B | 77.2% | 0.70 | 0.72 | 0.77 | 19.00 | 2.0% | 2.4 | 188.00 | 2.6% | 20.00 | 3.2 | 1.0 | 3.4 | 207.00 | 11.2 | 5.0 |
| B45 | 2.01 | B | 50.9% | 0.46 | 0.50 | 0.63 | 199.00 | 4.2% | 9.5 | 308.00 | 4.0% | 20.00 | 4.0 | 1.3 | 10.8 | 507.00 | 12.8 | 10.8 |
| B46 | 1.56 | B | 61.8% | 0.55 | 0.59 | 0.69 | 65.00 | 2.5% | 5.5 | 777.00 | 4.0% | 20.00 | 4.0 | 3.2 | 8.7 | 842.00 | 14.7 | 8.7 |
| B47 | 2.80 | B | 51.3% | 0.46 | 0.50 | 0.63 | 200.00 | 3.0% | 10.6 | 457.00 | 3.5% | 20.00 | 3.7 | 2.0 | 12.7 | 657.00 | 13.7 | 12.7 |
| B48 | 1.29 | B | 61.7% | 0.55 | 0.59 | 0.69 | 65.00 | 2.5% | 5.5 | 594.00 | 3.5% | 20.00 | 3.7 | 2.6 | 8.2 | 659.00 | 13.7 | 8.2 |
| B49 | 6.16 | C | 5.0% | 0.18 | 0.19 | 0.22 | 200.00 | 3.1% | 16.0 | 330.00 | 3.1% | 7.00 | 1.2 | 4.5 | 20.5 | 530.00 | 12.9 | 12.9 |
| B50 | 0.46 | C | 81.4% | 0.74 | 0.75 | 0.79 | 16.00 | 2.0% | 2.0 | 466.00 | 3.0% | 20.00 | 3.5 | 2.2 | 4.3 | 482.00 | 12.7 | 5.0 |

# STANDARD FORM SF-2
# TIME OF CONCENTRATION

Subdivision: _____ Project Name: Trails at Overland Ranch
Location: Aurora Project No.: 16118.00
Calculated By: AAM
Checked By: _____
Date: 6/10/22

| SUB-BASIN DATA | | | | | | | INITIAL/OVERLAND ($T_i$) | | | TRAVEL TIME ($T_t$) | | | | | *tc* CHECK (URBANIZED BASINS) | | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN | D.A. | Hydrologic | Impervious | $C_2$ | $C_5$ | $C_{100}$ | $L$ | $S_o$ | $t_i$ | $L_t$ | $S_t$ | $K$ | VEL. (ft/s) | $t_t$ (min) | COMP. $t_c$ (min) | TOTAL LENGTH (ft) | Urbanized $t_c$ (min) | $t_c$ (min) |
| B51 | 0.85 | B | 81.0% | 0.73 | 0.74 | 0.79 | 15.00 | 2.5% | 1.9 | 642.00 | 2.4% | 20.00 | 3.1 | 3.5 | 5.3 | 657.00 | 13.7 | 5.3 |
| B52 | 0.96 | B | 60.0% | 0.54 | 0.57 | 0.68 | 65.00 | 2.5% | 5.7 | 411.00 | 2.4% | 20.00 | 3.1 | 2.2 | 7.9 | 476.00 | 12.6 | 7.9 |
| B53 | 1.33 | C | 58.5% | 0.52 | 0.56 | 0.67 | 75.00 | 2.5% | 6.2 | 223.00 | 1.6% | 20.00 | 2.5 | 1.5 | 7.7 | 298.00 | 11.7 | 7.7 |
| B54 | 0.56 | B | 59.8% | 0.54 | 0.57 | 0.68 | 75.00 | 2.5% | 6.1 | 208.00 | 1.6% | 20.00 | 2.5 | 1.4 | 7.5 | 283.00 | 11.6 | 7.5 |
| B55 | 3.16 | B | 54.4% | 0.49 | 0.53 | 0.65 | 205.00 | 7.0% | 7.8 | 446.00 | 2.4% | 20.00 | 3.1 | 2.4 | 10.2 | 651.00 | 13.6 | 10.2 |
| B56 | 1.09 | B | 59.2% | 0.53 | 0.57 | 0.68 | 70.00 | 2.5% | 6.0 | 451.00 | 2.4% | 20.00 | 3.1 | 2.4 | 8.4 | 521.00 | 12.9 | 8.4 |
| B57 | 0.79 | B | 60.1% | 0.54 | 0.57 | 0.68 | 198.00 | 2.5% | 9.9 | 150.00 | 1.0% | 20.00 | 2.0 | 1.3 | 11.2 | 348.00 | 11.9 | 11.2 |
| B58 | 2.16 | B | 65.0% | 0.59 | 0.61 | 0.70 | 65.00 | 2.5% | 5.2 | 495.00 | 1.0% | 20.00 | 2.0 | 4.1 | 9.4 | 560.00 | 13.1 | 9.4 |
| B58A | 0.98 | B | 32.7% | 0.31 | 0.35 | 0.47 | 84.00 | 2.5% | 9.1 | 355.00 | 6.0% | 15.00 | 3.7 | 1.6 | 10.7 | 439.00 | 12.4 | 10.7 |
| B59 | 3.96 | B | 50.9% | 0.46 | 0.50 | 0.62 | 211.00 | 5.7% | 8.8 | 663.00 | 1.0% | 20.00 | 2.0 | 5.5 | 14.4 | 874.00 | 14.9 | 14.4 |
| B61 | 2.43 | B | 85.0% | 0.60 | 0.65 | 0.80 | 194.00 | 5.4% | 6.5 | 176.00 | 3.0% | 20.00 | 3.5 | 0.8 | 7.3 | 370.00 | 12.1 | 7.3 |
| B62 | 12.96 | B | 36.7% | 0.40 | 0.42 | 0.47 | 200.00 | 25.0% | 6.0 | 531.00 | 0.6% | 20.00 | 1.5 | 5.7 | 11.8 | 731.00 | 14.1 | 11.8 |
| C1 | 1.51 | B | 40.7% | 0.40 | 0.43 | 0.53 | 92.00 | 2.5% | 8.5 | 563.00 | 1.5% | 20.00 | 2.4 | 3.8 | 12.3 | 655.00 | 13.6 | 12.3 |
| C2 | 1.39 | B | 58.5% | 0.53 | 0.56 | 0.67 | 92.00 | 2.5% | 6.9 | 556.00 | 1.5% | 20.00 | 2.4 | 3.8 | 10.7 | 648.00 | 13.6 | 10.7 |
| C3 | 1.74 | C | 51.6% | 0.46 | 0.50 | 0.63 | 233.00 | 2.6% | 12.0 | 125.00 | 2.3% | 20.00 | 3.0 | 0.7 | 12.7 | 358.00 | 12.0 | 12.0 |
| C4 | 3.68 | C | 50.3% | 0.45 | 0.50 | 0.62 | 88.00 | 2.5% | 7.6 | 854.00 | 2.0% | 20.00 | 2.8 | 5.0 | 12.6 | 942.00 | 15.2 | 12.6 |
| C5 | 2.03 | C | 56.9% | 0.52 | 0.55 | 0.65 | 65.00 | 2.5% | 5.9 | 695.00 | 1.7% | 20.00 | 2.6 | 4.4 | 10.4 | 760.00 | 14.2 | 10.4 |
| C6 | 1.05 | B | 36.2% | 0.35 | 0.39 | 0.52 | 92.00 | 12.0% | 5.4 | 547.00 | 2.3% | 15.00 | 2.3 | 4.0 | 9.4 | 639.00 | 13.6 | 9.4 |
| C7 | 9.17 | B | 59.7% | 0.54 | 0.57 | 0.68 | 104.00 | 4.0% | 6.2 | 1253.00 | 1.4% | 20.00 | 2.4 | 8.8 | 15.0 | 1357.00 | 17.5 | 15.0 |
| C8 | 3.03 | B | 59.3% | 0.53 | 0.57 | 0.67 | 85.00 | 2.5% | 6.6 | 590.00 | 1.8% | 20.00 | 2.7 | 3.7 | 10.2 | 675.00 | 13.8 | 10.2 |
| C9 | 4.93 | B | 40.2% | 0.41 | 0.44 | 0.52 | 214.00 | 13.5% | 7.4 | 485.00 | 3.3% | 15.00 | 2.7 | 3.0 | 10.3 | 699.00 | 13.9 | 10.3 |
| D1 | 3.06 | C | 54.9% | 0.49 | 0.53 | 0.65 | 135.00 | 2.5% | 8.8 | 574.00 | 3.3% | 20.00 | 3.6 | 2.6 | 11.4 | 709.00 | 13.9 | 11.4 |
| D2 | 3.07 | C | 56.8% | 0.51 | 0.54 | 0.66 | 146.00 | 2.5% | 9.0 | 524.00 | 3.3% | 20.00 | 3.6 | 2.4 | 11.4 | 670.00 | 13.7 | 11.4 |
| D3 | 1.77 | C | 54.2% | 0.48 | 0.52 | 0.65 | 71.00 | 2.5% | 6.5 | 436.00 | 2.8% | 20.00 | 3.3 | 2.2 | 8.6 | 507.00 | 12.8 | 8.6 |
| D4 | 1.65 | C | 60.8% | 0.59 | 0.60 | 0.64 | 40.00 | 2.0% | 4.6 | 883.00 | 2.6% | 20.00 | 3.2 | 4.6 | 9.1 | 923.00 | 15.1 | 9.1 |
| D5 | 11.36 | B | 5.7% | 0.18 | 0.19 | 0.23 | 300.00 | 5.0% | 16.8 | 930.00 | 4.0% | 15.00 | 3.0 | 5.2 | 21.9 | 1230.00 | 16.8 | 16.8 |
| OS1 | 21.79 | B | 17.3% | 0.32 | 0.36 | 0.61 | 200.00 | 5.5% | 10.7 | 649.00 | 4.9% | 7.00 | 1.9 | 5.7 | 16.4 | 849.00 | 14.7 | 14.7 |
| OS2 | 13.65 | B | 17.5% | 0.32 | 0.37 | 0.61 | 200.00 | 4.2% | 11.7 | 496.00 | 4.6% | 7.00 | 2.5 | 3.3 | 15.0 | 696.00 | 13.9 | 13.9 |
| OS3 | 0.14 | B | 65.0% | 0.60 | 0.61 | 0.65 | 32.00 | 5.0% | 3.0 | 62.00 | 4.0% | 20.00 | 4.0 | 0.3 | 3.2 | 94.00 | 10.5 | 5.0 |
| OS4 | 0.72 | B | 2.0% | 0.15 | 0.16 | 0.20 | 100.00 | 16.0% | 6.8 | 166.00 | 18.0% | 7.00 | 3.0 | 0.9 | 7.7 | 266.00 | 11.5 | 7.7 |

# STANDARD FORM SF-2
# TIME OF CONCENTRATION

Subdivision: _____ Project Name: Trails at Overland Ranch
Location: Aurora Project No.: 16118.00
Calculated By: AAM
Checked By: _____
Date: 6/10/22

| SUB-BASIN DATA | | | | | | | INITIAL/OVERLAND ($T_i$) | | | TRAVEL TIME ($T_t$) | | | | | *tc* CHECK (URBANIZED BASINS) | | | FINAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASIN | D.A. | Hydrologic | Impervious | $C_2$ | $C_5$ | $C_{100}$ | $L$ | $S_o$ | $t_i$ | $L_t$ | $S_t$ | $K$ | VEL. (ft/s) | $t_t$ (min) | COMP. $t_c$ (min) | TOTAL LENGTH (ft) | Urbanized $t_c$ (min) | $t_c$ (min) |
| OS5 | 1.69 | B | 15.7% | 0.23 | 0.25 | 0.33 | 108.00 | 9.0% | 7.7 | 100.00 | 14.0% | 7.00 | 2.6 | 0.6 | 8.3 | 208.00 | 11.2 | 8.3 |
| | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | |

NOTES:

$$t_c = t_i + t_t \quad (5.2)$$

where $t_c$ = time of concentration (minutes)
$t_i$ = initial, inlet, or overland flow time (minutes)
$t_t$ = travel time in the ditch, channel, gutter, storm sewer, etc. (minut

$$t_c = \frac{L'}{180} + 10 \quad (5.4)$$

Where $t_c$ = time of concentration (minutes)

L' = length of flow to first design point from the most remote point (feet)

$t_c$ is lesser of Equation 5.2 and Equation 5.4

For Urbanized basins a minimum $t_c$ of 5.0 minutes is required.

For non-urbanized basins a minimum $t_c$ of 10.0 minutes is required.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{\sqrt[3]{S}} \quad (5.3)$$

where $t_i$ = initial or overland flow time (minutes)
$C_5$ = runoff coefficient for 5-year frequency
L = length of overland flow, (ft., 500 ft. max.)
S = average basin slope (ft/ft)

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Where:

$t_t$ = channelized flow time (travel time, min)
$L_t$ = waterway length (ft)
$S_o$ = waterway slope (ft/ft)
$V_t$ = travel time velocity (ft/sec) = $K\sqrt{S_o}$
$K$ = NRCS conveyance factor (see Table 6-2).

$$I = \frac{28.5\ P_1}{(10 + T_C)^{0.786}} \quad (5.5)$$

Where:
I = rainfall intensity (inches per hour)
$P_1$ = one-hour rainfall depth (inches) from Figures RA-1 through RA-6 in USDCM, Volume 1
$T_c$ = time of concentration (minutes).

Equation 6-4

**Table 6-2. NRCS Conveyance factors, K**

| Type of Land Surface | Conveyance Factor, K |
|---|---|
| Heavy meadow | 2.5 |
| Tillage/field | 5 |
| Short pasture and lawns | 7 |
| Nearly bare ground | 10 |
| Grassed waterway | 15 |
| Paved areas and shallow paved swales | 20 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_{1:}$ 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 71 | A1 | 1.39 | 0.10 | 12.56 | 0.14 | 2.04 | 0.29 | | | | | | | | 0.29 | 0.14 | 1.0 | 18 | 50 | 2.6 | 0.3 | Type C Inlet<br>Piped to DP 7.0 |
| | 72 | A2 | 1.32 | 0.54 | 7.77 | 0.72 | 2.46 | 1.77 | | | | | | | | 1.77 | 0.72 | 1.0 | 18 | 3 | 4.4 | 0.0 | Sump Inlet<br>Piped to DP 7.0 |
| | 7.0 | | | | | | | | 12.88 | 0.86 | 2.01 | 1.73 | | | | 1.73 | 0.86 | 1.0 | 18 | 60 | 4.3 | 0.2 | Sum of DP 71 & DP 72<br>Piped to DP 7.1 |
| | 73 | A3 | 0.45 | 0.66 | 5.57 | 0.30 | 2.72 | 0.82 | | | | | | | | 0.82 | 0.30 | 1.0 | 18 | 21 | 3.4 | 0.1 | Sump Inlet<br>Piped to DP 7.1 |
| | 7.1 | | | | | | | | 13.12 | 1.16 | 2.00 | 2.32 | | | | 2.32 | 1.16 | 1.0 | 18 | 147 | 4.8 | 0.5 | Sum of DP 7.0 & DP 73<br>Piped to DP 20.2 |
| | 74 | A4 | 6.00 | 0.36 | 18.32 | 2.18 | 1.70 | 3.71 | | | | | | | | 3.71 | 2.18 | 5.0 | 18 | 102 | 9.5 | 0.2 | On-grade inlet<br>Piped to DP 7.2 |
| | 7.2 | | | | | | | | 18.50 | 3.34 | 1.69 | 5.65 | | | | 5.65 | 3.34 | 2.5 | 24 | 320 | 8.3 | 0.6 | Sum of DP 7.1 & DP 74<br>Piped to DP 20.3 |
| | 75 | A5 | 1.03 | 0.38 | 12.70 | 0.39 | 2.03 | 0.79 | | | | | | | | 0.79 | 0.39 | 1.6 | 18 | 73 | 4.1 | 0.3 | On-grade inlet<br>Piped to DP 7.3 |
| | 7.3 | | | | | | | | 19.14 | 3.73 | 1.66 | 6.20 | | | | 6.20 | 3.73 | 1.0 | 24 | 107 | 6.1 | 0.3 | Sum of DP 7.2 & DP 75<br>Piped/Pond conveyance to DP 20.4 |
| | 76 | A6 | 1.09 | 0.20 | 7.96 | 0.22 | 2.43 | 0.53 | | | | | 0.53 | 0.22 | 0.5 | | | | | | | | Pond A<br>Pond conveyance to DP 7.4 |
| | 7.4 | | | | | | | | 19.44 | 3.95 | 1.65 | 6.52 | | | | | | | | | | | Pond A Outlet Structure<br>Release into existing storm sewer along Monaghans |
| | OS1 | OS1 | 21.79 | 0.32 | 14.72 | 2.11 | 1.89 | 4.00 | | | | | | | | 4.00 | 2.11 | 0.3 | 30 | 57 | 3.4 | 0.3 | Existing 30" Culvert<br>Piped to DP 1.0 |
| | 1 | B1 | 1.36 | 0.70 | 6.68 | 0.96 | 2.58 | 2.48 | | | | | | | | 2.48 | 0.96 | 0.3 | 30 | 3 | 3.0 | 0.0 | Future Sump Inlet<br>Piped to DP 1.0 |
| | 1.0 | | | | | | | | 15.00 | 3.07 | 1.88 | 5.78 | 5.78 | 3.07 | 3.0 | | | | | 580 | 3.5 | 2.8 | Sum of DP OS1 and DP 1<br>Swale Conveyance to DP 1.2 |
| | OS2 | OS2 | 13.65 | 0.32 | 13.87 | 1.54 | 1.95 | 3.00 | | | | | | | | 3.00 | 1.54 | 5.0 | 30 | 41 | 8.6 | 0.1 | Existing 24" Culvert<br>Piped to DP 1.1 |
| | 2 | B2 | 1.54 | 0.70 | 7.22 | 1.08 | 2.52 | 2.72 | | | | | | | | 2.72 | 1.08 | 0.3 | 30 | 3 | 3.1 | 0.0 | Future Sump Inlet<br>Piped to DP 1.1 |
| | 1.1 | | | | | | | | 13.95 | 2.62 | 1.94 | 5.08 | 5.08 | 2.62 | 5.5 | | | | | 337 | 4.7 | 1.2 | Sum of DP OS2 and DP 2<br>Swale Conveyance to DP 1.2 |
| | 3 | B3 | 8.43 | 0.23 | 13.96 | 1.96 | 1.94 | 3.80 | | | | | | | | 3.80 | 1.96 | 8.0 | 48 | 0 | 9.8 | 0.0 | 48" Culvert<br>Piped to DP 1.2 |
| | 1.2 | | | | | | | | 17.79 | 7.65 | 1.73 | 13.24 | | | | 13.24 | 7.65 | 8.0 | 48 | 83 | 14.6 | 0.1 | Sum of DP 1.0, DP 1.1 & DP 3<br>Piped to DP 1.5 |
| | 4 | B4 | 2.30 | 0.53 | 13.26 | 1.22 | 1.99 | 2.43 | | | | | | | | 2.43 | 1.22 | 1.0 | 18 | 21 | 4.8 | 0.1 | Sump Inlet<br>Piped to DP 1.3 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_{1:}$ 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 5 | B5 | 1.50 | 0.54 | 10.09 | 0.81 | 2.23 | 1.81 | | | | | | | | 1.81 | 0.81 | 1.0 | 18 | 21 | 4.3 | 0.1 | Sump Inlet<br>Piped to DP 1.3 |
| | 1.3 | | | | | | | | 13.33 | 2.03 | 1.98 | 4.02 | | | | 4.02 | 2.03 | 1.0 | 18 | 42 | 5.5 | 0.1 | Sum of DP 4 & DP 5<br>Piped to DP 1.5 |
| | 6 | B6 | 1.46 | 0.51 | 9.14 | 0.75 | 2.32 | 1.74 | | | | | | | | 1.74 | 0.75 | 1.0 | 18 | 19 | 4.3 | 0.1 | Sump Inlet<br>Piped to DP 1.3 |
| | 7 | B7 | 2.66 | 0.49 | 11.96 | 1.31 | 2.08 | 2.72 | | | | | | | | 2.72 | 1.31 | 1.0 | 18 | 19 | 4.9 | 0.1 | Sump Inlet<br>Piped to DP 1.3 |
| | 1.4 | | | | | | | | 12.02 | 2.06 | 2.07 | 4.26 | | | | 4.26 | 2.06 | 3.0 | 18 | 357 | 8.3 | 0.7 | Sum of DP 6 & DP 7<br>Piped to DP 1.5 |
| | 1.5 | | | | | | | | 17.88 | 11.74 | 1.72 | 20.20 | 20.20 | 11.74 | 3.2 | | | | | 371 | 5.0 | 1.2 | Sum of DP 1.2, DP 1.3, & DP 1.4<br>Channel conveyance to DP 1.8 |
| | 8 | B8 | 1.76 | 0.51 | 9.76 | 0.90 | 2.26 | 2.03 | | | | | | | | 2.03 | 0.90 | 1.0 | 18 | 338 | 4.6 | 1.2 | Type C Inlet<br>Piped to DP 1.6 |
| | 9 | B9 | 1.53 | 0.49 | 9.16 | 0.76 | 2.31 | 1.76 | | | | | 0.1 | 0.02 | 2.5 | 1.70 | 0.74 | 1.0 | 18 | 236<br>19 | 3.2<br>4.3 | 1.2<br>0.1 | On-grade inlet, carryover flow to DP 10<br>Piped to DP 1.6 |
| | 1.6 | | | | | | | | 10.99 | 1.64 | 2.15 | 3.52 | | | | 3.52 | 1.64 | 2.0 | 18 | 240 | 6.8 | 0.6 | Sum of DP 8 & DP 9<br>Piped to DP 1.7 |
| | 10 | B10 | 2.40 | 0.51 | 8.94 | 1.21 | 2.33 | 2.82 | 10.41 | 1.23 | 2.20 | 2.71 | | | | 2.71 | 1.23 | 1.0 | 18 | 19 | 5.0 | 0.1 | Sump Inlet<br>Sum of carryover from DP9 and Sub-Basin B10,Piped to DP 1.7 |
| | 11 | B11 | 0.44 | 0.54 | 6.59 | 0.24 | 2.59 | 0.62 | | | | | | | | 0.62 | 0.24 | 1.0 | 18 | 19 | 3.2 | 0.1 | Sump Inlet<br>Piped to DP 1.7 |
| | 1.7 | | | | | | | | 11.58 | 3.11 | 2.11 | 6.56 | | | | 6.56 | 3.11 | 5.0 | 24 | 475 | 11.0 | 0.7 | Sum of DP 1.6, DP 10, & DP 11<br>Piped to DP 1.8 |
| | 1.8 | | | | | | | | 19.12 | 14.85 | 1.67 | 24.81 | 24.81 | 14.85 | 3.0 | | | | | 386 | 5.0 | 1.3 | Sum of DP 1.5 & DP 1.7<br>Channel conveyance to DP 2.7 |
| | 12 | B12 | 0.48 | 0.63 | 6.52 | 0.30 | 2.60 | 0.78 | | | | | | | | 0.78 | 0.30 | 1.0 | 18 | 19 | 3.4 | 0.1 | Sump Inlet<br>Piped to DP 1.9 |
| | 13 | B13 | 2.33 | 0.37 | 11.80 | 0.86 | 2.09 | 1.80 | | | | | | | | 1.80 | 0.86 | 1.0 | 18 | 19 | 4.4 | 0.1 | Sump Inlet<br>Piped to DP 1.9 |
| | 1.9 | | | | | | | | 11.87 | 1.16 | 2.09 | 2.42 | | | | 2.42 | 1.16 | 4.0 | 18 | 843 | 7.7 | 1.8 | Sum of DP 12 & DP 13<br>Piped to DP 2.5 |
| | 14 | B14 | 1.54 | 0.73 | 6.88 | 1.13 | 2.56 | 2.89 | | | | | | | | 2.89 | 1.13 | 2.7 | 18 | 167 | 7.1 | 0.4 | On-grade inlet<br>Piped to DP 2.0 |
| | 15 | B15 | 2.20 | 0.18 | 13.20 | 0.40 | 1.99 | 0.80 | | | | | | | | 0.80 | 0.40 | 1.0 | 18 | 65 | 3.5 | 0.3 | Type C Inlet<br>Piped to DP 2.0 |
| | 2.0 | | | | | | | | 13.51 | 1.53 | 1.97 | 3.01 | | | | 3.01 | 1.53 | 1.5 | 18 | 64 | 5.9 | 0.2 | Sum of DP 14 & DP 15<br>Piped to DP 2.1 |
| | 16 | B16 | 0.66 | 0.61 | 8.28 | 0.40 | 2.40 | 0.96 | 11.35 | 0.44 | 2.13 | 0.93 | | | | 0.93 | 0.44 | 1.0 | 18 | 22 | 3.5 | 0.1 | Sump Inlet<br>Sum of carryover from DP 18 and Sub-Basin B16,Piped to DP 2.1 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_{1:}$ 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 17 | B17 | 0.37 | 0.74 | 5.00 | 0.27 | 2.81 | 0.76 | | | | | | | | 0.76 | 0.27 | 1.0 | 18 | 32 | 3.3 | 0.2 | Sump Inlet<br>Piped to DP 2.1 |
| | 2.1 | | | | | | | | 13.70 | 2.24 | 1.96 | 4.39 | | | | 4.39 | 2.24 | 1.0 | 24 | 126 | 5.5 | 0.4 | Sum of DP 2.0, DP 16 & DP 17<br>Piped to DP 2.3 |
| | 18 | B18 | 1.97 | 0.47 | 11.35 | 0.93 | 2.13 | 1.98 | | | | | 0.1 | 0.04 | 3.0 | 1.90 | 0.89 | 1.0 | 18 | 186<br>28 | 3.5<br>4.4 | 0.9<br>0.1 | On-grade inlet, carryover flow to DP 16<br>Piped to DP 2.2 |
| | 19 | B19 | 1.28 | 0.52 | 9.10 | 0.67 | 2.32 | 1.55 | | | | | | | | 1.55 | 0.67 | 1.0 | 18 | 28 | 4.3 | 0.1 | On-grade inlet<br>Piped to DP 2.2 |
| | 2.2 | | | | | | | | 11.46 | 1.56 | 2.12 | 3.31 | | | | 3.31 | 1.56 | 3.0 | 18 | 103 | 7.7 | 0.2 | Sum of DP 18 & DP 19<br>Piped to DP 2.3 |
| | 2.3 | | | | | | | | 14.08 | 3.80 | 1.93 | 7.33 | | | | 7.33 | 3.80 | 2.0 | 24 | 262 | 8.1 | 0.5 | Sum of DP 2.1 & DP 2.2<br>Piped to DP 2.4 |
| | 20 | B20 | 0.66 | 0.56 | 7.99 | 0.37 | 2.43 | 0.90 | | | | | | | | 0.90 | 0.37 | 1.0 | 18 | 32 | 3.6 | 0.1 | On-grade Inlet<br>Sum of carryover from DP19 and Sub-Basin B20,Piped to DP 2.4 |
| | 2.4 | | | | | | | | 14.61 | 4.17 | 1.90 | 7.92 | | | | 7.92 | 4.17 | 0.5 | 30 | 56 | 5.0 | 0.2 | Sum of DP 2.3 & DP 20<br>Piped to DP 2.6 |
| | 21 | B21 | 2.61 | 0.47 | 9.94 | 1.22 | 2.24 | 2.73 | | | | | | | | 2.73 | 1.22 | 1.0 | 18 | 19 | 4.9 | 0.1 | On-grade inlet<br>Piped to DP 2.5 |
| | 22 | B22 | 1.45 | 0.53 | 10.02 | 0.77 | 2.24 | 1.72 | | | | | | | | 1.72 | 0.77 | 1.0 | 18 | 19 | 4.3 | 0.1 | On-grade inlet, carryover flow to DP 27<br>Piped to DP 2.5 |
| | 2.5 | | | | | | | | 13.69 | 3.15 | 1.96 | 6.17 | | | | 6.17 | 3.15 | 4.0 | 24 | 87 | 10.1 | 0.1 | Sum of DP 1.9, DP 21 & DP 22<br>Piped to DP 2.6 |
| | 2.6 | | | | | | | | 14.80 | 7.32 | 1.89 | 13.83 | | | | 13.83 | 7.32 | 3.0 | 30 | 365 | 11.2 | 0.5 | Sum of DP 2.4 & DP 2.5<br>Piped to DP 2.7 |
| | 2.7 | | | | | | | | 20.40 | 22.17 | 1.61 | 35.70 | 35.70 | 22.17 | 3.3 | | | | | 723 | 6.0 | 2.0 | Sum of DP 1.8 & DP 2.6<br>Channel conveyance to DP 2.8 |
| | 23 | B23 | 22.95 | 0.29 | 18.20 | 6.55 | 1.71 | 11.20 | | | | | | | | 11.20 | 6.55 | 8.0 | 48 | 0 | 14.0 | 0.0 | 84" Culvert<br>Piped to DP 2.8 |
| | 2.8 | | | | | | | | 22.41 | 28.72 | 1.53 | 43.95 | | | | 43.95 | 28.72 | 4.0 | 84 | 179 | 15.4 | 0.2 | 84" Culvert<br>Piped to DP 5.6 |
| | 24 | B24 | 3.41 | 0.46 | 13.03 | 1.55 | 2.00 | 3.10 | | | | | | | | 3.10 | 1.55 | 1.0 | 18 | 21 | 5.2 | 0.1 | On-grade inlet<br>Piped to DP 2.9 |
| | 25 | B25 | 2.35 | 0.48 | 10.34 | 1.13 | 2.21 | 2.50 | | | | | | | | 2.50 | 1.13 | 1.0 | 18 | 21 | 4.8 | 0.1 | On-grade inlet<br>Piped to DP 2.9 |
| | 2.9 | | | | | | | | 13.10 | 2.68 | 2.00 | 5.36 | | | | 5.36 | 2.68 | 3.0 | 18 | 289 | 8.9 | 0.5 | Sum of DP 24 & DP 25<br>Piped to DP 3.3 |
| | 26 | B26 | 3.57 | 0.46 | 14.42 | 1.66 | 1.91 | 3.17 | | | | | | | | 3.17 | 1.66 | 1.0 | 18 | 21 | 5.2 | 0.1 | On-grade inlet<br>Piped to DP 3.0 |
| | 27 | B27 | 1.47 | 0.55 | 8.74 | 0.81 | 2.36 | 1.91 | | | | | | | | 1.91 | 0.81 | 1.0 | 18 | 21 | 4.4 | 0.1 | On-grade inlet<br>Piped to DP 3.0 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_{1:}$ 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 3.0 | | | | | | | | 0.08 | 2.47 | 3.83 | 9.46 | | | | 9.46 | 2.47 | 3.5 | 18 | 284 | 10.9 | 0.4 | Sum of DP 26 & DP 27<br>Piped to DP 3.1 |
| | 28 | B28 | 1.62 | 0.50 | 11.38 | 0.81 | 2.12 | 1.72 | | | | | | | | 1.72 | 0.81 | 1.0 | 18 | 19 | 4.4 | 0.1 | Sump Inlet<br>Piped to DP 3.1 |
| | 29 | B29 | 1.19 | 0.49 | 7.77 | 0.58 | 2.46 | 1.43 | | | | | | | | 1.43 | 0.58 | 1.0 | 18 | 19 | 4.1 | 0.1 | Sump Inlet<br>Piped to DP 3.1 |
| | 3.1 | | | | | | | | 0.51 | 3.86 | 3.71 | 14.32 | | | | 14.32 | 3.86 | 1.0 | 30 | 99 | 7.6 | 0.2 | Sum of DP 3.0, DP 28, & DP 29<br>Piped to DP 3.3 |
| | 30 | B30 | 2.80 | 0.44 | 12.11 | 1.23 | 2.07 | 2.55 | | | | | | | | 2.55 | 1.23 | 1.0 | 18 | 19 | 4.8 | 0.1 | Sump Inlet<br>Piped to DP 3.2 |
| | 31 | B31 | 1.87 | 0.48 | 9.68 | 0.89 | 2.27 | 2.02 | | | | | | | | 2.02 | 0.89 | 1.0 | 18 | 19 | 4.5 | 0.1 | Sump Inlet<br>Piped to DP 3.2 |
| | 3.2 | | | | | | | | 9.75 | 2.12 | 2.26 | 4.79 | | | | 4.79 | 2.12 | 1.0 | 24 | 19 | 5.7 | 0.1 | Sum of DP 30 & DP 31<br>Piped to DP 3.3 |
| | 3.3 | | | | | | | | 13.64 | 8.66 | 1.96 | 16.97 | | | | 16.97 | 8.66 | 1.0 | 36 | 105 | 7.8 | 0.2 | Sum of DP 2.9, DP 3.1, & DP 3.2<br>Piped to DP 3.4 |
| | 32 | B32 | 0.20 | 0.70 | 5.00 | 0.14 | 2.81 | 0.39 | | | | | | | | 0.39 | 0.14 | 1.0 | 18 | 21 | 2.8 | 0.1 | Sump Inlet<br>Piped to DP 3.4 |
| | 33 | B33 | 0.21 | 0.67 | 5.00 | 0.14 | 2.81 | 0.39 | | | | | | | | 0.39 | 0.14 | 1.0 | 18 | 21 | 2.8 | 0.1 | Sump Inlet<br>Piped to DP 3.4 |
| | 3.4 | | | | | | | | 13.86 | 8.94 | 1.95 | 17.43 | | | | 17.43 | 8.94 | 1.0 | 36 | 127 | 7.9 | 0.3 | Sum of DP 3.3, DP 32, & DP 33<br>Piped to DP 3.8 |
| | 34 | B34 | 1.53 | 0.45 | 11.81 | 0.69 | 2.09 | 1.44 | | | | | | | | 1.44 | 0.69 | 1.0 | 18 | 25 | 4.1 | 0.1 | Sump Inlet<br>Piped to DP 3.5 |
| | 35 | B35 | 0.98 | 0.55 | 6.96 | 0.54 | 2.55 | 1.38 | | | | | | | | 1.38 | 0.54 | 1.0 | 18 | 19 | 4.1 | 0.1 | Sump Inlet<br>Piped to DP 3.5 |
| | 3.5 | | | | | | | | 11.92 | 1.23 | 2.08 | 2.56 | | | | 2.56 | 1.23 | 1.0 | 18 | 595 | 4.8 | 2.1 | Sum of DP 34 & DP 35<br>Piped to DP 3.5A |
| | 36 | B36 | 1.24 | 0.51 | 9.56 | 0.64 | 2.28 | 1.46 | | | | | | | | 1.46 | 0.64 | 1.0 | 18 | 19 | 4.2 | 0.1 | Sump Inlet<br>Piped to DP 3.6 |
| | 37 | B37 | 1.74 | 0.48 | 11.16 | 0.84 | 2.14 | 1.80 | | | | | | | | 1.80 | 0.84 | 1.0 | 18 | 19 | 4.4 | 0.1 | Sump Inlet<br>Piped to DP 3.6 |
| | 3.6 | | | | | | | | 11.24 | 1.48 | 2.13 | 3.15 | | | | 3.15 | 1.48 | 1.0 | 18 | 107 | 5.1 | 0.3 | Sum of DP 36 & DP 37<br>Piped/ Pond Conveyance to DP 5.7 |
| | 33A | B33A | 0.41 | 0.50 | 7.58 | 0.20 | 2.48 | 0.50 | | | | | | | | 0.50 | 0.20 | 1.0 | 18 | 27 | 2.9 | 0.2 | Sump Inlet<br>Piped to DP 3.5A |
| | 33B | B33B | 0.21 | 0.64 | 5.00 | 0.13 | 2.81 | 0.37 | | | | | | | | 0.37 | 0.13 | 1.0 | 18 | 27 | 2.6 | 0.2 | Sump Inlet<br>Piped to DP 3.5A |
| | 3.5A | | | | | | | | 13.97 | 1.56 | 1.94 | 3.03 | | | | 3.03 | 1.56 | 1.0 | 18 | 59 | 5.0 | 0.2 | Sum of DP 3.5, DP36, & DP 37<br>Piped to DP 3.8 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_{1:}$ 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 3.8 | | | | | | | | 14.16 | 10.50 | 1.93 | 20.27 | | | | 20.27 | 10.50 | 0.5 | 42 | 360 | 6.4 | 0.9 | Sum of DP 3.4 & DP 3.5A<br>Piped to DP 3.9A |
| | 38 | B38 | 1.12 | 0.51 | 7.19 | 0.57 | 2.52 | 1.44 | | | | | | | | 1.44 | 0.57 | 1.0 | 18 | 55 | 4.1 | 0.2 | Sump Inlet<br>Piped to DP 3.9 |
| | 39 | B39 | 0.78 | 0.53 | 6.41 | 0.42 | 2.61 | 1.10 | | | | | | | | 1.10 | 0.42 | 1.0 | 18 | 3 | 3.8 | 0.0 | Sump Inlet<br>Piped to DP 3.9 |
| | 3.9 | | | | | | | | 7.42 | 0.99 | 2.49 | 2.47 | | | | 2.47 | 0.99 | 1.0 | 18 | 21 | 4.8 | 0.1 | Sum of DP 38 & DP 39<br>Piped to DP 3.9A |
| | 3.9A | | | | | | | | 15.11 | 11.49 | 1.87 | 21.49 | | | | 21.49 | 11.49 | 0.5 | 48 | 45 | 6.4 | 0.1 | Sum of DP 3.8 & DP 3.9<br>Piped to DP 5.6 |
| | 40 | B40 | 1.94 | 0.51 | 11.32 | 1.00 | 2.13 | 2.13 | | | | | | | | 2.13 | 1.00 | 2.3 | 18 | 237 | 6.3 | 0.6 | Type C Inlet<br>Piped to DP 4.0 |
| | 41 | B41 | 0.80 | 0.54 | 7.52 | 0.43 | 2.48 | 1.07 | | | | | | | | 1.07 | 0.43 | 1.0 | 18 | 19 | 3.7 | 0.1 | Piped to DP 4.0 |
| | 4.0 | | | | | | | | 11.95 | 1.43 | 2.08 | 2.97 | | | | 2.97 | 1.43 | 3.8 | 18 | 342 | 8.2 | 0.7 | Sum of DP 40 & DP 41<br>Piped to DP 4.1 |
| | 42 | B42 | 2.98 | 0.49 | 12.92 | 1.46 | 2.01 | 2.93 | | | | | | | | 2.93 | 1.46 | 1.0 | 18 | 22 | 5.0 | 0.1 | Sump Inlet<br>Piped to DP 4.1 |
| | 4.1 | | | | | | | | 12.65 | 2.89 | 2.03 | 5.87 | | | | 5.87 | 2.89 | 3.5 | 24 | 282 | 9.3 | 0.5 | Sum of DP 40 & DP 41<br>Piped to DP 4.1 |
| | 43 | B43 | 1.40 | 0.55 | 8.90 | 0.77 | 2.34 | 1.80 | 11.37 | 0.81 | 2.12 | 1.73 | | | | 1.73 | 0.81 | 1.0 | 18 | 19 | 4.3 | 0.1 | Sump Inlet<br>Sum of carryover from DP45 and Sub-Basin B43,Piped to DP 4.2 |
| | 44 | B44 | 0.22 | 0.70 | 5.00 | 0.15 | 2.81 | 0.42 | | | | | | | | 0.42 | 0.15 | 1.0 | 18 | 19 | 2.8 | 0.1 | Sump Inlet<br>Piped to DP 4.2 |
| | 4.2 | | | | | | | | 13.16 | 3.85 | 1.99 | 7.67 | | | | 7.67 | 3.85 | 1.0 | 24 | 79 | 6.4 | 0.2 | Sum of DP 4.1, DP43, & DP 44<br>Piped to DP 4.4 |
| | 45 | B45 | 2.01 | 0.46 | 10.82 | 0.92 | 2.17 | 2.00 | | | | | 0.1 | 0.04 | 4.0 | 1.90 | 0.88 | 2.0 | 18 | 132<br>22 | 4.0<br>5.6 | 0.6<br>0.1 | On-grade inlet, carryover flow to DP 43<br>Piped to DP 4.3 |
| | 46 | B46 | 1.56 | 0.55 | 8.73 | 0.87 | 2.36 | 2.05 | | | | | 0.2 | 0.06 | 4.0 | 1.90 | 0.81 | 1.0 | 18 | 594<br>19 | 4.0<br>4.4 | 2.5<br>0.1 | On-grade inlet, carryover flow to DP 48<br>Piped to DP 4.3 |
| | 4.3 | | | | | | | | 10.89 | 1.68 | 2.16 | 3.63 | | | | 3.63 | 1.68 | 4.0 | 18 | 81 | 8.7 | 0.2 | Sum of DP DP45 & DP 46<br>Piped to DP 4.4 |
| | 4.4 | | | | | | | | 13.36 | 5.54 | 1.98 | 10.96 | | | | 10.96 | 5.54 | 3.4 | 36 | 519 | 10.6 | 0.8 | Sum of DP 4.2 & DP 4.3<br>Piped to DP 4.5 |
| | 47 | B47 | 2.80 | 0.46 | 12.66 | 1.29 | 2.03 | 2.62 | | | | | | | | 2.62 | 1.29 | 2.0 | 18 | 19 | 6.3 | 0.1 | Sump Inlet<br>Piped to DP 4.5 |
| | 48 | B48 | 1.29 | 0.55 | 8.17 | 0.71 | 2.41 | 1.71 | 11.20 | 0.77 | 2.14 | 1.66 | | | | 1.66 | 0.77 | 2.0 | 18 | 19 | 5.5 | 0.1 | Sump Inlet<br>Sum of carryover from DP46 and Sub-Basin B48,Piped to DP 4.5 |
| | 4.5 | | | | | | | | 14.17 | 7.60 | 1.93 | 14.67 | | | | 14.67 | 7.60 | 1.0 | 30 | 127 | 7.6 | 0.3 | Sum of DP 4.4, DP 47, & DP 48<br>Piped to DP 5.4 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_{1:}$ 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 49 | B49 | 6.16 | 0.18 | 12.94 | 1.11 | 2.01 | 2.23 | | | | | | | | 2.23 | 1.11 | 2.8 | 18 | 239 | 6.6 | 0.6 | Proposed Stub<br>Piped to DP 4.6 |
| | 50 | B50 | 0.46 | 0.74 | 5.00 | 0.34 | 2.81 | 0.96 | | | | | | | | 0.96 | 0.34 | 1.0 | 18 | 27 | 3.6 | 0.1 | Future Sump Inlet<br>Piped to DP 4.6 |
| | 4.6 | | | | | | | | 13.55 | 1.45 | 1.97 | 2.86 | | | | 2.86 | 1.45 | 4.0 | 18 | 53 | 8.1 | 0.1 | Sum of DP 49 & DP 50<br>Piped to DP 4.9 |
| | 51 | B51 | 0.85 | 0.73 | 5.30 | 0.62 | 2.76 | 1.71 | | | | | | | | 1.71 | 0.62 | 1.0 | 18 | 19 | 4.4 | 0.1 | Sump Inlet<br>Piped to DP 4.7 |
| | 52 | B52 | 0.96 | 0.54 | 7.89 | 0.52 | 2.44 | 1.27 | | | | | | | | 1.27 | 0.52 | 1.0 | 18 | 19 | 3.9 | 0.1 | Sump Inlet<br>Piped to DP 4.7 |
| | 4.7 | | | | | | | | 7.98 | 1.14 | 2.43 | 2.77 | | | | 2.77 | 1.14 | 1.0 | 18 | 112 | 5.0 | 0.4 | Sum of DP 51 & DP 52<br>Piped to DP 4.9 |
| | 53 | B53 | 1.33 | 0.52 | 7.71 | 0.70 | 2.46 | 1.72 | | | | | | | | 1.72 | 0.70 | 1.0 | 18 | 19 | 4.3 | 0.1 | Sump Inlet<br>Piped to DP 4.8 |
| | 54 | B54 | 0.56 | 0.54 | 7.50 | 0.30 | 2.49 | 0.75 | | | | | | | | 0.75 | 0.30 | 1.0 | 18 | 19 | 3.3 | 0.1 | Sump Inlet<br>Piped to DP 4.8 |
| | 4.8 | | | | | | | | 7.79 | 1.00 | 2.45 | 2.45 | | | | 2.45 | 1.00 | 1.0 | 18 | 107 | 4.8 | 0.4 | Sum of DP 53 & DP 54<br>Piped to DP 4.9 |
| | 4.9 | | | | | | | | 13.66 | 3.59 | 1.96 | 7.04 | | | | 7.04 | 3.59 | 4.0 | 30 | 313 | 10.1 | 0.5 | Sum of DP 4.6, DP 4.7, & DP 4.8<br>Piped to DP 5.3 |
| | 55 | B55 | 3.16 | 0.49 | 10.18 | 1.55 | 2.22 | 3.44 | | | | | | | | 3.44 | 1.55 | 1.0 | 18 | 19 | 5.3 | 0.1 | Sump Inlet<br>Piped to DP 5.0 |
| | 56 | B56 | 1.09 | 0.53 | 8.40 | 0.58 | 2.39 | 1.39 | | | | | | | | 1.39 | 0.58 | 1.0 | 18 | 19 | 4.1 | 0.1 | Sump Inlet<br>Piped to DP 5.0 |
| | 5.0 | | | | | | | | 10.24 | 2.13 | 2.22 | 4.73 | | | | 4.73 | 2.13 | 2.0 | 24 | 112 | 7.3 | 0.3 | Sum of DP 55 & DP 56<br>Piped to DP 5.3 |
| | 57 | B57 | 0.79 | 0.54 | 11.17 | 0.43 | 2.14 | 0.92 | | | | | | | | 0.92 | 0.43 | 2.0 | 18 | 19 | 4.5 | 0.1 | Sump Inlet<br>Piped to DP 5.1 |
| | 59 | B59 | 3.96 | 0.46 | 14.37 | 1.83 | 1.92 | 3.51 | | | | | | | | 3.51 | 1.83 | 1.0 | 18 | 205 | 5.3 | 0.6 | On-grade inlet<br>Piped to DP 5.1 |
| | 5.1 | | | | | | | | 15.01 | 2.26 | 1.88 | 4.25 | | | | 4.25 | 2.26 | 1.0 | 24 | 26 | 5.5 | 0.1 | Sum of DP 57 & DP 59<br>Piped to DP 5.2 |
| | 58 | B58 | 2.16 | 0.59 | 9.37 | 1.27 | 2.29 | 2.91 | | | | | | | | 2.91 | 1.27 | 1.0 | 24 | 3 | 4.9 | 0.0 | Sump Inlet<br>Piped to DP 5.2 |
| | 5.2 | | | | | | | | 15.09 | 3.53 | 1.87 | 6.60 | | | | 6.60 | 3.53 | 2.0 | 24 | 488 | 8.0 | 1.0 | Sum of DP 5.1 & DP 58<br>Piped/Pond Conveyance to DP 5.7 |
| | 58A | B58A | 0.98 | 0.31 | 10.75 | 0.31 | 2.17 | 0.67 | | | | | | | | 0.67 | 0.31 | 6.0 | 18 | 42 | 6.1 | 0.1 | Type C Inlet<br>Piped to DP 5.2A |
| | 5.2A | | | | | | | | 16.11 | 3.84 | 1.81 | 6.95 | | | | 6.95 | 3.84 | 6.0 | 24 | 373 | 12.0 | 0.5 | Sum of DP 5.2 & DP 58A<br>Piped to DP 5.7 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_1$: 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 5.3 | | | | | | | | 14.18 | 5.72 | 1.93 | 11.04 | | | | 11.04 | 5.72 | 3.7 | 42 | 245 | 10.8 | 0.4 | Sum of DP 4.9 & DP 5.0<br>Piped to DP 5.3A |
| | 39A | B39A | 0.23 | 0.60 | 5.00 | 0.14 | 2.81 | 0.39 | | | | | | | | 0.39 | 0.14 | 1.0 | 18 | 27 | 2.8 | 0.2 | Sump Inlet<br>Piped to DP 5.3A |
| | 39B | B39B | 0.26 | 0.74 | 5.00 | 0.19 | 2.81 | 0.53 | | | | | | | | 0.53 | 0.19 | 1.0 | 18 | 27 | 3.1 | 0.1 | Sump Inlet<br>Piped to DP 5.3A |
| | 5.3A | | | | | | | | 14.55 | 6.05 | 1.90 | 11.50 | | | | 11.50 | 6.05 | 3.0 | 42 | 59 | 10.2 | 0.1 | Sum of DP 5.3, DP 39A & DP 39B<br>Piped to DP 5.4 |
| | 5.4 | | | | | | | | 14.65 | 13.65 | 1.90 | 25.94 | | | | 25.94 | 13.65 | 3.0 | 48 | 306 | 12.7 | 0.4 | Sum of DP 4.5 & DP 5.3A<br>Piped to DP 5.5 |
| | 61 | B61 | 2.43 | 0.60 | 7.33 | 1.46 | 2.50 | 3.65 | | | | | | | | 3.65 | 1.46 | 1.0 | 18 | 143 | 5.4 | 0.4 | Sump Inlet<br>Piped to DP 5.5 |
| | 5.5 | | | | | | | | 15.05 | 15.11 | 1.87 | 28.26 | | | | 28.26 | 15.11 | 3.0 | 48 | 32 | 13.1 | 0.0 | Sum of DP 5.4 & DP 61<br>Piped to DP 5.6 |
| | 5.6 | | | | | | | | 22.61 | 55.32 | 1.52 | 84.09 | 22.6 | 55.32 | 0.6 | | | | | 531 | 1.5 | 5.7 | Sum of DP 2.8, DP 3.9A, & DP 5.5<br>Pond Conveyance to DP 5.7 |
| | 62 | B62 | 12.96 | 0.40 | 11.75 | 5.19 | 2.09 | 10.85 | | | | | 10.85 | 5.19 | 0.5 | | | | | | | | Pond B<br>Pond conveyance to DP 5.7 |
| | 5.7 | | | | | | | | 28.32 | 65.83 | 1.34 | 88.22 | | | | | | | | | | | Sum of DP 3.6, DP 5.6, DP 5.2A, and DP 62<br>Pond B Outlet Structure |
| | 81 | C1 | 1.51 | 0.40 | 12.35 | 0.60 | 2.05 | 1.23 | | | | | | | | 1.23 | 0.60 | 1.0 | 18 | 19 | 3.9 | 0.1 | Sump Inlet<br>Piped to DP 8.0 |
| | 82 | C2 | 1.39 | 0.53 | 10.68 | 0.73 | 2.18 | 1.59 | | | | | | | | 1.59 | 0.73 | 1.0 | 18 | 19 | 4.2 | 0.1 | Sump Inlet<br>Piped to DP 8.0 |
| | 8.0 | | | | | | | | 12.43 | 1.33 | 2.04 | 2.71 | | | | 2.71 | 1.33 | 2.5 | 18 | 524 | 6.9 | 1.3 | Sum of DP 81 & DP 82<br>Piped to DP 8.2 |
| | 83 | C3 | 1.74 | 0.46 | 11.99 | 0.80 | 2.08 | 1.66 | | | | | | | | 1.66 | 0.80 | 2.0 | 18 | 26 | 5.5 | 0.1 | Sump Inlet<br>Piped to DP 8.1 |
| | 84 | C4 | 3.68 | 0.45 | 12.60 | 1.67 | 2.03 | 3.39 | | | | | | | | 3.39 | 1.67 | 2.5 | 18 | 211 | 7.4 | 0.5 | On-grade inlet<br>Piped to DP 8.1 |
| | 8.1 | | | | | | | | 13.08 | 2.47 | 2.00 | 4.94 | | | | 4.94 | 2.47 | 1.0 | 18 | 27 | 5.8 | 0.1 | Sum of DP 83 & DP 84<br>Piped to DP 8.2 |
| | 8.2 | | | | | | | | 13.69 | 3.80 | 1.96 | 7.45 | | | | 7.45 | 3.80 | 1.0 | 24 | 21 | 6.5 | 0.1 | Sum of DP 8.0 & DP 8.1<br>Piped to DP 8.3 |
| | 85 | C5 | 2.03 | 0.52 | 10.35 | 1.05 | 2.21 | 2.32 | | | | | | | | 2.32 | 1.05 | 1.0 | 18 | 3 | 4.8 | 0.0 | Sump Inlet<br>Piped to DP 8.3 |
| | 8.3 | | | | | | | | 13.74 | 4.85 | 1.96 | 9.51 | | | | 9.51 | 4.85 | 5.0 | 30 | 140 | 11.9 | 0.2 | Sum of DP 8.2 & DP 85<br>Piped to DP 8.4 |
| | 86 | C6 | 1.05 | 0.35 | 9.40 | 0.37 | 2.29 | 0.85 | | | | | | | | 0.85 | 0.37 | 6.0 | 18 | 14 | 6.5 | 0.0 | Type C Inlet<br>Piped to DP 8.4 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 2-Year
$P_1$: 0.83 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| Flow | 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) | tc (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) | $t_t$ (min) | |
| | 8.4 | | | | | | | | 13.94 | 5.22 | 1.94 | 10.13 | | | | 10.13 | 5.22 | 6.0 | 30 | 89 | 13.0 | 0.1 | Sum of DP 8.3 & DP 86<br>Piped/Pond Conveyance to DP 8.5 |
| | 87 | C7 | 9.17 | 0.54 | 15.01 | 4.91 | 1.88 | 9.23 | | | | | 9.2 | 4.91 | 0.5 | | | | | 484 | 1.4 | 5.7 | Future Storm Infrastructure<br>Piped/Pond Conveyance to DP 8.5 |
| | 88 | C8 | 3.03 | 0.53 | 10.23 | 1.61 | 2.22 | 3.57 | | | | | | | | 3.57 | 1.61 | 5.0 | 24 | 193 | 9.3 | 0.3 | Future Storm Infrastructure<br>Piped/Pond Conveyance to DP 8.5 |
| | 89 | C9 | 4.93 | 0.41 | 10.34 | 2.04 | 2.21 | 4.51 | | | | | 4.51 | 2.04 | 0.5 | | | | | | | | Pond C<br>Pond Conveyance to DP 8.5 |
| | 8.5 | | | | | | | | 20.72 | 13.78 | 1.60 | 22.05 | | | | 22.05 | 13.78 | 5.0 | 30 | 140 | 15.2 | 0.2 | Sum of DP 8.4, DP 87, DP 88 & DP 89<br>Pond C Outlet Structure |
| | 91 | D1 | 3.06 | 0.49 | 11.45 | 1.51 | 2.12 | 3.20 | | | | | | | | 3.20 | 1.51 | 1.0 | 18 | 19 | 5.2 | 0.1 | Sump Inlet<br>Piped to DP 9.0 |
| | 92 | D2 | 3.07 | 0.51 | 11.35 | 1.56 | 2.13 | 3.32 | | | | | | | | 3.32 | 1.56 | 1.0 | 18 | 19 | 5.3 | 0.1 | Sump Inlet<br>Piped to DP 9.0 |
| | 9.0 | | | | | | | | 11.51 | 3.07 | 2.11 | 6.48 | | | | 6.48 | 3.07 | 1.0 | 24 | 210 | 6.1 | 0.6 | Sum of DP 91 & DP 92<br>Piped to DP 9.1 |
| | 93 | D3 | 1.77 | 0.48 | 8.64 | 0.86 | 2.36 | 2.03 | | | | | | | | 2.03 | 0.86 | 1.0 | 18 | 21 | 4.6 | 0.1 | Sump Inlet<br>Piped to DP 9.1 |
| | 94 | D4 | 1.65 | 0.59 | 9.15 | 0.97 | 2.32 | 2.25 | | | | | | | | 2.25 | 0.97 | 1.0 | 18 | 21 | 4.6 | 0.1 | Sump Inlet<br>Piped to DP 9.1 |
| | 9.1 | | | | | | | | 12.08 | 4.90 | 2.07 | 10.14 | 10.1 | 4.90 | 4.0 | | | | | 958 | 4.0 | 4.0 | Sum of DP 9.0, DP 93 & DP 94<br>Swale Conveyance to DP 9.2 |
| | 95 | D5 | 11.36 | 0.18 | 16.83 | 2.01 | 1.78 | 3.58 | | | | | 3.6 | 2.01 | 4.0 | | | | | 0 | 4.0 | 0.0 | Pond D<br>Pond Conveyance to DP 9.2 |
| | 9.2 | | | | | | | | 16.83 | 6.91 | 1.78 | 12.30 | | | | | | | | | | | Sum of 9.1 and DP 95<br>Pond D Outlet Structure |
| | OS3 | OS3 | 0.14 | 0.60 | 5.00 | 0.08 | 2.81 | 0.22 | | | | | 0.22 | 0.08 | 4.0 | | | | | | | | Overland Flow<br>Future road conveyance to DP OS3 |
| | OS4 | OS4 | 0.72 | 0.15 | 7.73 | 0.11 | 2.46 | 0.27 | | | | | 0.27 | 0.11 | 18.0 | | | | | | | | Overland Flow<br>Surface conveyance offsite to DP OS4 |
| | OS5 | OS5 | 1.69 | 0.23 | 8.34 | 0.39 | 2.40 | 0.94 | | | | | 0.94 | 0.39 | 14.0 | | | | | | | | Overland Flow<br>Surface conveyance offsite to DP OS5 |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | 71 | A1 | 1.39 | 0.15 | 12.56 | 0.21 | 5.86 | 1.23 | | | | | | | | 1.23 | 0.21 | 1.0 | 18 | 50 | 3.9 | 0.2 | Type C Inlet<br>Piped to DP 7.0 |
| | 72 | A2 | 1.32 | 0.63 | 7.77 | 0.83 | 7.07 | 5.87 | 19.47 | 1.68 | 4.75 | 7.97 | | | | 7.97 | 1.68 | 1.0 | 18 | 3 | 6.5 | 0.0 | Sump Inlet<br>Sum of carryover from DP74 and Sub-Basin A2,Piped to DP 7.0 |
| | 7.0 | | | | | | | | 19.47 | 1.89 | 4.75 | 8.97 | | | | 8.97 | 1.89 | 1.0 | 18 | 60 | 6.7 | 0.2 | Sum of DP 71 & DP 72<br>Piped to DP 7.1 |
| | 73 | A3 | 0.45 | 0.72 | 5.57 | 0.32 | 7.84 | 2.51 | | | | | | | | 2.51 | 0.32 | 1.0 | 18 | 21 | 4.9 | 0.1 | Sump Inlet<br>Piped to DP 7.1 |
| | 7.1 | | | | | | | | 19.62 | 2.21 | 4.73 | 10.44 | | | | 10.44 | 2.21 | 1.0 | 18 | 147 | 6.8 | 0.4 | Sum of DP 7.0 & DP 73<br>Piped to DP 20.2 |
| | 74 | A4 | 6.00 | 0.41 | 18.32 | 2.46 | 4.90 | 12.05 | | | | | 4.2 | 0.85 | 1.4 | 7.90 | 1.61 | 5.0 | 18 | 164<br>102 | 2.4<br>12.0 | 1.2<br>0.1 | On-grade inlet, carryover flow to DP 72<br>Piped to DP 7.2 |
| | 7.2 | | | | | | | | 19.98 | 3.82 | 4.68 | 17.88 | | | | 17.88 | 3.82 | 2.5 | 24 | 320 | 11.4 | 0.5 | Sum of DP 7.1 & DP 74<br>Piped to DP 20.3 |
| | 75 | A5 | 1.03 | 0.43 | 12.70 | 0.44 | 5.83 | 2.57 | | | | | | | | 2.57 | 0.44 | 1.6 | 18 | 73 | 5.8 | 0.2 | On-grade inlet<br>Piped to DP 7.3 |
| | 7.3 | | | | | | | | 20.45 | 4.26 | 4.63 | 19.72 | | | | 19.72 | 4.26 | 1.0 | 24 | 107 | 8.1 | 0.2 | Sum of DP 7.2 & DP 75<br>Piped/Pond conveyance to DP 20.4 |
| | 76 | A6 | 1.09 | 0.29 | 7.96 | 0.32 | 7.01 | 2.24 | | | | | 2.24 | 0.32 | 0.5 | | | | | | | | Pond A<br>Pond conveyance to DP 7.4 |
| | 7.4 | | | | | | | | 20.67 | 4.58 | 4.60 | 21.07 | | | | | | | | | | | Pond A Outlet Structure<br>Release into existing storm sewer along Monaghans |
| | OS1 | OS1 | 21.79 | 0.61 | 14.72 | 8.99 | 5.45 | 49.00 | | | | | | | | 49.00 | 8.99 | 0.3 | 30 | 57 | 10.0 | 0.1 | Existing 30" Culvert<br>Piped to DP 1.0 |
| | 1 | B1 | 1.36 | 0.76 | 6.68 | 1.03 | 7.43 | 7.65 | | | | | | | | 7.65 | 1.03 | 0.3 | 30 | 3 | 4.1 | 0.0 | Future Sump Inlet<br>Piped to DP 1.0 |
| | 1.0 | | | | | | | | 14.81 | 10.02 | 5.44 | 54.51 | 54.51 | 10.02 | 3.0 | | | | | 580 | 3.5 | 2.8 | Sum of DP OS1 and DP 1<br>Swale Conveyance to DP 1.2 |
| | OS2 | OS2 | 13.65 | 0.61 | 13.87 | 6.07 | 5.60 | 34.00 | | | | | | | | 34.00 | 6.07 | 5.0 | 30 | 41 | 17.2 | 0.0 | Existing 24" Culvert<br>Piped to DP 1.1 |
| | 2 | B2 | 1.54 | 0.75 | 7.22 | 1.16 | 7.24 | 8.40 | | | | | | | | 8.40 | 1.16 | 0.3 | 30 | 3 | 4.2 | 0.0 | Future Sump Inlet<br>Piped to DP 1.1 |
| | 1.1 | | | | | | | | 13.91 | 7.23 | 5.60 | 40.50 | 40.50 | 7.23 | 5.5 | | | | | 337 | 4.7 | 1.2 | Sum of DP OS2 and DP 2<br>Swale Conveyance to DP 1.2 |
| | 3 | B3 | 8.43 | 0.31 | 13.96 | 2.62 | 5.59 | 14.65 | | | | | | | | 14.65 | 2.62 | 8.0 | 48 | 0 | 15.3 | 0.0 | 48" Culvert<br>Piped to DP 1.2 |
| | 1.2 | | | | | | | | 17.60 | 19.87 | 5.00 | 99.36 | | | | 99.36 | 19.87 | 8.0 | 48 | 83 | 26.6 | 0.1 | Sum of DP 1.0, DP 1.1 & DP 3<br>Piped to DP 1.5 |
| | 4 | B4 | 2.30 | 0.66 | 13.26 | 1.52 | 5.72 | 8.69 | | | | | | | | 8.69 | 1.52 | 1.0 | 18 | 21 | 6.7 | 0.1 | Sump Inlet<br>Piped to DP 1.3 |
| | 5 | B5 | 1.50 | 0.65 | 10.09 | 0.98 | 6.42 | 6.29 | | | | | | | | 6.29 | 0.98 | 1.0 | 18 | 21 | 6.2 | 0.1 | Sump Inlet<br>Piped to DP 1.3 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | 1.3 | | | | | | | | 13.31 | 2.50 | 5.71 | 14.28 | | | | 14.28 | 2.50 | 1.0 | 18 | 42 | 8.1 | 0.1 | Sum of DP 4 & DP 5<br>Piped to DP 1.5 |
| | 6 | B6 | 1.46 | 0.66 | 9.14 | 0.97 | 6.67 | 6.47 | | | | | | | | 6.47 | 0.97 | 1.0 | 18 | 19 | 6.3 | 0.1 | Sump Inlet<br>Piped to DP 1.3 |
| | 7 | B7 | 2.66 | 0.65 | 11.96 | 1.74 | 5.98 | 10.41 | | | | | | | | 10.41 | 1.74 | 1.0 | 18 | 19 | 6.8 | 0.0 | Sump Inlet<br>Piped to DP 1.3 |
| | 1.4 | | | | | | | | 12.00 | 2.71 | 5.97 | 16.18 | | | | 16.18 | 2.71 | 3.0 | 18 | 357 | 11.7 | 0.5 | Sum of DP 6 & DP 7<br>Piped to DP 1.5 |
| | 1.5 | | | | | | | | 17.65 | 25.08 | 4.99 | 125.16 | 125.16 | 25.08 | 3.2 | | | | | 371 | 5.0 | 1.2 | Sum of DP 1.2, DP 1.3, & DP 1.4<br>Channel conveyance to DP 1.8 |
| | 8 | B8 | 1.76 | 0.66 | 9.76 | 1.17 | 6.50 | 7.61 | | | | | | | | 7.61 | 1.17 | 1.0 | 18 | 338 | 6.5 | 0.9 | Type C Inlet<br>Piped to DP 1.6 |
| | 9 | B9 | 1.53 | 0.65 | 9.16 | 1.00 | 6.66 | 6.66 | | | | | 3.0 | 0.44 | 2.5 | 3.70 | 0.56 | 1.0 | 18 | 236<br>19 | 3.2<br>5.4 | 1.2<br>0.1 | On-grade inlet, carryover flow to DP 10<br>Piped to DP 1.6 |
| | 1.6 | | | | | | | | 10.63 | 1.73 | 6.28 | 10.84 | | | | 10.84 | 1.73 | 2.0 | 18 | 240 | 9.2 | 0.4 | Sum of DP 8 & DP 9<br>Piped to DP 1.7 |
| | 10 | B10 | 2.40 | 0.66 | 8.94 | 1.58 | 6.72 | 10.62 | 10.41 | 2.02 | 6.34 | 12.83 | | | | 12.83 | 2.02 | 1.0 | 18 | 19 | 7.3 | 0.0 | Sump Inlet<br>Sum of carryover from DP9 and Sub-Basin B10,Piped to DP 1.7 |
| | 11 | B11 | 0.44 | 0.68 | 6.59 | 0.30 | 7.46 | 2.24 | | | | | | | | 2.24 | 0.30 | 1.0 | 18 | 19 | 4.7 | 0.1 | Sump Inlet<br>Piped to DP 1.7 |
| | 1.7 | | | | | | | | 11.07 | 4.05 | 6.18 | 25.03 | | | | 25.03 | 4.05 | 5.0 | 24 | 475 | 15.9 | 0.5 | Sum of DP 1.6, DP 10, & DP 11<br>Piped to DP 1.8 |
| | 1.8 | | | | | | | | 18.89 | 29.13 | 4.82 | 140.42 | 140.42 | 29.13 | 3.0 | | | | | 386 | 5.0 | 1.3 | Sum of DP 1.5 & DP 1.7<br>Channel conveyance to DP 2.7 |
| | 12 | B12 | 0.48 | 0.73 | 6.52 | 0.35 | 7.48 | 2.62 | | | | | | | | 2.62 | 0.35 | 1.0 | 18 | 19 | 4.9 | 0.1 | Sump Inlet<br>Piped to DP 1.9 |
| | 13 | B13 | 2.33 | 0.50 | 11.80 | 1.16 | 6.02 | 6.98 | | | | | | | | 6.98 | 1.16 | 1.0 | 18 | 19 | 6.3 | 0.1 | Sump Inlet<br>Piped to DP 1.9 |
| | 1.9 | | | | | | | | 11.85 | 1.51 | 6.01 | 9.08 | | | | 9.08 | 1.51 | 4.0 | 18 | 843 | 11.4 | 1.2 | Sum of DP 12 & DP 13<br>Piped to DP 2.5 |
| | 14 | B14 | 1.54 | 0.79 | 6.88 | 1.21 | 7.36 | 8.91 | | | | | 2.2 | 0.30 | 1.5 | 6.70 | 0.91 | 2.7 | 18 | 206<br>167 | 2.4<br>9.1 | 1.4<br>0.3 | On-grade inlet, carryover flow to DP 16<br>Piped to DP 2.0 |
| | 15 | B15 | 2.20 | 0.22 | 13.20 | 0.48 | 5.73 | 2.75 | | | | | | | | 2.75 | 0.48 | 1.0 | 18 | 65 | 4.9 | 0.2 | Type C Inlet<br>Piped to DP 2.0 |
| | 2.0 | | | | | | | | 13.42 | 1.39 | 5.69 | 7.91 | | | | 7.91 | 1.39 | 1.5 | 18 | 64 | 7.7 | 0.1 | Sum of DP 14 & DP 15<br>Piped to DP 2.1 |
| | 16 | B16 | 0.66 | 0.72 | 8.28 | 0.47 | 6.91 | 3.25 | 12.25 | 1.38 | 5.92 | 8.18 | | | | 8.18 | 1.38 | 1.0 | 18 | 22 | 6.5 | 0.1 | Sump Inlet<br>Sum of carryover from DP14, DP 18, and Sub-Basin B16,Piped to DP 2.1 |
| | 17 | B17 | 0.37 | 0.80 | 5.00 | 0.29 | 8.07 | 2.34 | | | | | | | | 2.34 | 0.29 | 1.0 | 18 | 32 | 4.7 | 0.1 | Sump Inlet<br>Piped to DP 2.1 |
| | 2.1 | | | | | | | | 13.56 | 3.06 | 5.66 | 17.34 | | | | 17.34 | 3.06 | 1.0 | 24 | 126 | 8.0 | 0.3 | Sum of DP 2.0, DP 16 & DP 17<br>Piped to DP 2.3 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | | | | | | | | | | | | | 3.8 | 0.61 | 3.0 | | | | | 186 | 3.5 | 0.9 | On-grade inlet, carryover flow to DP 16 |
| | 18 | B18 | 1.97 | 0.64 | 11.35 | 1.25 | 6.12 | 7.65 | | | | | | | | 3.90 | 0.64 | 1.0 | 18 | 28 | 5.4 | 0.1 | Piped to DP 2.2 |
| | | | | | | | | | | | | | 2.3 | 0.35 | 1.9 | | | | | 308 | 2.8 | 1.9 | On-grade inlet, carryover flow to DP 20 |
| | 19 | B19 | 1.28 | 0.67 | 9.10 | 0.86 | 6.68 | 5.74 | | | | | | | | 3.40 | 0.51 | 1.0 | 18 | 28 | 5.3 | 0.1 | Piped to DP 2.2 |
| | | | | | | | | | | | | | | | | | | | | | | | Sum of DP 18 & DP 19 |
| | 2.2 | | | | | | | | 11.44 | 1.15 | 6.10 | 6.99 | | | | 6.99 | 1.15 | 3.0 | 18 | 103 | 9.5 | 0.2 | Piped to DP 2.3 |
| | | | | | | | | | | | | | | | | | | | | | | | Sum of DP 2.1 & DP 2.2 |
| | 2.3 | | | | | | | | 13.83 | 4.21 | 5.61 | 23.61 | | | | 23.61 | 4.21 | 2.0 | 24 | 262 | 11.1 | 0.4 | Piped to DP 2.4 |
| | | | | | | | | | | | | | | | | | | | | | | | On-grade Inlet |
| | 20 | B20 | 0.66 | 0.69 | 7.99 | 0.46 | 7.00 | 3.22 | 10.96 | 0.81 | 6.20 | 5.03 | | | | 5.03 | 0.81 | 1.0 | 18 | 32 | 5.9 | 0.1 | Sum of carryover from DP19 and Sub-Basin B20,Piped to DP 2.4 |
| | | | | | | | | | | | | | | | | | | | | | | | Sum of DP 2.3 & DP 20 |
| | 2.4 | | | | | | | | 14.22 | 5.02 | 5.54 | 27.81 | | | | 27.81 | 5.02 | 0.5 | 30 | 56 | 6.7 | 0.1 | Piped to DP 2.6 |
| | | | | | | | | | | | | | 2.5 | 0.39 | 4.0 | | | | | 921 | 4.0 | 3.8 | On-grade inlet, carryover flow to DP 26 |
| | 21 | B21 | 2.61 | 0.64 | 9.94 | 1.66 | 6.45 | 10.71 | | | | | | | | 8.20 | 1.27 | 1.0 | 18 | 19 | 6.6 | 0.0 | Piped to DP 2.5 |
| | | | | | | | | | | | | | 2.6 | 0.41 | 4.0 | | | | | 896 | 4.0 | 3.7 | On-grade inlet, carryover flow to DP 27 |
| | 22 | B22 | 1.45 | 0.67 | 10.02 | 0.97 | 6.43 | 6.24 | | | | | | | | 3.60 | 0.56 | 1.0 | 18 | 19 | 5.3 | 0.1 | Piped to DP 2.5 |
| | | | | | | | | | | | | | | | | | | | | | | | Sum of DP 1.9, DP 21 & DP 22 |
| | 2.5 | | | | | | | | 13.08 | 3.34 | 5.75 | 19.21 | | | | 19.21 | 3.34 | 4.0 | 24 | 87 | 13.8 | 0.1 | Piped to DP 2.6 |
| | | | | | | | | | | | | | | | | | | | | | | | Sum of DP 2.4 & DP 2.5 |
| | 2.6 | | | | | | | | 14.36 | 8.36 | 5.51 | 46.07 | | | | 46.07 | 8.36 | 3.0 | 30 | 365 | 15.4 | 0.4 | Piped to DP 2.7 |
| | | | | | | | | | | | | | 174.72 | 37.49 | 3.3 | | | | | 723 | 6.0 | 2.0 | Sum of DP 1.8 & DP 2.6 |
| | 2.7 | | | | | | | | 20.18 | 37.49 | 4.66 | 174.72 | | | | | | | | | | | Channel conveyance to DP 2.8 |
| | | | | | | | | | | | | | | | | | | | | | | | 84" Culvert |
| | 23 | B23 | 22.95 | 0.41 | 18.20 | 9.38 | 4.91 | 46.06 | | | | | | | | 46.06 | 9.38 | 8.0 | 48 | 0 | 21.4 | 0.0 | Piped to DP 2.8 |
| | | | | | | | | | | | | | | | | | | | | | | | 84" Culvert |
| | 2.8 | | | | | | | | 22.19 | 46.87 | 4.43 | 207.65 | | | | 207.65 | 46.87 | 4.0 | 84 | 179 | 24.4 | 0.1 | Piped to DP 5.6 |
| | | | | | | | | | | | | | 3.4 | 0.58 | 2.8 | | | | | 347 | 3.3 | 1.7 | On-grade inlet, carryover flow to DP 30 |
| | 24 | B24 | 3.41 | 0.62 | 13.03 | 2.11 | 5.76 | 12.15 | | | | | | | | 8.80 | 1.53 | 1.0 | 18 | 21 | 6.7 | 0.1 | Piped to DP 2.9 |
| | | | | | | | | | | | | | 1.8 | 0.28 | 2.8 | | | | | 334 | 3.3 | 1.7 | On-grade inlet, carryover flow to DP 28 |
| | 25 | B25 | 2.35 | 0.63 | 10.34 | 1.49 | 6.35 | 9.46 | | | | | | | | 7.70 | 1.21 | 1.0 | 18 | 21 | 6.5 | 0.1 | Piped to DP 2.9 |
| | | | | | | | | | | | | | | | | | | | | | | | Sum of DP 24 & DP 25 |
| | 2.9 | | | | | | | | 13.08 | 2.74 | 5.75 | 15.76 | | | | 15.76 | 2.74 | 3.0 | 18 | 289 | 11.6 | 0.4 | Piped to DP 3.3 |
| | | | | | | | | | | | | | 5.0 | 0.91 | 2.0 | | | | | 268 | 2.8 | 1.6 | On-grade inlet, carryover flow to DP 28 |
| | 26 | B26 | 3.57 | 0.62 | 14.42 | 2.23 | 5.50 | 12.27 | 14.42 | 2.62 | 5.50 | 14.40 | | | | 9.40 | 1.71 | 1.0 | 18 | 21 | 6.7 | 0.1 | Sum of Carryover from DP21 and Sub-Basin B26 Piped to DP 3.0 |
| | | | | | | | | | | | | | 1.1 | 0.19 | 1.9 | | | | | 295 | 2.8 | 1.8 | On-grade inlet, carryover flow to DP 29 |
| | 27 | B27 | 1.47 | 0.69 | 8.74 | 1.01 | 6.78 | 6.85 | 13.75 | 1.42 | 5.63 | 8.00 | | | | 6.90 | 1.23 | 1.0 | 18 | 21 | 6.3 | 0.1 | Sum of Carryover from DP22 and Sub-Basin B27, Piped to DP 3.0 |
| | | | | | | | | | | | | | | | | | | | | | | | Sum of DP 26 & DP 27 |
| | 3.0 | | | | | | | | 14.47 | 2.93 | 5.49 | 16.11 | | | | 16.11 | 2.93 | 3.5 | 18 | 284 | 12.3 | 0.4 | Piped to DP 3.1 |
| | | | | | | | | | | | | | | | | | | | | | | | Sump Inlet |
| | 28 | B28 | 1.62 | 0.66 | 11.38 | 1.06 | 6.11 | 6.48 | 16.00 | 2.25 | 5.24 | 11.77 | | | | 11.77 | 2.25 | 1.0 | 18 | 19 | 6.7 | 0.0 | Sum of carryover from DP 25, DP26, & Sub-Basin B28,Piped to DP 3.1 |
| | | | | | | | | | | | | | | | | | | | | | | | Sump Inlet |
| | 29 | B29 | 1.19 | 0.65 | 7.77 | 0.77 | 7.07 | 5.44 | 15.53 | 0.96 | 5.31 | 5.12 | | | | 5.12 | 0.96 | 1.0 | 18 | 19 | 5.9 | 0.1 | Sum of carryover from DP27 and Sub-Basin B29,Piped to DP 3.1 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | 3.1 | | | | | | | | 16.05 | 6.15 | 5.23 | 32.14 | | | | 32.14 | 6.15 | 1.0 | 30 | 99 | 9.2 | 0.2 | Sum of DP 3.0, DP 28, & DP 29<br>Piped to DP 3.3 |
| | 30 | B30 | 2.80 | 0.58 | 12.11 | 1.62 | 5.95 | 9.64 | 14.76 | 2.20 | 5.44 | 11.98 | | | | 11.98 | 2.20 | 1.0 | 18 | 19 | 6.8 | 0.0 | Sump Inlet<br>Sum of carryover from DP24 and Sub-Basin B30,Piped to DP 3.2 |
| | 31 | B31 | 1.87 | 0.64 | 9.68 | 1.20 | 6.52 | 7.82 | | | | | | | | 7.82 | 1.20 | 1.0 | 18 | 19 | 6.5 | 0.0 | Sump Inlet<br>Piped to DP 3.2 |
| | 3.2 | | | | | | | | 14.80 | 3.40 | 5.44 | 18.51 | | | | 18.51 | 3.40 | 1.0 | 24 | 19 | 8.0 | 0.0 | Sum of DP 30 & DP 31<br>Piped to DP 3.3 |
| | 3.3 | | | | | | | | 16.22 | 12.29 | 5.20 | 63.90 | | | | 63.90 | 12.29 | 1.0 | 36 | 105 | 10.8 | 0.2 | Sum of DP 2.9, DP 3.1, & DP 3.2<br>Piped to DP 3.4 |
| | 32 | B32 | 0.20 | 0.77 | 5.00 | 0.15 | 8.07 | 1.21 | | | | | | | | 1.21 | 0.15 | 1.0 | 18 | 21 | 3.9 | 0.1 | Sump Inlet<br>Piped to DP 3.4 |
| | 33 | B33 | 0.21 | 0.75 | 5.00 | 0.16 | 8.07 | 1.29 | | | | | | | | 1.29 | 0.16 | 1.0 | 18 | 21 | 4.0 | 0.1 | Sump Inlet<br>Piped to DP 3.4 |
| | 3.4 | | | | | | | | 16.39 | 12.60 | 5.18 | 65.26 | | | | 65.26 | 12.60 | 1.0 | 36 | 127 | 10.8 | 0.2 | Sum of DP 3.3, DP 32, & DP 33<br>Piped to DP 3.8 |
| | 34 | B34 | 1.53 | 0.62 | 11.81 | 0.95 | 6.01 | 5.71 | | | | | | | | 5.71 | 0.95 | 1.0 | 18 | 25 | 6.1 | 0.1 | Sump Inlet<br>Piped to DP 3.5 |
| | 35 | B35 | 0.98 | 0.68 | 6.96 | 0.67 | 7.33 | 4.91 | | | | | | | | 4.91 | 0.67 | 1.0 | 18 | 19 | 5.8 | 0.1 | Sump Inlet<br>Piped to DP 3.5 |
| | 3.5 | | | | | | | | 11.88 | 1.62 | 6.00 | 9.72 | | | | 9.72 | 1.62 | 1.0 | 18 | 595 | 6.8 | 1.5 | Sum of DP 34 & DP 35<br>Piped to DP 3.5A |
| | 36 | B36 | 1.24 | 0.67 | 9.56 | 0.83 | 6.55 | 5.44 | | | | | | | | 5.44 | 0.83 | 1.0 | 18 | 44 | 6.0 | 0.1 | Sump Inlet<br>Piped to DP 3.6 |
| | 37 | B37 | 1.74 | 0.63 | 11.16 | 1.10 | 6.16 | 6.78 | | | | | | | | 6.78 | 1.10 | 1.0 | 18 | 3 | 6.3 | 0.0 | Sump Inlet<br>Piped to DP 3.6 |
| | 3.6 | | | | | | | | 11.17 | 1.93 | 6.16 | 11.89 | | | | 11.89 | 1.93 | 2.0 | 18 | 472 | 9.3 | 0.8 | Sum of DP 36 & DP 37<br>Piped/ Pond Conveyance to DP 5.7 |
| | 33A | B33A | 0.41 | 0.55 | 7.58 | 0.23 | 7.13 | 1.64 | | | | | | | | 1.64 | 0.23 | 1.0 | 18 | 27 | 4.2 | 0.1 | Sump Inlet<br>Piped to DP 3.5A |
| | 33B | B33B | 0.21 | 0.69 | 5.00 | 0.15 | 8.07 | 1.21 | | | | | | | | 1.21 | 0.15 | 1.0 | 18 | 27 | 3.9 | 0.1 | Sump Inlet<br>Piped to DP 3.5A |
| | 3.5A | | | | | | | | 13.35 | 2.00 | 5.70 | 11.40 | | | | 11.40 | 2.00 | 1.0 | 18 | 59 | 6.5 | 0.2 | Sum of DP 3.5, DP36, & DP 37<br>Piped to DP 3.8 |
| | 3.8 | | | | | | | | 16.58 | 14.60 | 5.15 | 75.18 | | | | 75.18 | 14.60 | 0.5 | 42 | 360 | 8.4 | 0.7 | Sum of DP 3.4 & DP 3.5A<br>Piped to DP 3.9A |
| | 38 | B38 | 1.12 | 0.57 | 7.19 | 0.64 | 7.25 | 4.64 | | | | | | | | 4.64 | 0.64 | 1.0 | 18 | 55 | 5.7 | 0.2 | Sump Inlet<br>Piped to DP 3.9 |
| | 39 | B39 | 0.78 | 0.58 | 6.41 | 0.46 | 7.52 | 3.46 | | | | | | | | 3.46 | 0.46 | 1.0 | 18 | 3 | 5.2 | 0.0 | Sump Inlet<br>Piped to DP 3.9 |
| | 3.9 | | | | | | | | 7.35 | 1.10 | 7.20 | 7.92 | | | | 7.92 | 1.10 | 1.0 | 18 | 21 | 6.5 | 0.1 | Sum of DP 38 & DP 39<br>Piped to DP 3.9A |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | 3.9A | | | | | | | | 17.30 | 15.70 | 5.04 | 79.12 | | | | 79.12 | 15.70 | 0.5 | 48 | 45 | 9.0 | 0.1 | Sum of DP 3.8 & DP 3.9<br>Piped to DP 5.6 |
| | 40 | B40 | 1.94 | 0.66 | 11.32 | 1.29 | 6.12 | 7.89 | | | | | | | | 7.89 | 1.29 | 2.3 | 18 | 237 | 8.9 | 0.4 | Type C Inlet<br>Piped to DP 4.0 |
| | 41 | B41 | 0.80 | 0.68 | 7.52 | 0.54 | 7.15 | 3.86 | | | | | 1.1 | 0.15 | 4.0 | 2.80 | 0.39 | 1.0 | 18 | 302<br>19 | 4.0<br>5.0 | 1.3<br>0.1 | On-grade inlet, carryover flow to DP 42<br>Piped to DP 4.0 |
| | 4.0 | | | | | | | | 11.76 | 1.68 | 6.03 | 10.14 | | | | 10.14 | 1.68 | 3.8 | 18 | 342 | 11.5 | 0.5 | Sum of DP 40 & DP 41<br>Piped to DP 4.1 |
| | 42 | B42 | 2.98 | 0.65 | 12.92 | 1.94 | 5.78 | 11.21 | 12.92 | 2.09 | 5.78 | 12.07 | | | | 12.07 | 2.09 | 1.0 | 18 | 22 | 6.8 | 0.1 | Sump Inlet<br>Sum of carryover from DP41 and Sub-Basin B42,Piped to DP 4.1 |
| | 4.1 | | | | | | | | 12.98 | 3.77 | 5.77 | 21.75 | | | | 21.75 | 3.77 | 3.5 | 24 | 282 | 13.5 | 0.3 | Sum of DP 40 & DP 41<br>Piped to DP 4.1 |
| | 43 | B43 | 1.40 | 0.68 | 8.90 | 0.96 | 6.73 | 6.46 | 11.37 | 1.59 | 6.11 | 9.71 | | | | 9.71 | 1.59 | 1.0 | 18 | 19 | 6.7 | 0.0 | Sump Inlet<br>Sum of carryover from DP45 and Sub-Basin B43,Piped to DP 4.2 |
| | 44 | B44 | 0.22 | 0.77 | 5.00 | 0.17 | 8.07 | 1.37 | | | | | | | | 1.37 | 0.17 | 1.0 | 18 | 19 | 4.1 | 0.1 | Sump Inlet<br>Piped to DP 4.2 |
| | 4.2 | | | | | | | | 13.33 | 5.53 | 5.71 | 31.57 | | | | 31.57 | 5.53 | 1.0 | 24 | 79 | 10.1 | 0.1 | Sum of DP 4.1, DP43, & DP 44<br>Piped to DP 4.4 |
| | 45 | B45 | 2.01 | 0.63 | 10.82 | 1.27 | 6.24 | 7.92 | | | | | 3.9 | 0.63 | 4.0 | 4.00 | 0.64 | 2.0 | 18 | 132<br>22 | 4.0<br>7.0 | 0.6<br>0.1 | On-grade inlet, carryover flow to DP 43<br>Piped to DP 4.3 |
| | 46 | B46 | 1.56 | 0.69 | 8.73 | 1.08 | 6.78 | 7.32 | | | | | 3.5 | 0.52 | 4.0 | 3.80 | 0.56 | 1.0 | 18 | 594<br>19 | 4.0<br>5.4 | 2.5<br>0.1 | On-grade inlet, carryover flow to DP 48<br>Piped to DP 4.3 |
| | 4.3 | | | | | | | | 10.87 | 1.20 | 6.23 | 7.49 | | | | 7.49 | 1.20 | 4.0 | 18 | 81 | 10.9 | 0.1 | Sum of DP DP45 & DP 46<br>Piped to DP 4.4 |
| | 4.4 | | | | | | | | 13.46 | 6.73 | 5.68 | 38.23 | | | | 38.23 | 6.73 | 3.4 | 36 | 519 | 15.3 | 0.6 | Sum of DP 4.2 & DP 4.3<br>Piped to DP 4.5 |
| | 47 | B47 | 2.80 | 0.63 | 12.66 | 1.77 | 5.84 | 10.34 | | | | | | | | 10.34 | 1.77 | 2.0 | 18 | 19 | 9.1 | 0.0 | Sump Inlet<br>Piped to DP 4.5 |
| | 48 | B48 | 1.29 | 0.69 | 8.17 | 0.89 | 6.94 | 6.18 | 11.20 | 1.41 | 6.15 | 8.67 | | | | 8.67 | 1.41 | 2.0 | 18 | 19 | 8.6 | 0.0 | Sump Inlet<br>Sum of carryover from DP46 and Sub-Basin B48,Piped to DP 4.5 |
| | 4.5 | | | | | | | | 14.02 | 9.91 | 5.58 | 55.30 | | | | 55.30 | 9.91 | 1.0 | 30 | 127 | 11.3 | 0.2 | Sum of DP 4.4, DP 47, & DP 48<br>Piped to DP 5.4 |
| | 49 | B49 | 6.16 | 0.22 | 12.94 | 1.36 | 5.78 | 7.86 | | | | | | | | 7.86 | 1.36 | 1.0 | 24 | 42 | 6.5 | 0.1 | Proposed Stub<br>Piped to DP 4.6 |
| | 50 | B50 | 0.46 | 0.79 | 5.00 | 0.36 | 8.07 | 2.91 | | | | | | | | 2.91 | 0.36 | 3.0 | 18 | 96 | 7.4 | 0.2 | Future Sump Inlet<br>Piped to DP 4.6 |
| | 4.6 | | | | | | | | 13.05 | 1.72 | 5.76 | 9.91 | | | | 9.91 | 1.72 | 3.0 | 24 | 257 | 10.3 | 0.4 | Sum of DP 49 & DP 50<br>Piped to DP 4.9 |
| | 51 | B51 | 0.85 | 0.79 | 5.30 | 0.67 | 7.95 | 5.33 | | | | | | | | 5.33 | 0.67 | 1.0 | 18 | 19 | 5.9 | 0.1 | Sump Inlet<br>Piped to DP 4.7 |
| | 52 | B52 | 0.96 | 0.68 | 7.89 | 0.65 | 7.03 | 4.57 | | | | | | | | 4.57 | 0.65 | 1.0 | 18 | 19 | 5.7 | 0.1 | Sump Inlet<br>Piped to DP 4.7 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | 4.7 | | | | | | | | 7.95 | 1.32 | 7.01 | 9.25 | | | | 9.25 | 1.32 | 1.0 | 18 | 112 | 6.7 | 0.3 | Sum of DP 51 & DP 52<br>Piped to DP 4.9 |
| | 53 | B53 | 1.33 | 0.67 | 7.71 | 0.89 | 7.08 | 6.30 | | | | | | | | 6.30 | 0.89 | 1.0 | 18 | 19 | 6.2 | 0.1 | Sump Inlet<br>Piped to DP 4.8 |
| | 54 | B54 | 0.56 | 0.68 | 7.50 | 0.38 | 7.15 | 2.72 | | | | | | | | 2.72 | 0.38 | 1.0 | 18 | 19 | 5.0 | 0.1 | Sump Inlet<br>Piped to DP 4.8 |
| | 4.8 | | | | | | | | 7.76 | 1.27 | 7.07 | 8.98 | | | | 8.98 | 1.27 | 1.0 | 18 | 107 | 6.7 | 0.3 | Sum of DP 53 & DP 54<br>Piped to DP 4.9 |
| | 4.9 | | | | | | | | 13.47 | 4.31 | 5.68 | 24.48 | | | | 24.48 | 4.31 | 4.0 | 30 | 313 | 14.5 | 0.4 | Sum of DP 4.6, DP 4.7, & DP 4.8<br>Piped to DP 5.3 |
| | 55 | B55 | 3.16 | 0.65 | 10.18 | 2.04 | 6.39 | 13.04 | | | | | | | | 13.04 | 2.04 | 1.0 | 18 | 19 | 7.4 | 0.0 | Sump Inlet<br>Piped to DP 5.0 |
| | 56 | B56 | 1.09 | 0.68 | 8.40 | 0.74 | 6.88 | 5.09 | | | | | | | | 5.09 | 0.74 | 1.0 | 18 | 19 | 5.9 | 0.1 | Sump Inlet<br>Piped to DP 5.0 |
| | 5.0 | | | | | | | | 10.23 | 2.78 | 6.38 | 17.74 | | | | 17.74 | 2.78 | 2.0 | 24 | 112 | 10.4 | 0.2 | Sum of DP 55 & DP 56<br>Piped to DP 5.3 |
| | 57 | B57 | 0.79 | 0.68 | 11.17 | 0.54 | 6.16 | 3.33 | 15.61 | 1.43 | 5.30 | 7.58 | | | | 7.58 | 1.43 | 2.0 | 18 | 19 | 8.4 | 0.0 | Sump Inlet<br>Sum of carryover from DP59 and Sub-Basin B57,Piped to DP 5.1 |
| | 59 | B59 | 3.96 | 0.62 | 14.37 | 2.47 | 5.51 | 13.61 | | | | | 4.9 | 0.89 | 1.0 | 8.70 | 1.58 | 1.0 | 18 | 149<br>205 | 2.0<br>6.7 | 1.2<br>0.5 | On-grade inlet, carryover flow to DP 57<br>Piped to DP 5.1 |
| | 5.1 | | | | | | | | 15.65 | 3.01 | 5.30 | 15.95 | | | | 15.95 | 3.01 | 1.0 | 24 | 26 | 7.8 | 0.1 | Sum of DP 57 & DP 59<br>Piped to DP 5.2 |
| | 58 | B58 | 2.16 | 0.70 | 9.37 | 1.52 | 6.60 | 10.03 | | | | | | | | 10.03 | 1.52 | 1.0 | 24 | 3 | 6.9 | 0.0 | Sump Inlet<br>Piped to DP 5.2 |
| | 5.2 | | | | | | | | 15.70 | 4.53 | 5.29 | 23.96 | | | | 23.96 | 4.53 | 6.0 | 24 | 163 | 17.0 | 0.2 | Sum of DP 5.1 & DP 58<br>Piped/Pond Conveyance to DP 5.2A |
| | 58A | B58A | 0.98 | 0.47 | 10.75 | 0.46 | 6.26 | 2.88 | | | | | | | | 2.88 | 0.46 | 6.0 | 18 | 42 | 9.6 | 0.1 | Type C Inlet<br>Piped to DP 5.2A |
| | 5.2A | | | | | | | | 15.86 | 4.99 | 5.26 | 26.25 | | | | 26.25 | 4.99 | 6.0 | 24 | 373 | 17.4 | 0.4 | Sum of DP 5.2 & DP 58A<br>Piped to DP 5.7 |
| | 5.3 | | | | | | | | 13.83 | 7.09 | 5.61 | 39.77 | | | | 39.77 | 7.09 | 3.7 | 42 | 245 | 15.8 | 0.3 | Sum of DP 4.9 & DP 5.0<br>Piped to DP 5.3A |
| | 39A | B39A | 0.23 | 0.65 | 5.00 | 0.15 | 8.07 | 1.21 | | | | | | | | 1.21 | 0.15 | 1.0 | 18 | 27 | 3.9 | 0.1 | Sump Inlet<br>Piped to DP 5.3A |
| | 39B | B39B | 0.26 | 0.79 | 5.00 | 0.21 | 8.07 | 1.69 | | | | | | | | 1.69 | 0.21 | 1.0 | 18 | 27 | 4.3 | 0.1 | Sump Inlet<br>Piped to DP 5.3A |
| | 5.3A | | | | | | | | 14.09 | 7.45 | 5.56 | 41.42 | | | | 41.42 | 7.45 | 3.0 | 42 | 59 | 14.9 | 0.1 | Sum of DP 5.3, DP 39A & DP 39B<br>Piped to DP 5.4 |
| | 5.4 | | | | | | | | 14.21 | 17.36 | 5.54 | 96.17 | | | | 96.17 | 17.36 | 3.0 | 48 | 306 | 18.5 | 0.3 | Sum of DP 4.5 & DP 5.3A<br>Piped to DP 5.5 |
| | 61 | B61 | 2.43 | 0.80 | 7.33 | 1.94 | 7.21 | 13.99 | | | | | | | | 13.99 | 1.94 | 1.0 | 18 | 143 | 7.9 | 0.3 | Sump Inlet<br>Piped to DP 5.5 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | 5.5 | | | | | | | | 14.48 | 19.30 | 5.49 | 105.96 | | | | 105.96 | 19.30 | 3.0 | 48 | 32 | 18.9 | 0.0 | Sum of DP 5.4 & DP 61<br>Piped to DP 5.6 |
| | 5.6 | | | | | | | | 22.31 | 81.87 | 4.42 | 361.87 | 22.3 | 81.87 | 0.6 | | | | | 531 | 1.5 | 5.7 | Sum of DP 2.8, DP 3.9A, & DP 5.5<br>Pond Conveyance to DP 5.7 |
| | 62 | B62 | 12.96 | 0.47 | 11.75 | 6.06 | 6.03 | 36.54 | | | | | 36.54 | 6.06 | 0.5 | | | | | | | | Pond B<br>Pond conveyance to DP 5.7 |
| | 5.7 | | | | | | | | 22.31 | 94.85 | 4.42 | 419.25 | | | | | | | | | | | Sum of DP 3.6, DP 5.6, DP 5.2A, and DP 62<br>Pond B Outlet Structure |
| | 81 | C1 | 1.51 | 0.53 | 12.35 | 0.80 | 5.90 | 4.72 | | | | | | | | 4.72 | 0.80 | 1.0 | 18 | 19 | 5.7 | 0.1 | Sump Inlet<br>Piped to DP 8.0 |
| | 82 | C2 | 1.39 | 0.67 | 10.68 | 0.93 | 6.27 | 5.83 | | | | | | | | 5.83 | 0.93 | 1.0 | 18 | 19 | 6.1 | 0.1 | Sump Inlet<br>Piped to DP 8.0 |
| | 8.0 | | | | | | | | 12.40 | 1.73 | 5.89 | 10.19 | | | | 10.19 | 1.73 | 2.5 | 18 | 524 | 9.9 | 0.9 | Sum of DP 81 & DP 82<br>Piped to DP 8.2 |
| | 83 | C3 | 1.74 | 0.63 | 11.99 | 1.10 | 5.98 | 6.58 | 14.14 | 1.87 | 5.55 | 10.37 | | | | 10.37 | 1.87 | 2.0 | 18 | 26 | 9.0 | 0.0 | Sump Inlet<br>Sum of carryover from DP 84 and Sub-Basin C3,Piped to DP 8.1 |
| | 84 | C4 | 3.68 | 0.62 | 12.60 | 2.29 | 5.85 | 13.40 | | | | | 4.5 | 0.77 | 1.0 | 8.90 | 1.52 | 2.5 | 18 | 185<br>211 | 2.0<br>9.4 | 1.5<br>0.4 | On-grade inlet, carryover flow to DP 83<br>Piped to DP 8.1 |
| | 8.1 | | | | | | | | 14.19 | 3.39 | 5.54 | 18.78 | | | | 18.78 | 3.39 | 1.0 | 18 | 27 | 10.6 | 0.0 | Sum of DP 83 & DP 84<br>Piped to DP 8.2 |
| | 8.2 | | | | | | | | 14.24 | 5.12 | 5.54 | 28.36 | | | | 28.36 | 5.12 | 1.0 | 24 | 21 | 9.0 | 0.0 | Sum of DP 8.0 & DP 8.1<br>Piped to DP 8.3 |
| | 85 | C5 | 2.03 | 0.65 | 10.35 | 1.32 | 6.35 | 8.38 | | | | | | | | 8.38 | 1.32 | 1.0 | 18 | 3 | 6.6 | 0.0 | Sump Inlet<br>Piped to DP 8.3 |
| | 8.3 | | | | | | | | 14.27 | 6.44 | 5.53 | 35.61 | | | | 35.61 | 6.44 | 5.0 | 30 | 140 | 17.5 | 0.1 | Sum of DP 8.2 & DP 85<br>Piped to DP 8.4 |
| | 86 | C6 | 1.05 | 0.52 | 9.40 | 0.54 | 6.60 | 3.56 | | | | | | | | 3.56 | 0.54 | 6.0 | 18 | 14 | 10.1 | 0.0 | Type C Inlet<br>Piped to DP 8.4 |
| | 8.4 | | | | | | | | 14.41 | 6.98 | 5.51 | 38.46 | | | | 38.46 | 6.98 | 6.0 | 30 | 89 | 18.9 | 0.1 | Sum of DP 8.3 & DP 86<br>Piped/Pond Conveyance to DP 8.5 |
| | 87 | C7 | 9.17 | 0.68 | 15.01 | 6.20 | 5.40 | 33.48 | | | | | 33.5 | 6.20 | 0.5 | | | | | 484 | 1.4 | 5.7 | Future Storm Infrastructure<br>Piped/Pond Conveyance to DP 8.5 |
| | 88 | C8 | 3.03 | 0.67 | 10.23 | 2.03 | 6.38 | 12.95 | | | | | | | | 12.95 | 2.03 | 5.0 | 24 | 193 | 13.5 | 0.2 | Future Storm Infrastructure<br>Piped/Pond Conveyance to DP 8.5 |
| | 89 | C9 | 4.93 | 0.52 | 10.34 | 2.55 | 6.35 | 16.19 | | | | | 16.19 | 2.55 | 0.5 | | | | | | | | Pond C<br>Pond Conveyance to DP 8.5 |
| | 8.5 | | | | | | | | 20.72 | 17.76 | 4.60 | 81.70 | | | | 81.70 | 17.76 | 5.0 | 30 | 140 | 21.1 | 0.1 | Sum of DP 8.4, DP 87, DP 88 & DP 89<br>Pond C Outlet Structure |
| | 91 | D1 | 3.06 | 0.65 | 11.45 | 1.98 | 6.09 | 12.06 | | | | | | | | 12.06 | 1.98 | 1.0 | 18 | 19 | 6.8 | 0.0 | Sump Inlet<br>Piped to DP 9.0 |
| | 92 | D2 | 3.07 | 0.66 | 11.35 | 2.03 | 6.12 | 12.42 | | | | | | | | 12.42 | 2.03 | 1.0 | 18 | 19 | 7.0 | 0.0 | Sump Inlet<br>Piped to DP 9.0 |

# STANDARD FORM SF-3

## STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: Aurora
Design Storm: 100-Year
$P_1$: 2.38 Inches

Project Name: Trails at Overland Ranch
Project No.: 16118.00
Calculated By: AAM
Checked By:
Date: 6/10/22

| 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) | tc (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) | $t_t$ (min) | |
| | 9.0 | | | | | | | | 11.50 | 4.01 | 6.08 | 24.38 | | | | 24.38 | 4.01 | 1.0 | 24 | 210 | 8.0 | 0.4 | Sum of DP 91 & DP 92<br>Piped to DP 9.1 |
| | 93 | D3 | 1.77 | 0.65 | 8.64 | 1.15 | 6.80 | 7.82 | | | | | | | | 7.82 | 1.15 | 1.0 | 18 | 21 | 6.5 | 0.1 | Sump Inlet<br>Piped to DP 9.1 |
| | 94 | D4 | 1.65 | 0.64 | 9.15 | 1.05 | 6.66 | 6.99 | | | | | | | | 6.99 | 1.05 | 1.0 | 18 | 21 | 6.3 | 0.1 | Sump Inlet<br>Piped to DP 9.1 |
| | 9.1 | | | | | | | | 11.93 | 6.21 | 5.99 | 37.20 | 37.2 | 6.21 | 4.0 | | | | | 958 | 4.0 | 4.0 | Sum of DP 9.0, DP 93 & DP 94<br>Swale Conveyance to DP 9.2 |
| | 95 | D5 | 11.36 | 0.23 | 16.83 | 2.59 | 5.11 | 13.23 | | | | | 13.2 | 2.59 | 4.0 | | | | | 0 | 4.0 | 0.0 | Pond D<br>Pond Conveyance to DP 9.2 |
| | 9.2 | | | | | | | | 16.83 | 8.80 | 5.11 | 44.97 | | | | | | | | | | | Sum of 9.1 and DP 95<br>Pond D Outlet Structure |
| | OS3 | OS3 | 0.14 | 0.65 | 5.00 | 0.09 | 8.07 | 0.73 | | | | | 0.73 | 0.09 | 4.0 | | | | | | | | Overland Flow<br>Future road conveyance to DP OS3 |
| | OS4 | OS4 | 0.72 | 0.20 | 7.73 | 0.14 | 7.08 | 0.99 | | | | | 0.99 | 0.14 | 18.0 | | | | | | | | Overland Flow<br>Surface conveyance offsite to DP OS4 |
| | OS5 | OS5 | 1.69 | 0.33 | 8.34 | 0.55 | 6.89 | 3.79 | | | | | 3.79 | 0.55 | 14.0 | | | | | | | | Overland Flow<br>Surface conveyance offsite to DP OS5 |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

# APPENDIX C
# HYDRAULIC CALCULATIONS

**10-Year Input**

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| Basin B | 1 | RAINGAGE | 0.225 | 0.282 | 0.574 | 0.040 | 43.0 | 0.35 | 0.10 | 4.50 | 0.60 | 0.0018 | 0.00 | 0.82 | 0.21 | 40.90 |

**10-Year Output**

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

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| Basin B | | 0.093 | 0.241 | 16.3 | 4.52 | 8.5 | 3.19 | 7.5 | 415 | 522,430 | 0.66 | 343,911 | 30.0 | 134 | 342,687 | 0.93 |

**100-Year Input**

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| Basin B | 1 | RAINGAGE | 0.225 | 0.282 | 0.574 | 0.040 | 43.0 | 0.35 | 0.10 | 4.50 | 0.60 | 0.0018 | 0.00 | 0.82 | 0.21 | 41.69 |

**100-Year Output**

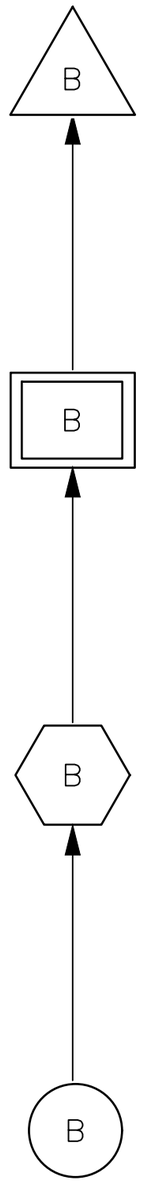
**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)**

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| Basin B | | 0.092 | 0.244 | 16.0 | 4.50 | 8.3 | 3.18 | 7.5 | 421 | 522,430 | 1.76 | 917,781 | 35.0 | 379 | 914,780 | 2.63 |

Data Category

- [TITLE]
- [OPTIONS]
- [FILES]
- [EVAPORATION]
- [JUNCTIONS]
- [OUTFALLS]
- [STORAGE]
- [CONDUITS]
- [OUTLETS]
- [XSECTIONS]
- [CURVES]
- [REPORT]

| Name | Type | X-Value | Y-Value |
|---|---|---|---|
| PondBOutlet | Rating | .5 | .19 |
| PondBOutlet | | 1 | .27 |
| PondBOutlet | | 1.5 | .38 |
| PondBOutlet | | 2 | .59 |
| PondBOutlet | | 2.5 | .71 |
| PondBOutlet | | 3 | .89 |
| PondBOutlet | | 3.5 | 1.11 |
| PondBOutlet | | 4 | 1.27 |
| PondBOutlet | | 4.5 | 1.4 |
| PondBOutlet | | 5 | 1.52 |
| PondBOutlet | | 5.5 | 1.63 |
| PondBOutlet | | 6 | 5.09 |
| PondBOutlet | | 6.5 | 67.29 |
| PondBOutlet | | 7 | 139.61 |
| PondBOutlet | | 7.5 | 146.25 |
| PondBOutlet | | 8 | 152.6 |
| PondBOutlet | | 8.5 | 158.7 |
| PondBOutlet | | 9 | 164.57 |
| PondBOutlet | | 9.5 | 170.24 |
| PondBOutlet | | 10 | 227.51 |
| PondBOutlet | | 10.5 | 391.23 |
| PondBOutlet | | 11 | 619.93 |
| ; | | | |
| PondB | Storage | 0 | 100 |
| PondB | | .33 | 200 |
| PondB | | 1.33 | 4553 |
| PondB | | 2.33 | 24854 |
| PondB | | 3.33 | 58812 |
| PondB | | 4.33 | 84656 |
| PondB | | 5.33 | 96914 |
| PondB | | 6.33 | 103463 |
| PondB | | 7.33 | 109614 |
| PondB | | 8.33 | 115825 |
| PondB | | 9.33 | 122096 |
| PondB | | 10.33 | 129138 |
| PondB | | 11.33 | 136316 |
| PondB | | 11.83 | 143627 |




## LEGEND

- B — SUB–WATERSHED
- B — OUTFALL
- B — DETENTION POND
- B — POND OUTLET STRUCTURE

SWMM MODEL
SCHEMATICS
POND B
JOB NO. 16118.00
6/28/22
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303–740–9393 • Colorado Springs 719–593–2593
Fort Collins 970–491–9888 • www.jrengineering.com

**10-YEAR SUMMARY REPORT**
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
---

**********
Analysis Options
**********
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date ..... 01/01/2005 00:00:00
Ending Date ..... 01/05/2005 06:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:15:00
Routing Time Step ..... 30.00 sec

| Flow Routing Continuity | Volume acre-feet | Volume 10^6 gal |
|---|---|---|
| Dry Weather Inflow ..... | 0.000 | 0.000 |
| Wet Weather Inflow ..... | 0.000 | 0.000 |
| Groundwater Inflow ..... | 0.000 | 0.000 |
| RDII Inflow ..... | 0.000 | 0.000 |
| External Inflow ..... | 7.867 | 2.563 |
| External Outflow ..... | 7.866 | 2.563 |
| Flooding Loss ..... | 0.000 | 0.000 |
| Evaporation Loss ..... | 0.000 | 0.000 |
| Exfiltration Loss ..... | 0.000 | 0.000 |
| Initial Stored Volume .... | 0.000 | 0.000 |
| Final Stored Volume ..... | 0.000 | 0.000 |
| Continuity Error (%) ..... | 0.015 | |

**********
Highest Flow Instability Indexes
**********
All links are stable.

**********
Routing Time Step Summary
**********
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 1.00
% of Steps Not Converging : 0.00

**********
Node Depth Summary
**********

| Node | Type | Average Depth Feet | Maximum Depth Feet | Maximum HGL Feet | Time of Max Occurrence days hr:min | Reported Max Depth Feet |
|---|---|---|---|---|---|---|
| 1 | JUNCTION | 0.00 | 0.00 | 6049.80 | 0 00:00 | 0.00 |
| 3 | OUTFALL | 0.00 | 0.00 | 6036.00 | 0 00:00 | 0.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | STORAGE | 2.52 | 6.10 | 6046.10 | 0 | 01:57 | 6.10 | |

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

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Time of Max Occurrence days hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|
| 1 | JUNCTION | 134.03 | 134.03 | 0 00:30 | 2.56 | 2.56 | 0.000 |
| 3 | OUTFALL | 0.00 | 15.32 | 0 01:57 | 0 | 2.56 | 0.000 |
| 2 | STORAGE | 0.00 | 134.03 | 0 00:30 | 0 | 2.56 | 0.015 |

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

No nodes were flooded.

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

| Storage Unit | Average Volume 1000 ft³ | Avg Pcnt Full | Evap Pcnt Loss | Exfil Pcnt Loss | Maximum Volume 1000 ft³ | Max Pcnt Full | Time of Max Occurrence days hr:min | Maximum Outflow CFS |
|---|---|---|---|---|---|---|---|---|
| 2 | 73.856 | 6 | 0 | 0 | 297.899 | 26 | 0 01:57 | 15.32 |

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

| Outfall Node | Flow Freq Pcnt | Avg Flow CFS | Max Flow CFS | Total Volume 10^6 gal |
|---|---|---|---|---|
| 3 | 66.19 | 1.41 | 15.32 | 2.563 |
| System | 66.19 | 1.41 | 15.32 | 2.563 |

**********
Link Flow Summary
**********

| Link | Type | Maximum \|Flow\| CFS | Time of Max Occurrence days hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|
| 1 | DUMMY | 134.03 | 0 00:30 | | | |
| 2 | DUMMY | 15.32 | 0 01:57 | | | |

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

No conduits were surcharged.

Analysis begun on:  Thu Oct 20 14:19:00 2022
Analysis ended on:  Thu Oct 20 14:19:00 2022
Total elapsed time: < 1 sec

**100-YEAR SUMMARY REPORT**
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.1)
---

**********
Analysis Options
**********
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date ..... 01/01/2005 00:00:00
Ending Date ..... 01/05/2005 06:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:15:00
Routing Time Step ..... 30.00 sec

| Flow Routing Continuity | Volume acre-feet | Volume 10^6 gal |
|---|---|---|
| Dry Weather Inflow ..... | 0.000 | 0.000 |
| Wet Weather Inflow ..... | 0.000 | 0.000 |
| Groundwater Inflow ..... | 0.000 | 0.000 |
| RDII Inflow ..... | 0.000 | 0.000 |
| External Inflow ..... | 21.000 | 6.843 |
| External Outflow ..... | 20.987 | 6.839 |
| Flooding Loss ..... | 0.000 | 0.000 |
| Evaporation Loss ..... | 0.000 | 0.000 |
| Exfiltration Loss ..... | 0.000 | 0.000 |
| Initial Stored Volume .... | 0.000 | 0.000 |
| Final Stored Volume ..... | 0.000 | 0.000 |
| Continuity Error (%) ..... | 0.060 | |

**********
Highest Flow Instability Indexes
**********
All links are stable.

**********
Routing Time Step Summary
**********
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 1.00
% of Steps Not Converging : 0.00

**********
Node Depth Summary
**********

| Node | Type | Average Depth Feet | Maximum Depth Feet | Maximum HGL Feet | Time of Max Occurrence days hr:min | Reported Max Depth Feet |
|---|---|---|---|---|---|---|
| 1 | JUNCTION | 0.00 | 0.00 | 6049.80 | 0 00:00 | 0.00 |
| 3 | OUTFALL | 0.00 | 0.00 | 6036.00 | 0 00:00 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | STORAGE | 2.56 | 8.44 | 6048.44 | 0 | 01:15 | 8.44 |

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

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Time of Max Occurrence days hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|
| 1 | JUNCTION | 378.93 | 378.93 | 0 00:35 | 6.84 | 6.84 | 0.000 |
| 3 | OUTFALL | 0.00 | 122.34 | 0 01:15 | 0 | 6.84 | 0.000 |
| 2 | STORAGE | 0.00 | 378.93 | 0 00:35 | 0 | 6.84 | 0.060 |

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

No nodes were flooded.

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

| Storage Unit | Average Volume 1000 ft³ | Avg Pcnt Full | Evap Pcnt Loss | Exfil Pcnt Loss | Maximum Volume 1000 ft³ | Max Pcnt Full | Time of Max Occurrence days hr:min | Maximum Outflow CFS |
|---|---|---|---|---|---|---|---|---|
| 2 | 77.658 | 7 | 0 | 0 | 554.269 | 48 | 0 01:15 | 122.34 |

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

| Outfall Node | Flow Freq Pcnt | Avg Flow CFS | Max Flow CFS | Total Volume 10^6 gal |
|---|---|---|---|---|
| 3 | 66.42 | 3.75 | 122.34 | 6.838 |
| System | 66.42 | 3.75 | 122.34 | 6.838 |

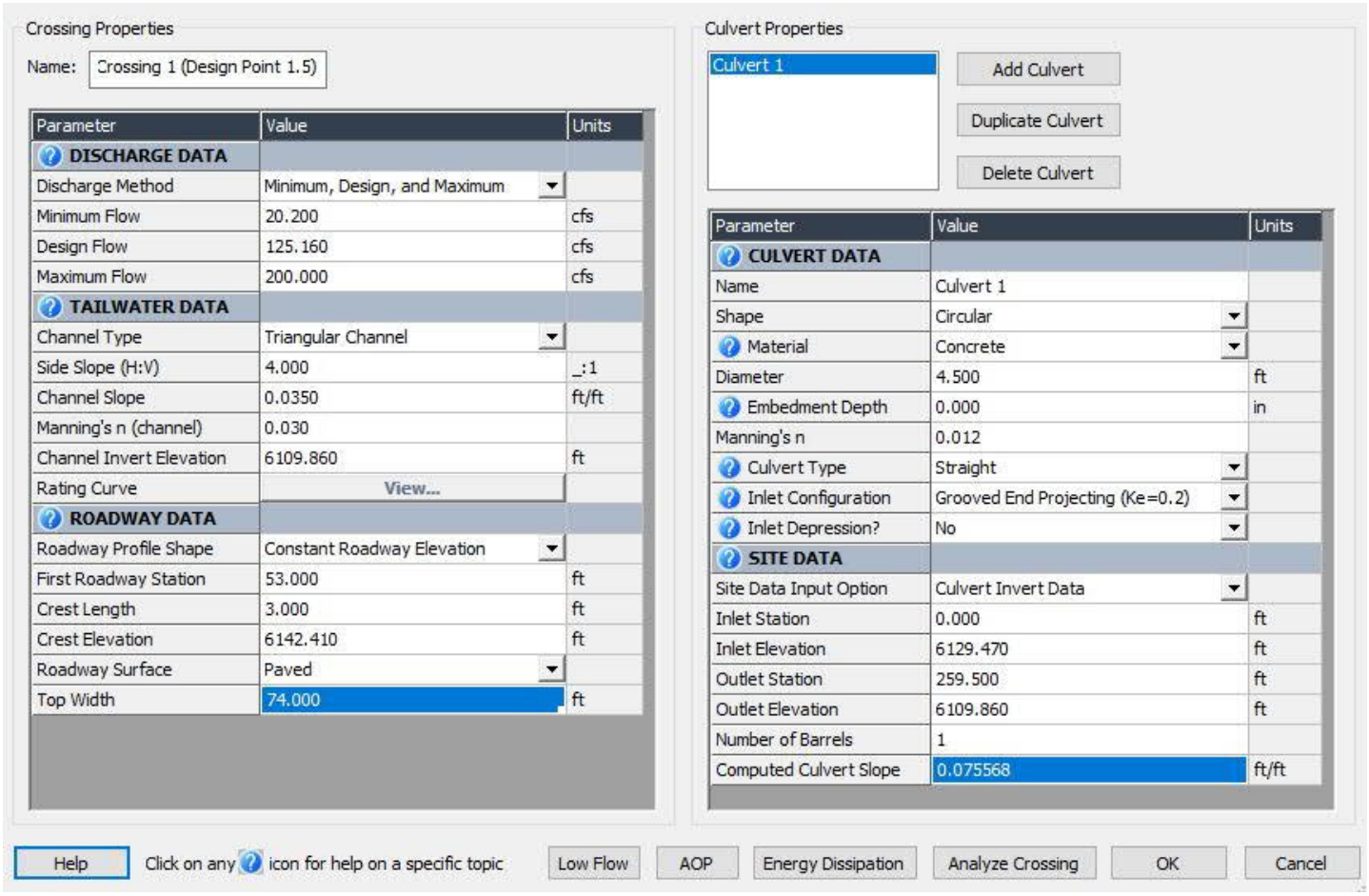
**********
Link Flow Summary
**********

| Link | Type | Maximum \|Flow\| CFS | Time of Max Occurrence days hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|
| 1 | DUMMY | 378.93 | 0 00:35 | | | |
| 2 | DUMMY | 122.34 | 0 01:15 | | | |

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

No conduits were surcharged.

Analysis begun on:  Thu Oct 20 14:05:08 2022
Analysis ended on:  Thu Oct 20 14:05:09 2022
Total elapsed time: 00:00:01


Crossing Properties
Name: Crossing 1 (Design Point 1.5)
Parameter | Value | Units
DISCHARGE DATA
Discharge Method | Minimum, Design, and Maximum
Minimum Flow | 20.200 | cfs
Design Flow | 125.160 | cfs
Maximum Flow | 200.000 | cfs
TAILWATER DATA
Channel Type | Triangular Channel
Side Slope (H:V) | 4.000 | _:1
Channel Slope | 0.0350 | ft/ft
Manning's n (channel) | 0.030
Channel Invert Elevation | 6109.860 | ft
Rating Curve | View...
ROADWAY DATA
Roadway Profile Shape | Constant Roadway Elevation
First Roadway Station | 53.000 | ft
Crest Length | 3.000 | ft
Crest Elevation | 6142.410 | ft
Roadway Surface | Paved
Top Width | 74.000 | ft
Culvert Properties
Culvert 1
Add Culvert
Duplicate Culvert
Delete Culvert
Parameter | Value | Units
CULVERT DATA
Name | Culvert 1
Shape | Circular
Material | Concrete
Diameter | 4.500 | ft
Embedment Depth | 0.000 | in
Manning's n | 0.012
Culvert Type | Straight
Inlet Configuration | Grooved End Projecting (Ke=0.2)
Inlet Depression? | No
SITE DATA
Site Data Input Option | Culvert Invert Data
Inlet Station | 0.000 | ft
Inlet Elevation | 6129.470 | ft
Outlet Station | 259.500 | ft
Outlet Elevation | 6109.860 | ft
Number of Barrels | 1
Computed Culvert Slope | 0.075568 | ft/ft
Help
Click on any icon for help on a specific topic
Low Flow
AOP
Energy Dissipation
Analyze Crossing
OK
Cancel

Crossing Properties

Name: Crossing 2 (Design Point 5.6)

| Parameter | Value | Units |
|---|---|---|
| **DISCHARGE DATA** | | |
| Discharge Method | Minimum, Design, and Maximum | |
| Minimum Flow | 84.090 | cfs |
| Design Flow | 361.870 | cfs |
| Maximum Flow | 500.000 | cfs |
| **TAILWATER DATA** | | |
| Channel Type | Trapezoidal Channel | |
| Bottom Width | 40.000 | ft |
| Side Slope (H:V) | 4.000 | _:1 |
| Channel Slope | 0.0050 | ft/ft |
| Manning's n (channel) | 0.030 | |
| Channel Invert Elevation | 6050.800 | ft |
| Rating Curve | View... | |
| **ROADWAY DATA** | | |
| Roadway Profile Shape | Constant Roadway Elevation | |
| First Roadway Station | 61.000 | ft |
| Crest Length | 29.000 | ft |
| Crest Elevation | 6087.280 | ft |
| Roadway Surface | Paved | |
| Top Width | 100.000 | ft |

Culvert Properties

Culvert 2

Add Culvert

Duplicate Culvert

Delete Culvert

| Parameter | Value | U. |
|---|---|---|
| **CULVERT DATA** | | |
| Name | Culvert 2 | |
| Shape | Concrete Box | |
| Material | Concrete | |
| Span | 7.000 | ft |
| Rise | 6.000 | ft |
| Embedment D... | 0.000 | in |
| Manning's n | 0.012 | |
| Culvert Type | Straight | |
| Inlet Configur... | Square Edge (30-75° flare) Wingwall (Ke... | |
| Inlet Depression? | No | |
| **SITE DATA** | | |
| Site Data Input Op... | Culvert Invert Data | |
| Inlet Station | 0.000 | ft |
| Inlet Elevation | 6058.010 | ft |
| Outlet Station | 287.000 | ft |
| Outlet Elevation | 6050.800 | ft |
| Number of Barrels | 1 | |
| Computed Culvert ... | 0.025122 | f... |

# Culvert Crossing: Crossing 1 (Design Point 1.5)

## Crossing Summary Table

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 6131.11 | 20.20 | 20.20 | 0.00 | 1 |
| 6131.78 | 38.18 | 38.18 | 0.00 | 1 |
| 6132.40 | 56.16 | 56.16 | 0.00 | 1 |
| 6132.93 | 74.14 | 74.14 | 0.00 | 1 |
| 6133.43 | 92.12 | 92.12 | 0.00 | 1 |
| 6133.93 | 110.10 | 110.10 | 0.00 | 1 |
| 6134.38 | 125.16 | 125.16 | 0.00 | 1 |
| 6135.08 | 146.06 | 146.06 | 0.00 | 1 |
| 6135.76 | 164.04 | 164.04 | 0.00 | 1 |
| 6136.54 | 182.02 | 182.02 | 0.00 | 1 |
| 6137.41 | 200.00 | 200.00 | 0.00 | 1 |
| 6142.41 | 281.77 | 281.77 | 0.00 | Overtopping |

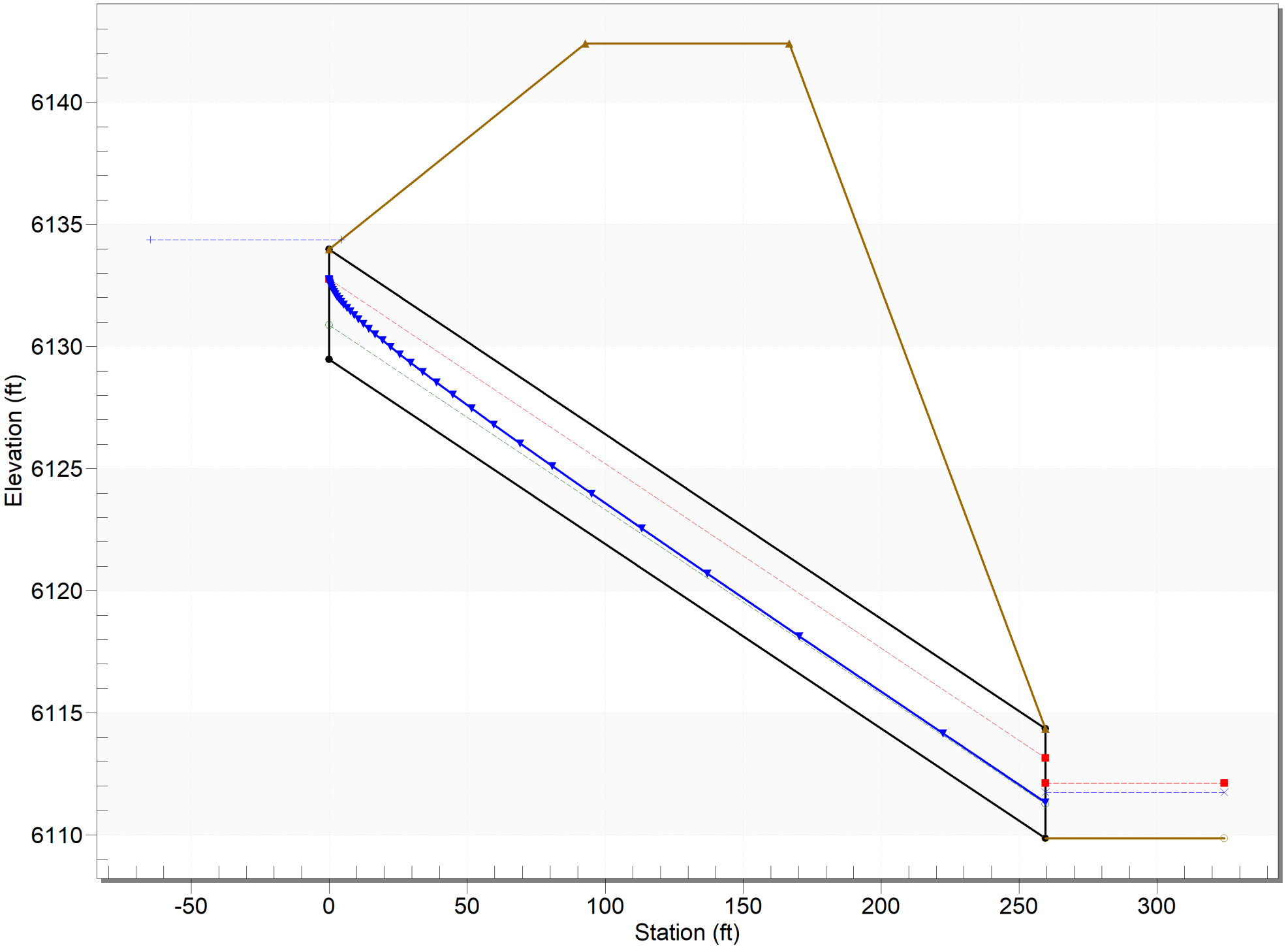
# Culvert Crossing: Crossing 1 (Design Point 1.5)

## Culvert Summary Table - Culvert 1

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth(ft) | Outlet Control Depth(ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20.20 | 20.20 | 6131.11 | 1.64 | 0.0* | 1-S2n | 0.57 | 1.28 | 0.57 | 0.95 | 17.22 | 5.55 |
| 38.18 | 38.18 | 6131.78 | 2.31 | 0.0* | 1-S2n | 0.78 | 1.78 | 0.78 | 1.21 | 20.83 | 6.50 |
| 56.16 | 56.16 | 6132.40 | 2.93 | 0.0* | 1-S2n | 0.94 | 2.17 | 0.97 | 1.40 | 22.37 | 7.16 |
| 74.14 | 74.14 | 6132.93 | 3.46 | 0.0* | 1-S2n | 1.08 | 2.51 | 1.11 | 1.55 | 24.27 | 7.68 |
| 92.12 | 92.12 | 6133.43 | 3.96 | 0.0* | 1-S2n | 1.20 | 2.82 | 1.25 | 1.69 | 25.68 | 8.10 |
| 110.10 | 110.10 | 6133.93 | 4.46 | 0.0* | 1-S2n | 1.32 | 3.09 | 1.37 | 1.80 | 26.80 | 8.47 |
| 125.16 | 125.16 | 6134.38 | 4.91 | 0.0* | 5-S2n | 1.41 | 3.29 | 1.48 | 1.89 | 27.59 | 8.75 |
| 146.06 | 146.06 | 6135.08 | 5.61 | 0.0* | 5-S2n | 1.53 | 3.55 | 1.61 | 2.00 | 28.57 | 9.09 |
| 164.04 | 164.04 | 6135.76 | 6.29 | 0.0* | 5-S2n | 1.63 | 3.74 | 1.73 | 2.09 | 29.23 | 9.36 |
| 182.02 | 182.02 | 6136.54 | 7.07 | 0.0* | 5-S2n | 1.72 | 3.90 | 1.84 | 2.18 | 29.84 | 9.61 |
| 200.00 | 200.00 | 6137.41 | 7.94 | 0.0* | 5-S2n | 1.81 | 4.04 | 1.94 | 2.25 | 30.44 | 9.84 |

# Crossing - Crossing 1 (Design Point 1.5), Design Discharge - 125.2 cfs

Culvert - Culvert 1, Culvert Discharge - 125.2 cfs



# Culvert Crossing: Crossing 2 (Design Point 5.6)

## Crossing Summary Table

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 2 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 6060.48 | 84.09 | 84.09 | 0.00 | 1 |
| 6061.26 | 125.68 | 125.68 | 0.00 | 1 |
| 6061.97 | 167.27 | 167.27 | 0.00 | 1 |
| 6062.61 | 208.86 | 208.86 | 0.00 | 1 |
| 6063.22 | 250.45 | 250.45 | 0.00 | 1 |
| 6063.83 | 292.04 | 292.04 | 0.00 | 1 |
| 6064.45 | 333.64 | 333.64 | 0.00 | 1 |
| 6064.89 | 361.87 | 361.87 | 0.00 | 1 |
| 6065.81 | 416.82 | 416.82 | 0.00 | 1 |
| 6066.58 | 458.41 | 458.41 | 0.00 | 1 |
| 6067.41 | 500.00 | 500.00 | 0.00 | 1 |
| 6087.28 | 1068.04 | 1068.04 | 0.00 | Overtopping |

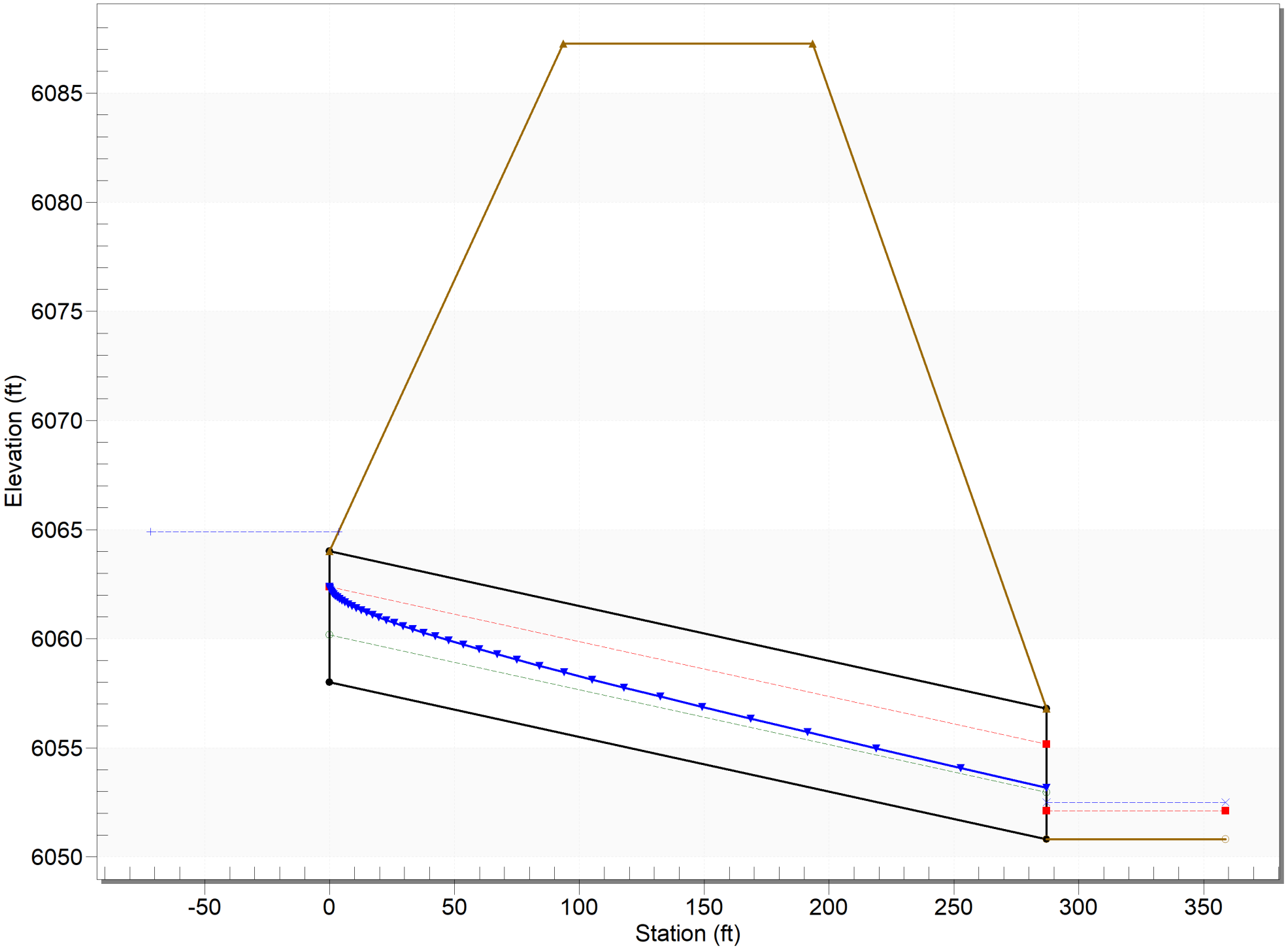
# Culvert Crossing: Crossing 2 (Design Point 5.6)

## Water Surface Profiles

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth(ft) | Outlet Control Depth(ft) | Flow Type | Length Full (ft) | Length Free (ft) |
|---|---|---|---|---|---|---|---|
| 84.09 | 84.09 | 6060.48 | 2.47 | 0.0* | 1-S2n | 0.00 | 287.00 |
| 125.68 | 125.68 | 6061.26 | 3.25 | 0.0* | 1-S2n | 0.00 | 287.00 |
| 167.27 | 167.27 | 6061.97 | 3.96 | 0.0* | 1-S2n | 0.00 | 287.00 |
| 208.86 | 208.86 | 6062.61 | 4.60 | 0.0* | 1-S2n | 0.00 | 287.00 |
| 250.45 | 250.45 | 6063.22 | 5.21 | 0.0* | 1-S2n | 0.00 | 287.00 |
| 292.04 | 292.04 | 6063.83 | 5.82 | 0.0* | 1-S2n | 0.00 | 287.00 |
| 333.64 | 333.64 | 6064.45 | 6.44 | 0.0* | 5-S2n | 0.00 | 287.00 |
| 361.87 | 361.87 | 6064.89 | 6.88 | 0.0* | 5-S2n | 0.00 | 287.00 |
| 416.82 | 416.82 | 6065.81 | 7.80 | 1.29 | 5-S2n | 0.00 | 287.00 |
| 458.41 | 458.41 | 6066.58 | 8.57 | 2.10 | 5-S2n | 0.00 | 287.00 |
| 500.00 | 500.00 | 6067.41 | 9.40 | 2.97 | 5-S2n | 0.00 | 287.00 |

# Crossing - Crossing 2 (Design Point 5.6), Design Discharge - 361.9 cfs

Culvert - Culvert 2, Culvert Discharge - 361.9 cfs



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Swale B3A (2-Year)

**Triangular**

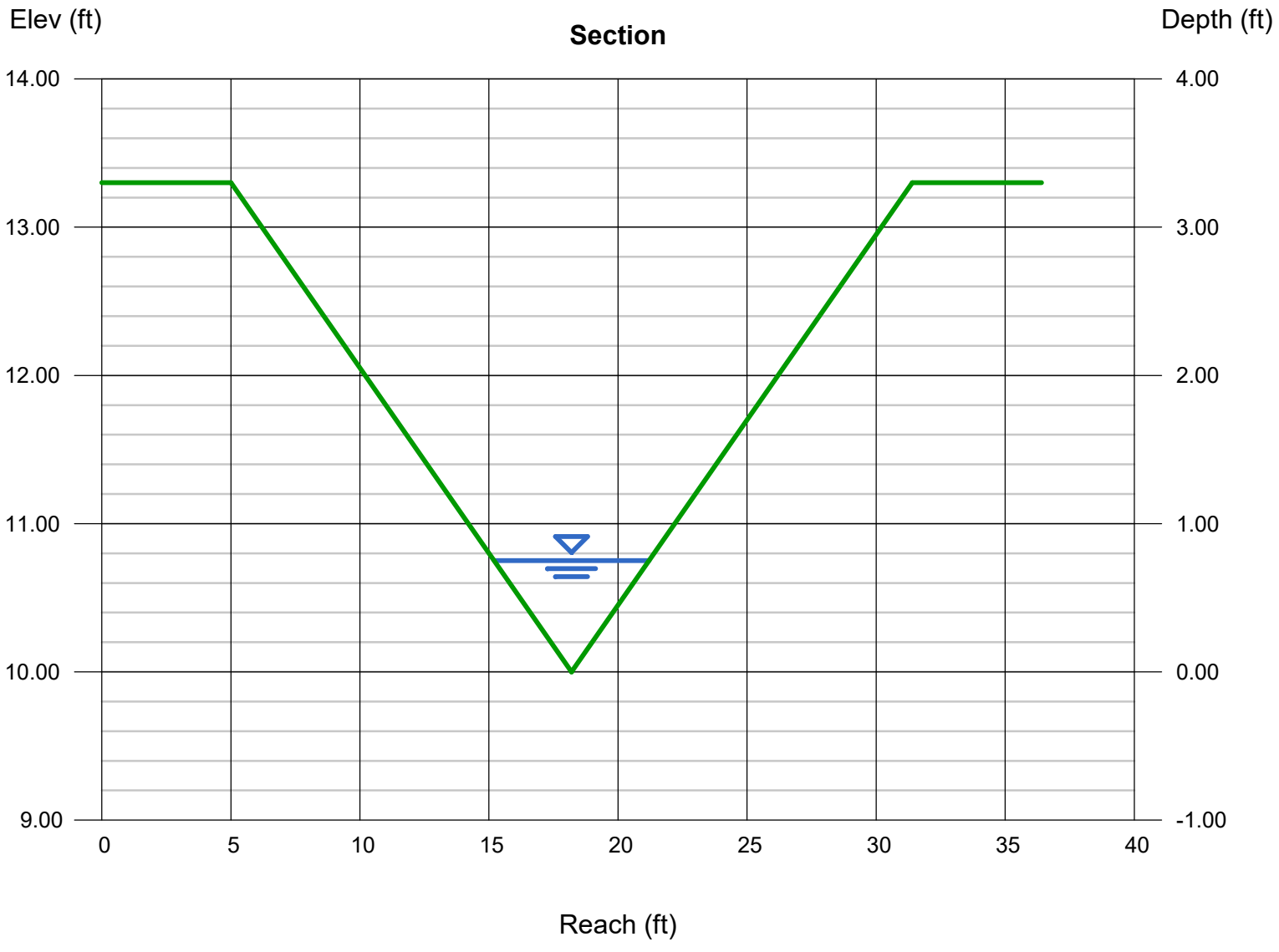
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 3.30 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.43 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 8.71 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.75 |
| Q (cfs) | = 8.710 |
| Area (sqft) | = 2.25 |
| Velocity (ft/s) | = 3.87 |
| Wetted Perim (ft) | = 6.18 |
| Crit Depth, Yc (ft) | = 0.79 |
| Top Width (ft) | = 6.00 |
| EGL (ft) | = 0.98 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Swale B3A (100-Year)

**Triangular**

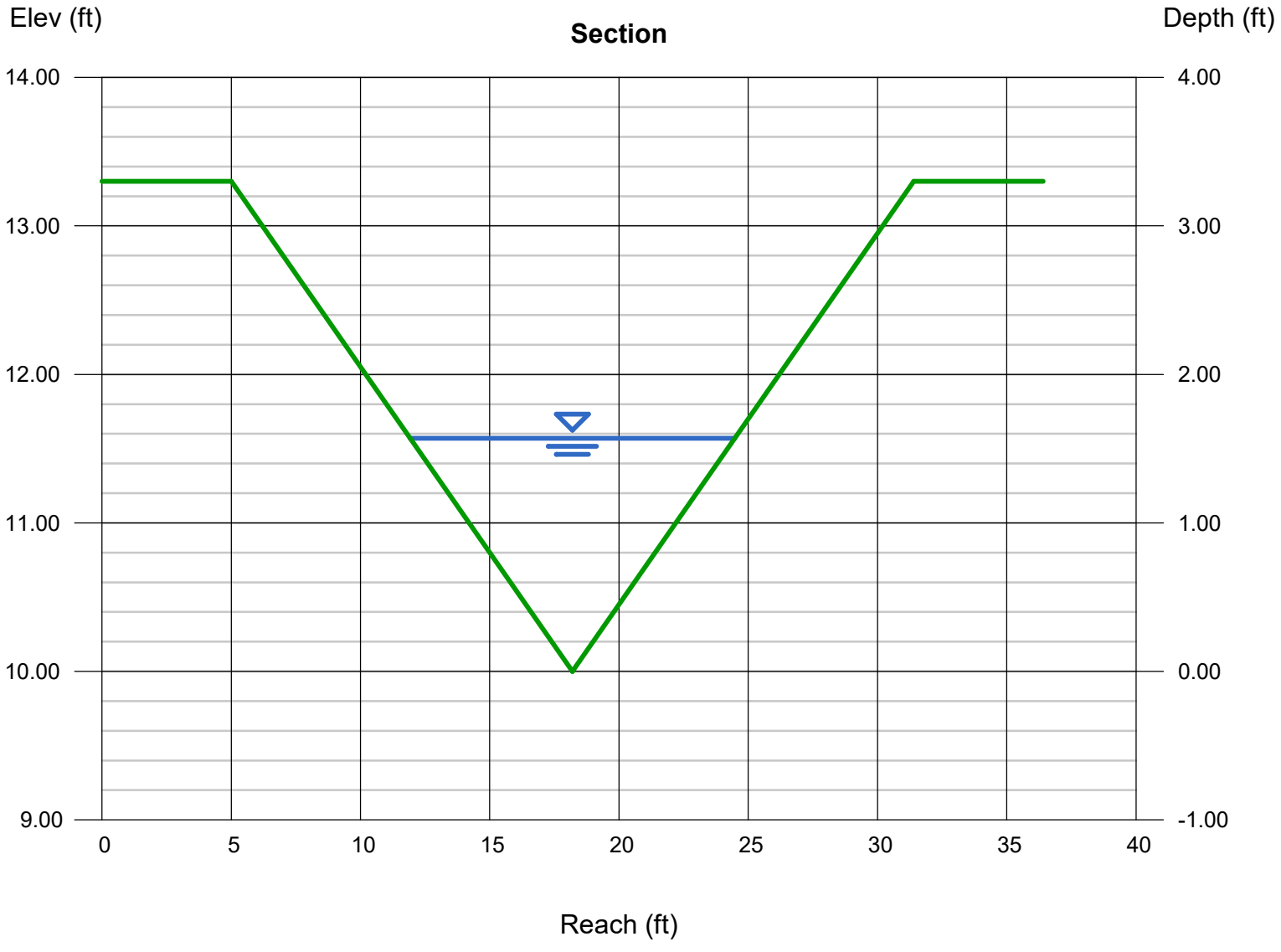
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 3.30 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.43 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 63.20 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.57 |
| Q (cfs) | = 63.20 |
| Area (sqft) | = 9.86 |
| Velocity (ft/s) | = 6.41 |
| Wetted Perim (ft) | = 12.95 |
| Crit Depth, Yc (ft) | = 1.74 |
| Top Width (ft) | = 12.56 |
| EGL (ft) | = 2.21 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Swale B3B (2-Year)

**Triangular**

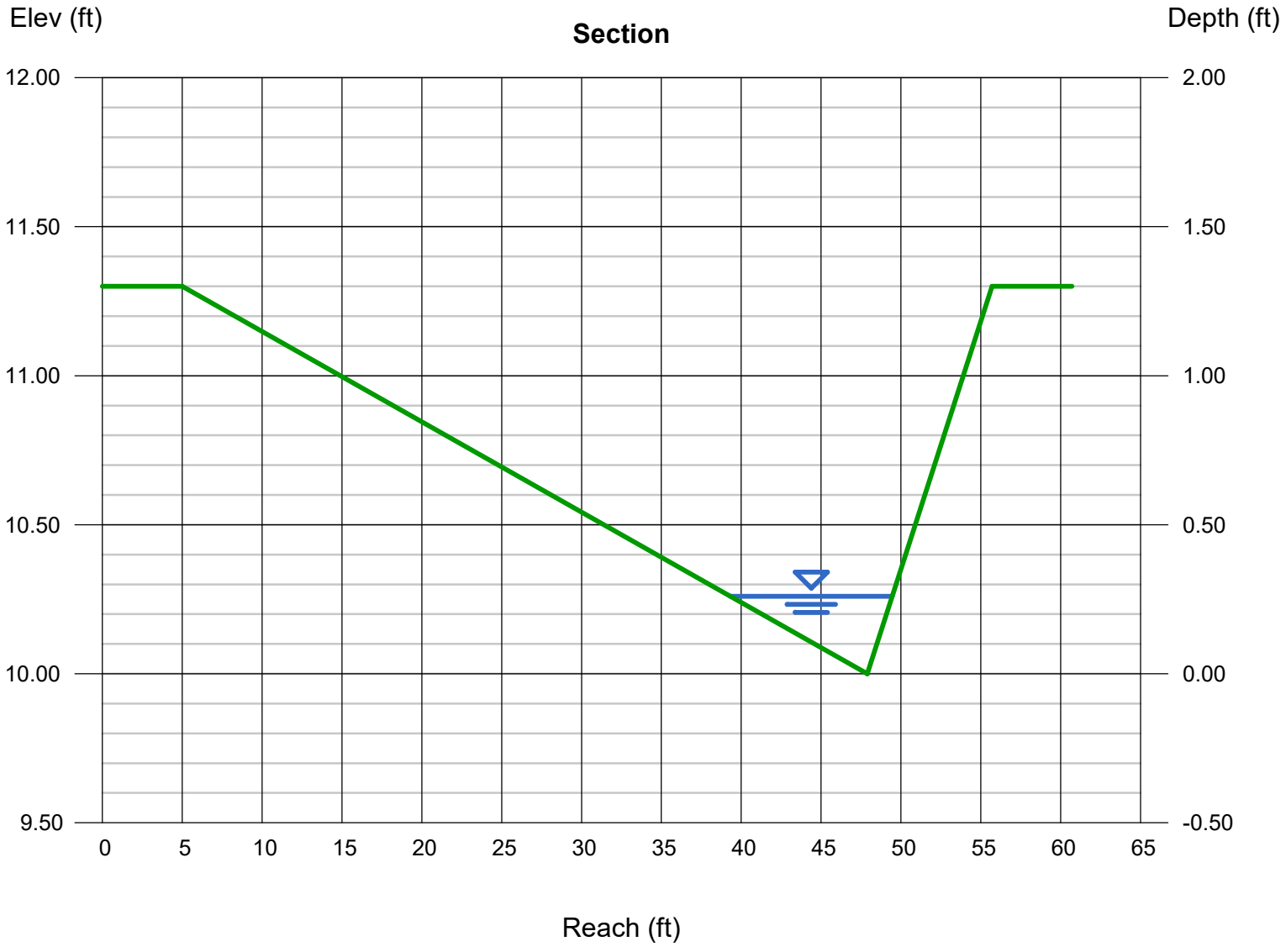
| | |
|---|---|
| Side Slopes (z:1) | = 33.00, 6.00 |
| Total Depth (ft) | = 1.30 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 5.80 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 3.80 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.26 |
| Q (cfs) | = 3.800 |
| Area (sqft) | = 1.32 |
| Velocity (ft/s) | = 2.88 |
| Wetted Perim (ft) | = 10.17 |
| Crit Depth, Yc (ft) | = 0.30 |
| Top Width (ft) | = 10.14 |
| EGL (ft) | = 0.39 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Swale B3B (100-Year)

**Triangular**

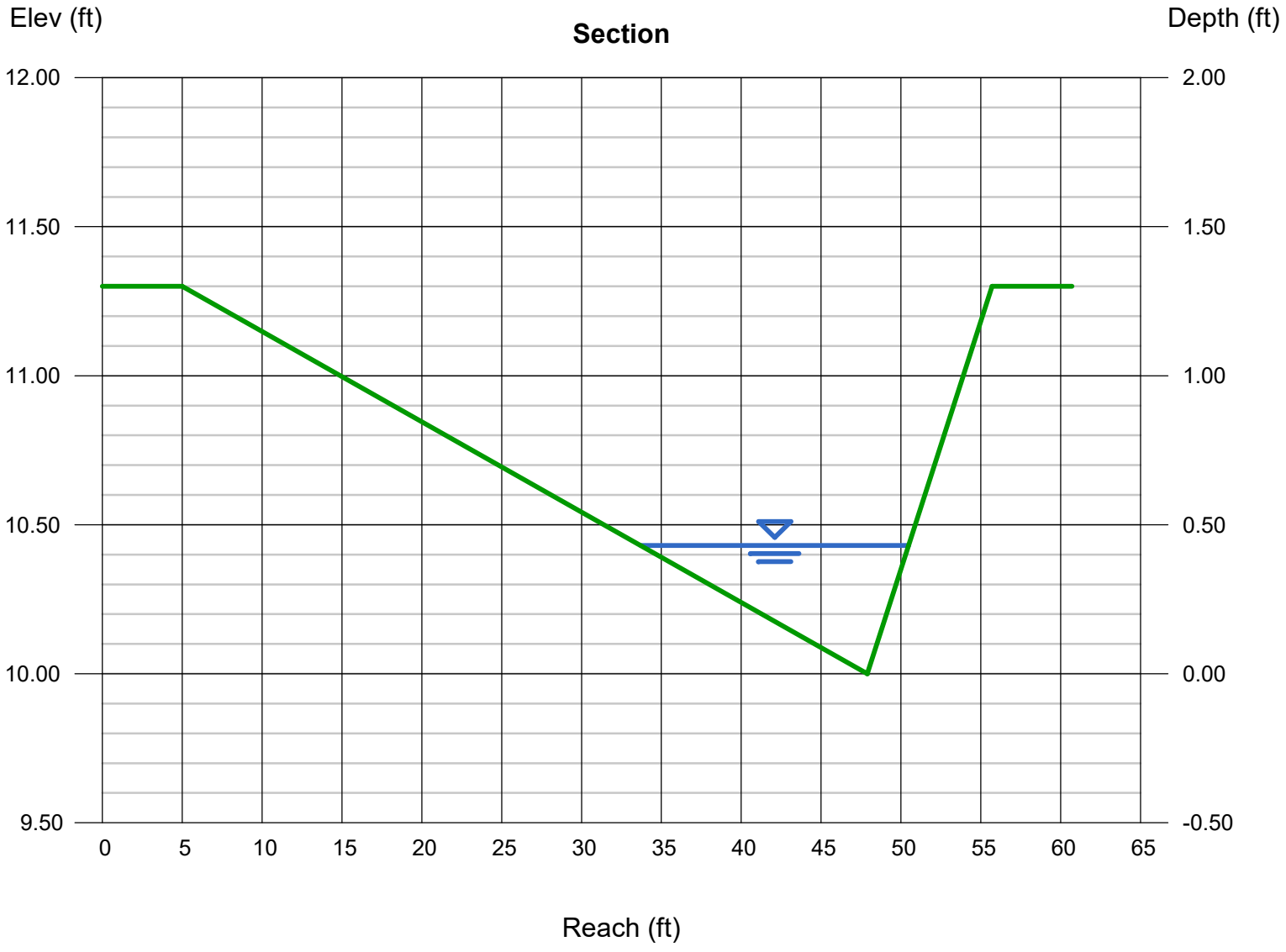
| | |
|---|---|
| Side Slopes (z:1) | = 33.00, 6.00 |
| Total Depth (ft) | = 1.30 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 5.80 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 14.65 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.43 |
| Q (cfs) | = 14.65 |
| Area (sqft) | = 3.61 |
| Velocity (ft/s) | = 4.06 |
| Wetted Perim (ft) | = 16.81 |
| Crit Depth, Yc (ft) | = 0.52 |
| Top Width (ft) | = 16.77 |
| EGL (ft) | = 0.69 |



# Channel Report



## Swale B3C (2-Year)

**Triangular**

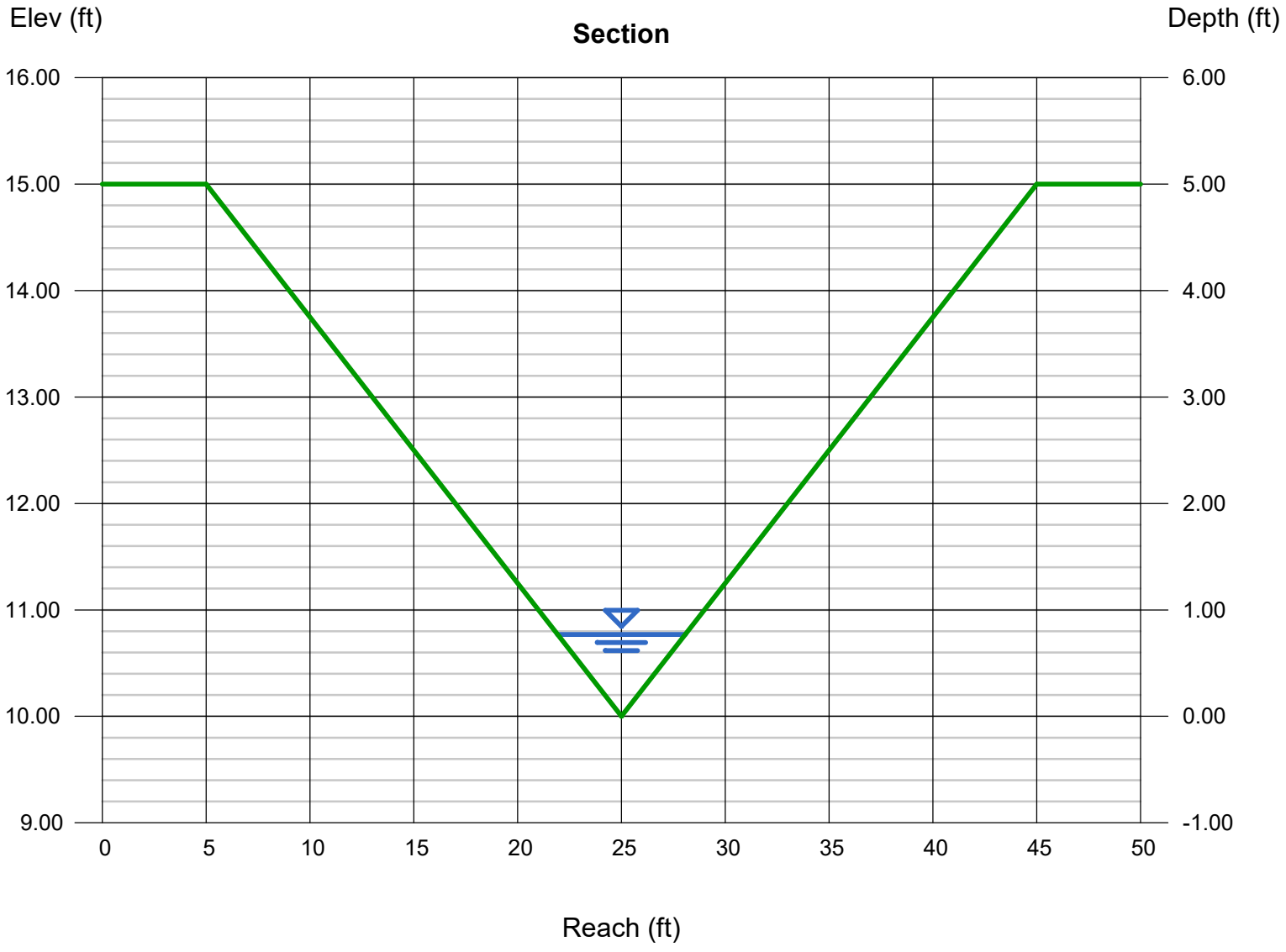
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 5.00 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.00 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 8.56 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.77 |
| Q (cfs) | = 8.560 |
| Area (sqft) | = 2.37 |
| Velocity (ft/s) | = 3.61 |
| Wetted Perim (ft) | = 6.35 |
| Crit Depth, Yc (ft) | = 0.78 |
| Top Width (ft) | = 6.16 |
| EGL (ft) | = 0.97 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Swale B3C (100-Year)

**Triangular**

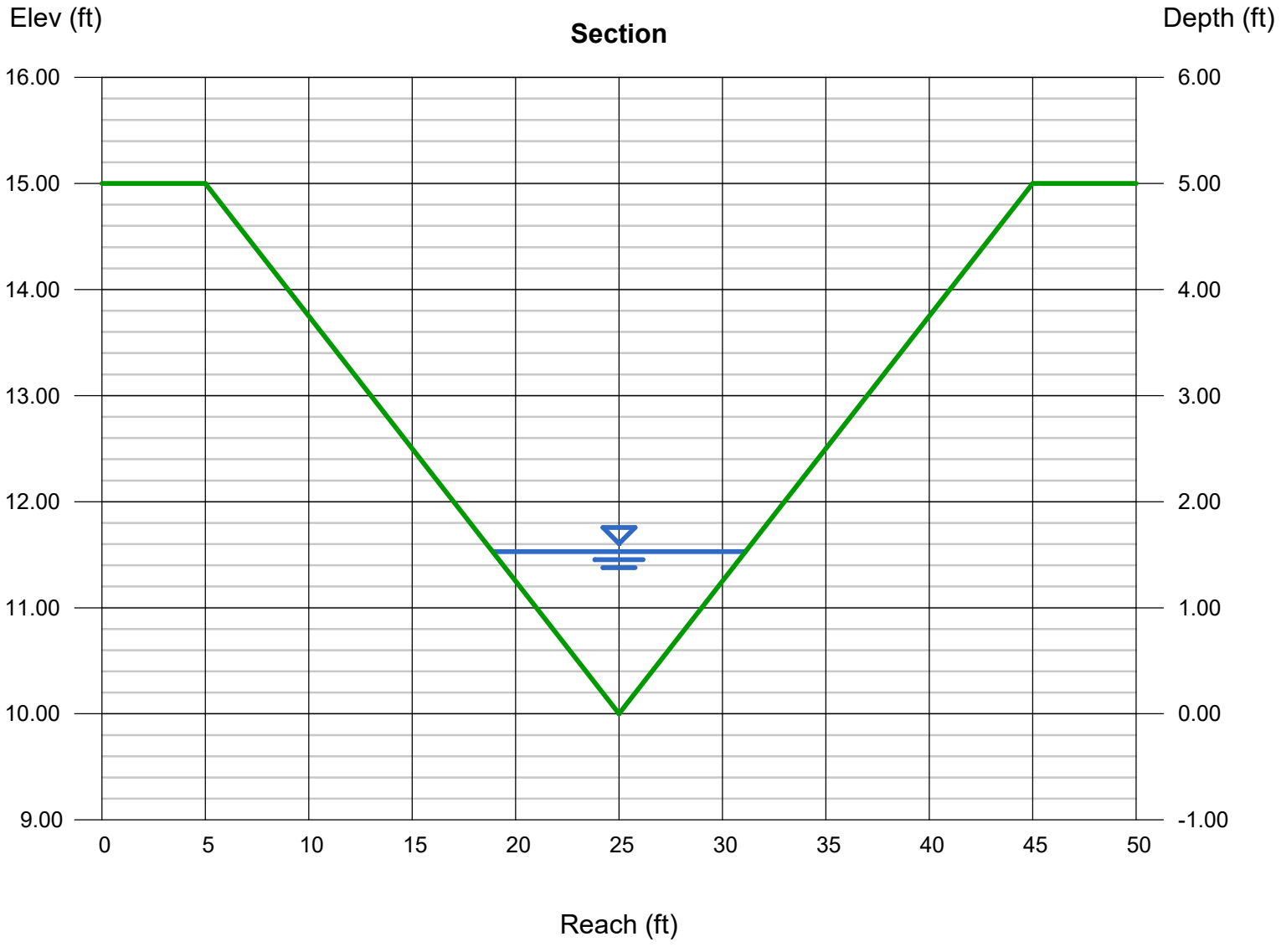
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 5.00 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.00 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 53.10 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.53 |
| Q (cfs) | = 53.10 |
| Area (sqft) | = 9.36 |
| Velocity (ft/s) | = 5.67 |
| Wetted Perim (ft) | = 12.62 |
| Crit Depth, Yc (ft) | = 1.62 |
| Top Width (ft) | = 12.24 |
| EGL (ft) | = 2.03 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 14 2022

## Swale A1 (2-Year)

**Triangular**

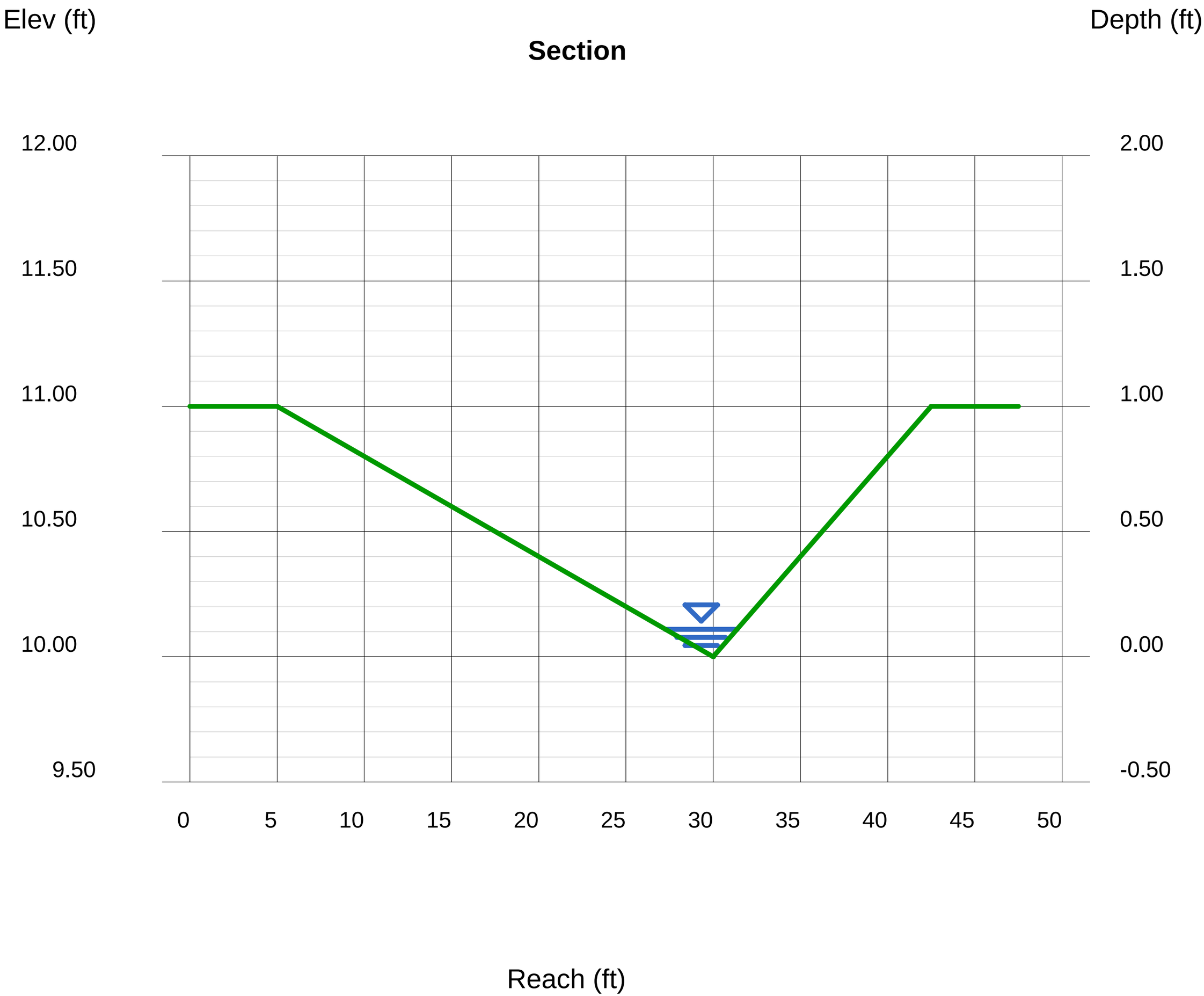
| | |
|---|---|
| Side Slopes (z:1) | = 25.00, 12.50 |
| Total Depth (ft) | = 1.00 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 4.00 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.30 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.11 |
| Q (cfs) | = 0.300 |
| Area (sqft) | = 0.23 |
| Velocity (ft/s) | = 1.32 |
| Wetted Perim (ft) | = 4.13 |
| Crit Depth, Yc (ft) | = 0.11 |
| Top Width (ft) | = 4.13 |
| EGL (ft) | = 0.14 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jun 21 2023

## Swale A1 (100-Year)

**Triangular**

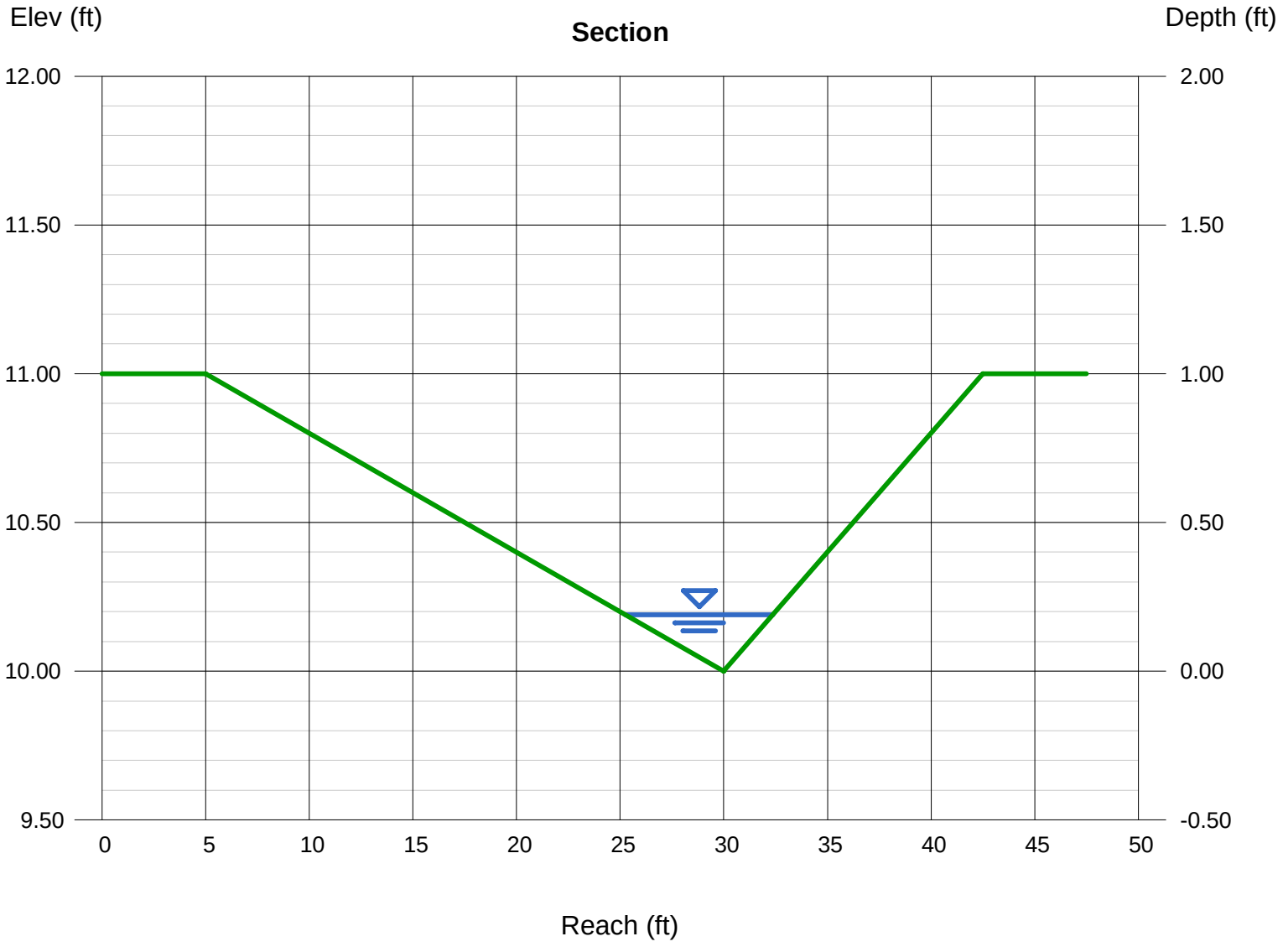
| | |
|---|---|
| Side Slopes (z:1) | = 25.00, 12.50 |
| Total Depth (ft) | = 1.00 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 4.00 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 1.23 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.19 |
| Q (cfs) | = 1.230 |
| Area (sqft) | = 0.68 |
| Velocity (ft/s) | = 1.82 |
| Wetted Perim (ft) | = 7.14 |
| Crit Depth, Yc (ft) | = 0.20 |
| Top Width (ft) | = 7.13 |
| EGL (ft) | = 0.24 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Swale B15 (2-Year)

**Triangular**

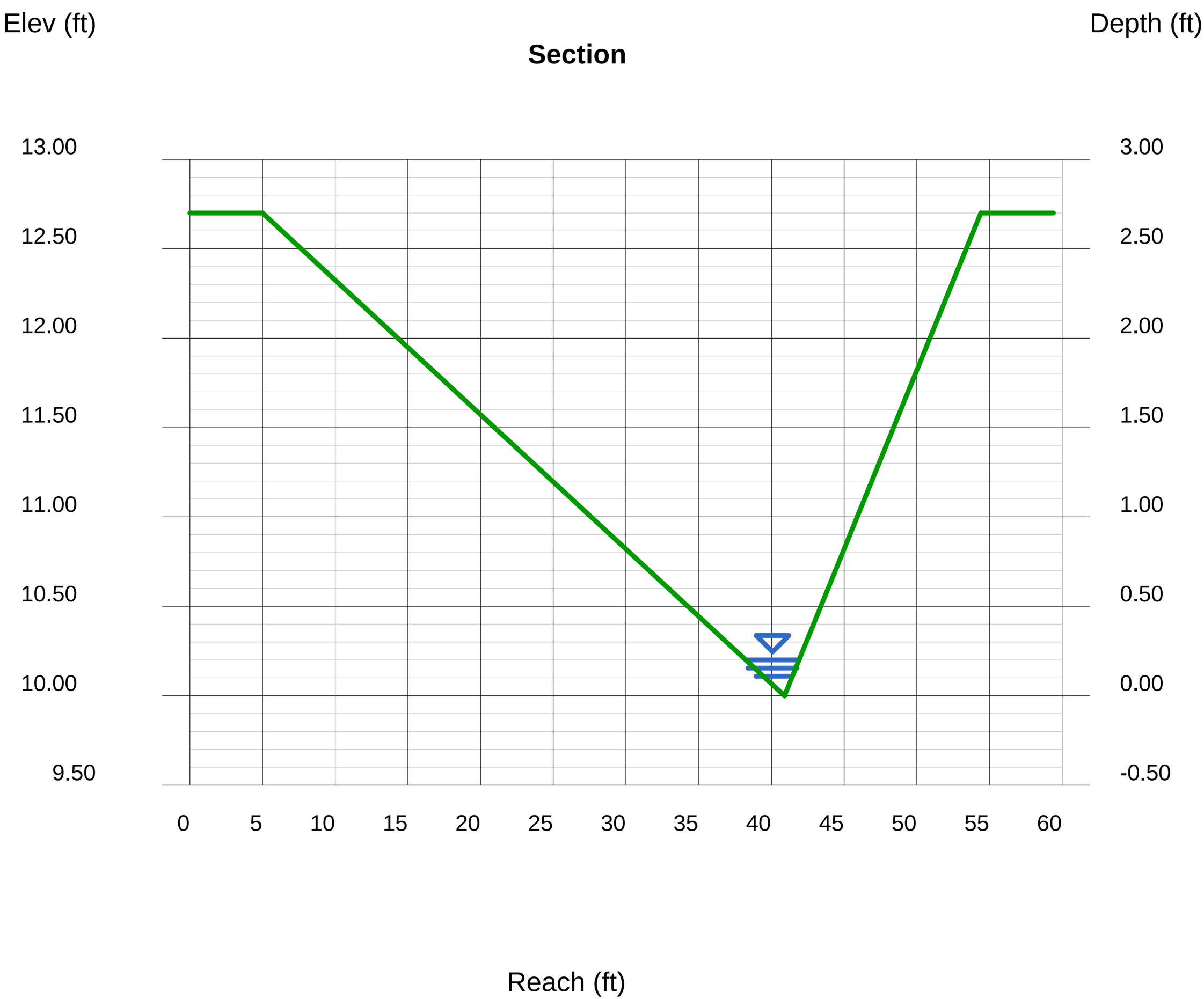
| | |
|---|---|
| Side Slopes (z:1) | = 13.30, 5.00 |
| Total Depth (ft) | = 2.70 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 4.57 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.80 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.20 |
| Q (cfs) | = 0.800 |
| Area (sqft) | = 0.37 |
| Velocity (ft/s) | = 2.19 |
| Wetted Perim (ft) | = 3.69 |
| Crit Depth, Yc (ft) | = 0.22 |
| Top Width (ft) | = 3.66 |
| EGL (ft) | = 0.27 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 22 2023

## Swale B15 (100-Year)

**Triangular**

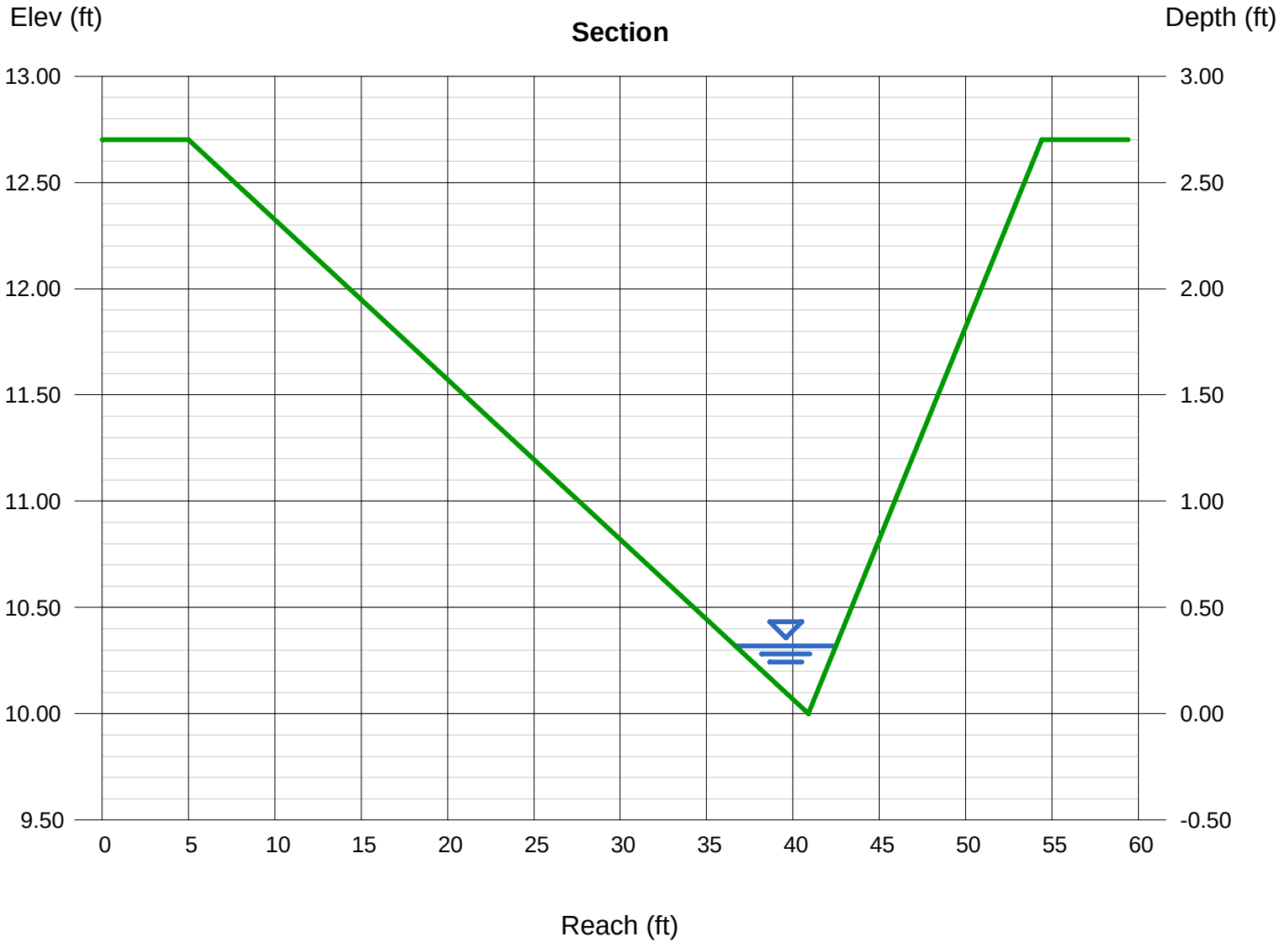
| | |
|---|---|
| Side Slopes (z:1) | = 13.30, 5.00 |
| Total Depth (ft) | = 2.70 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 4.57 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 2.75 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.32 |
| Q (cfs) | = 2.750 |
| Area (sqft) | = 0.94 |
| Velocity (ft/s) | = 2.94 |
| Wetted Perim (ft) | = 5.90 |
| Crit Depth, Yc (ft) | = 0.36 |
| Top Width (ft) | = 5.86 |
| EGL (ft) | = 0.45 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 14 2022

## Swale B58A (2-Year)

**Triangular**

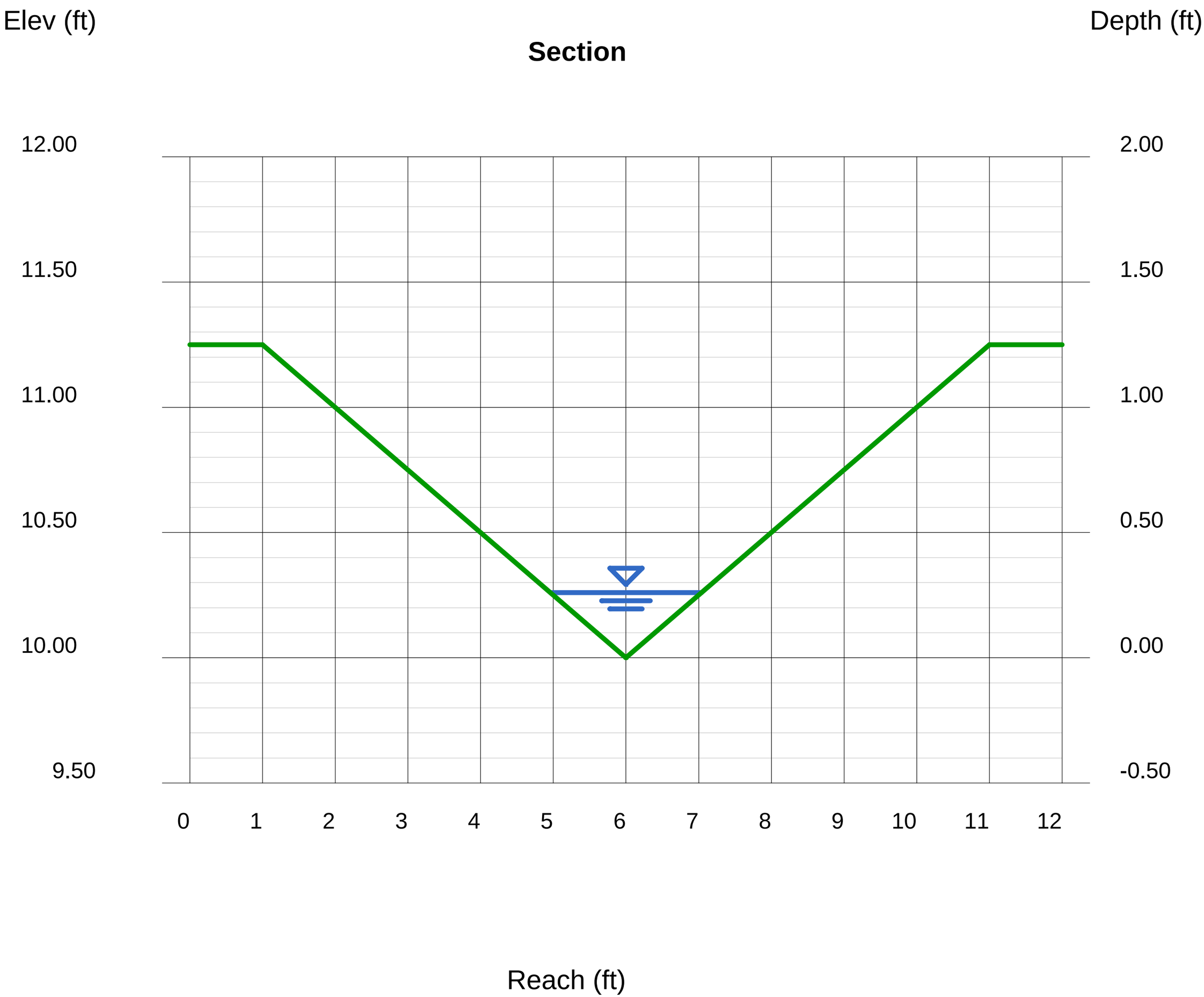
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 1.25 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 4.39 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.67 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.26 |
| Q (cfs) | = 0.670 |
| Area (sqft) | = 0.27 |
| Velocity (ft/s) | = 2.48 |
| Wetted Perim (ft) | = 2.14 |
| Crit Depth, Yc (ft) | = 0.29 |
| Top Width (ft) | = 2.08 |
| EGL (ft) | = 0.36 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 14 2022

## Swale B58A (100-Year)

**Triangular**

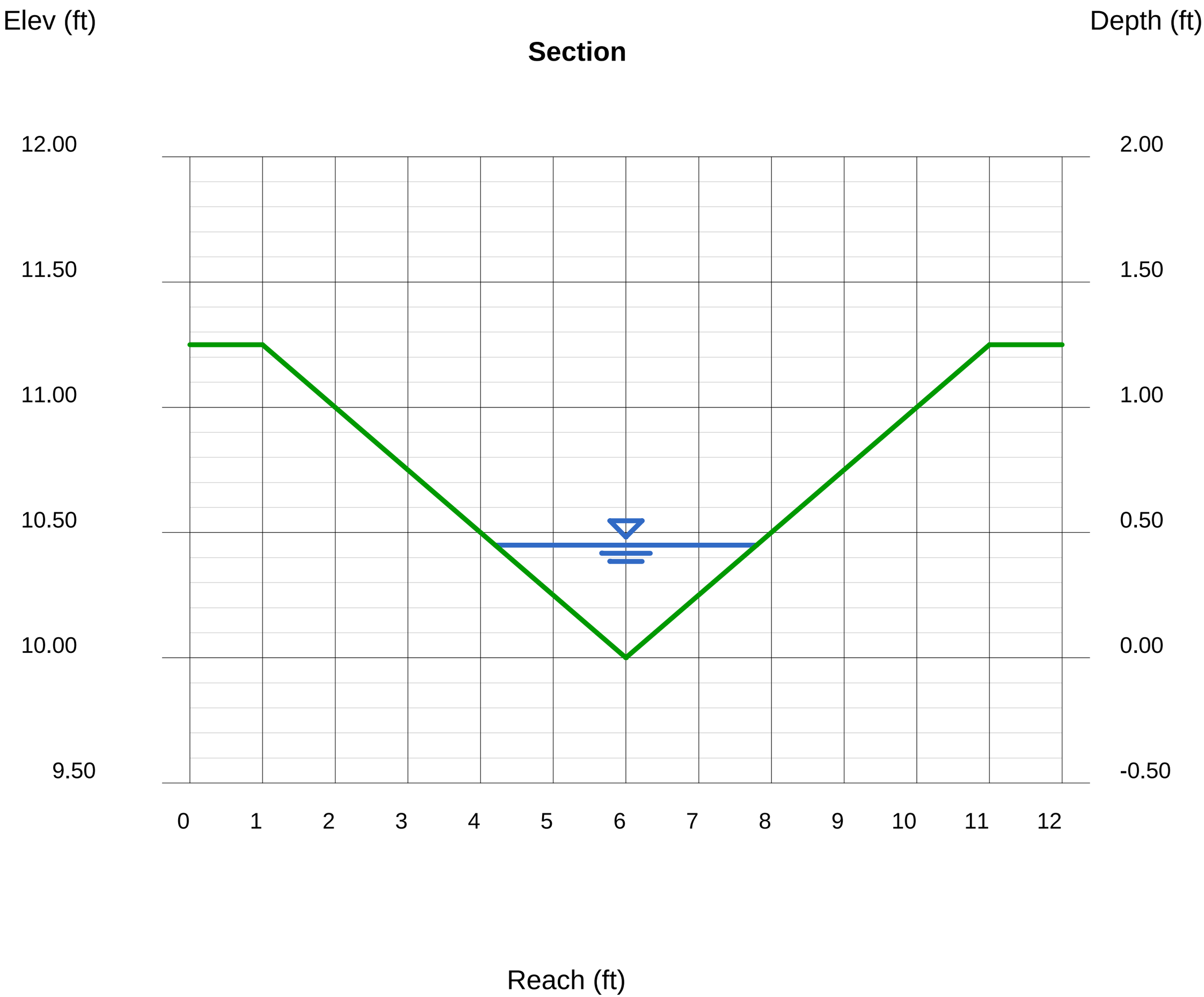
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 1.25 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 4.39 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 2.88 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.45 |
| Q (cfs) | = 2.880 |
| Area (sqft) | = 0.81 |
| Velocity (ft/s) | = 3.56 |
| Wetted Perim (ft) | = 3.71 |
| Crit Depth, Yc (ft) | = 0.51 |
| Top Width (ft) | = 3.60 |
| EGL (ft) | = 0.65 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 14 2022

## Swale C6 (2-Year)

**Triangular**

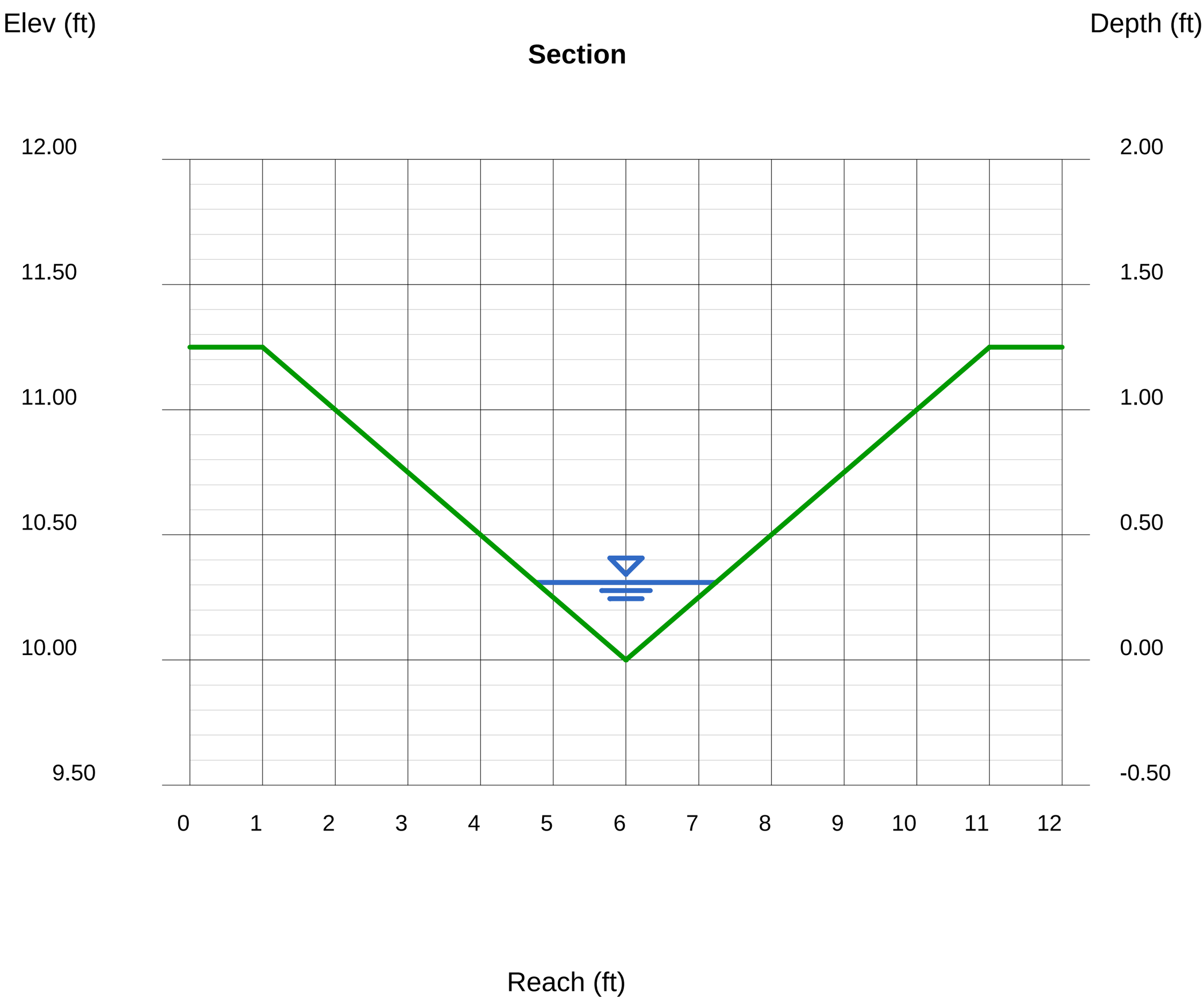
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 1.25 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.78 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.85 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.31 |
| Q (cfs) | = 0.850 |
| Area (sqft) | = 0.38 |
| Velocity (ft/s) | = 2.21 |
| Wetted Perim (ft) | = 2.56 |
| Crit Depth, Yc (ft) | = 0.31 |
| Top Width (ft) | = 2.48 |
| EGL (ft) | = 0.39 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 14 2022

## Swale C6 (100-Year)

**Triangular**

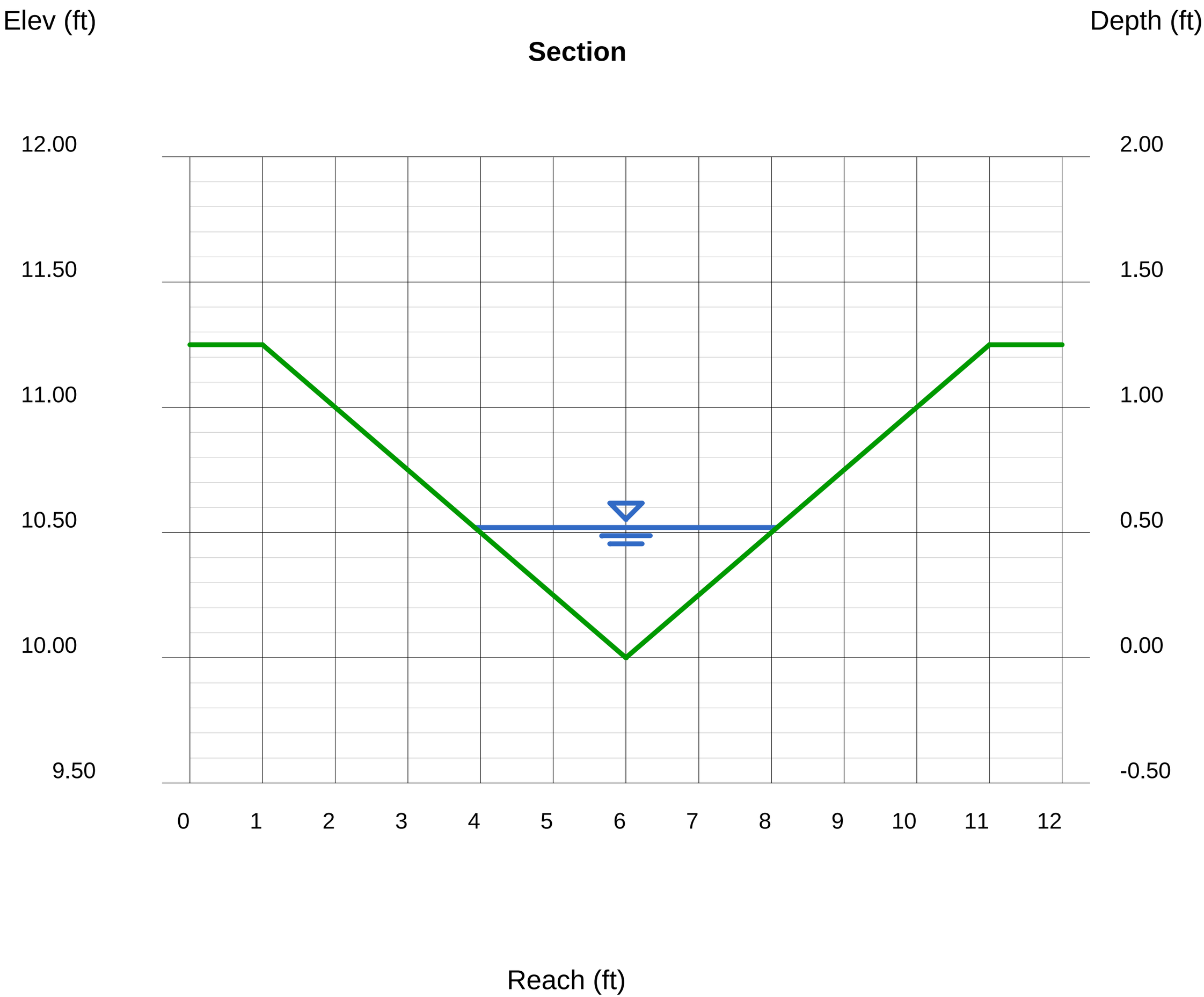
| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 1.25 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.78 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 3.56 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.52 |
| Q (cfs) | = 3.560 |
| Area (sqft) | = 1.08 |
| Velocity (ft/s) | = 3.29 |
| Wetted Perim (ft) | = 4.29 |
| Crit Depth, Yc (ft) | = 0.55 |
| Top Width (ft) | = 4.16 |
| EGL (ft) | = 0.69 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 14 2022

## Swale D5 (2-Year)

**Trapezoidal**

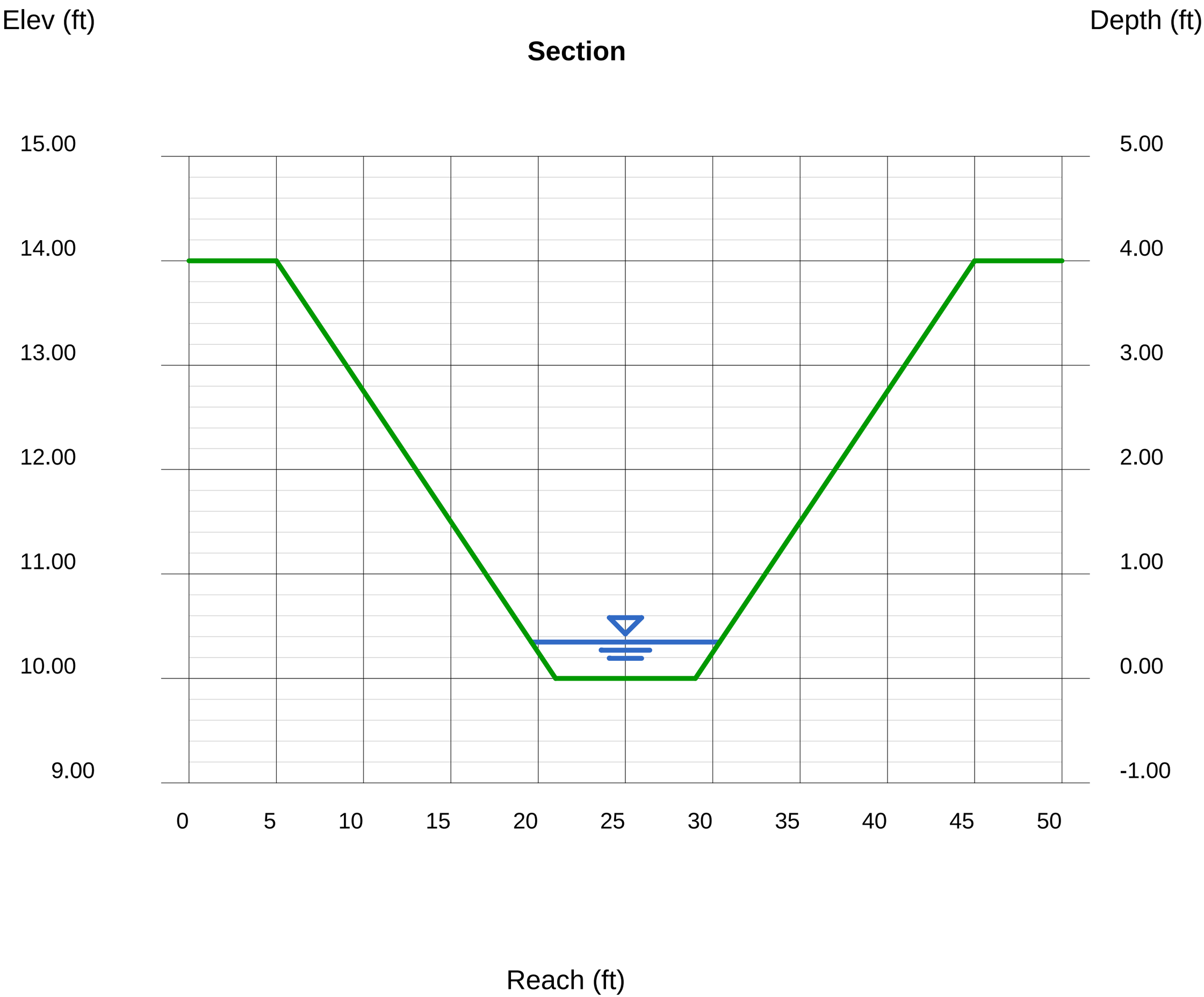
| | |
|---|---|
| Bottom Width (ft) | = 8.00 |
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 4.00 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.92 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 12.30 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.35 |
| Q (cfs) | = 12.30 |
| Area (sqft) | = 3.29 |
| Velocity (ft/s) | = 3.74 |
| Wetted Perim (ft) | = 10.89 |
| Crit Depth, Yc (ft) | = 0.40 |
| Top Width (ft) | = 10.80 |
| EGL (ft) | = 0.57 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 14 2022

## Swale D5 (100-Year)

**Trapezoidal**

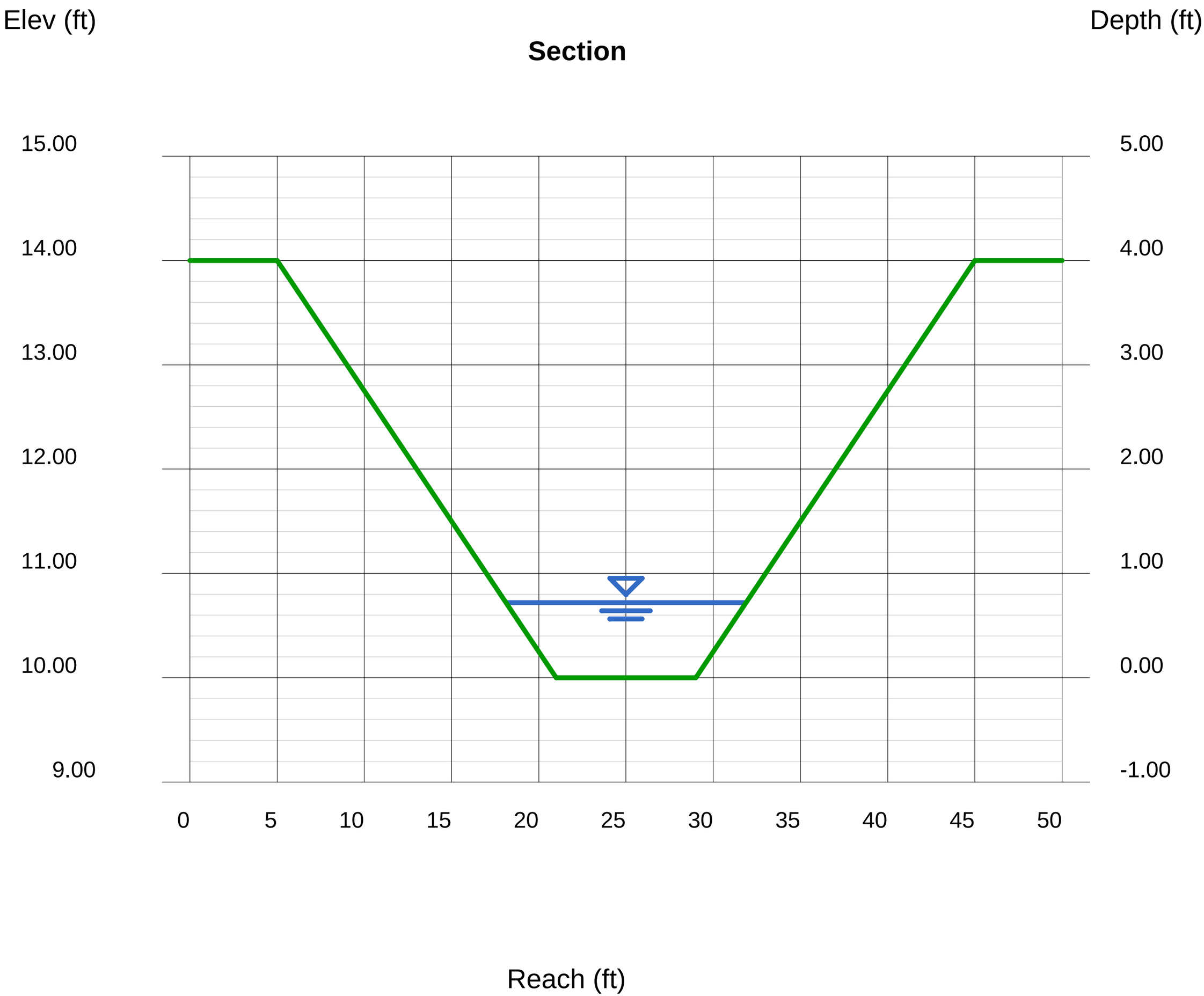
| | |
|---|---|
| Bottom Width (ft) | = 8.00 |
| Side Slopes (z:1) | = 4.00, 4.00 |
| Total Depth (ft) | = 4.00 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 2.92 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 44.97 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.72 |
| Q (cfs) | = 44.97 |
| Area (sqft) | = 7.83 |
| Velocity (ft/s) | = 5.74 |
| Wetted Perim (ft) | = 13.94 |
| Crit Depth, Yc (ft) | = 0.86 |
| Top Width (ft) | = 13.76 |
| EGL (ft) | = 1.23 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jun 29 2022

## Drainageway 1 (2-Year)

**User-defined**

| | |
|---|---|
| Invert Elev (ft) | = 6082.56 |
| Slope (%) | = 1.70 |
| N-Value | = 0.030 |

**Calculations**

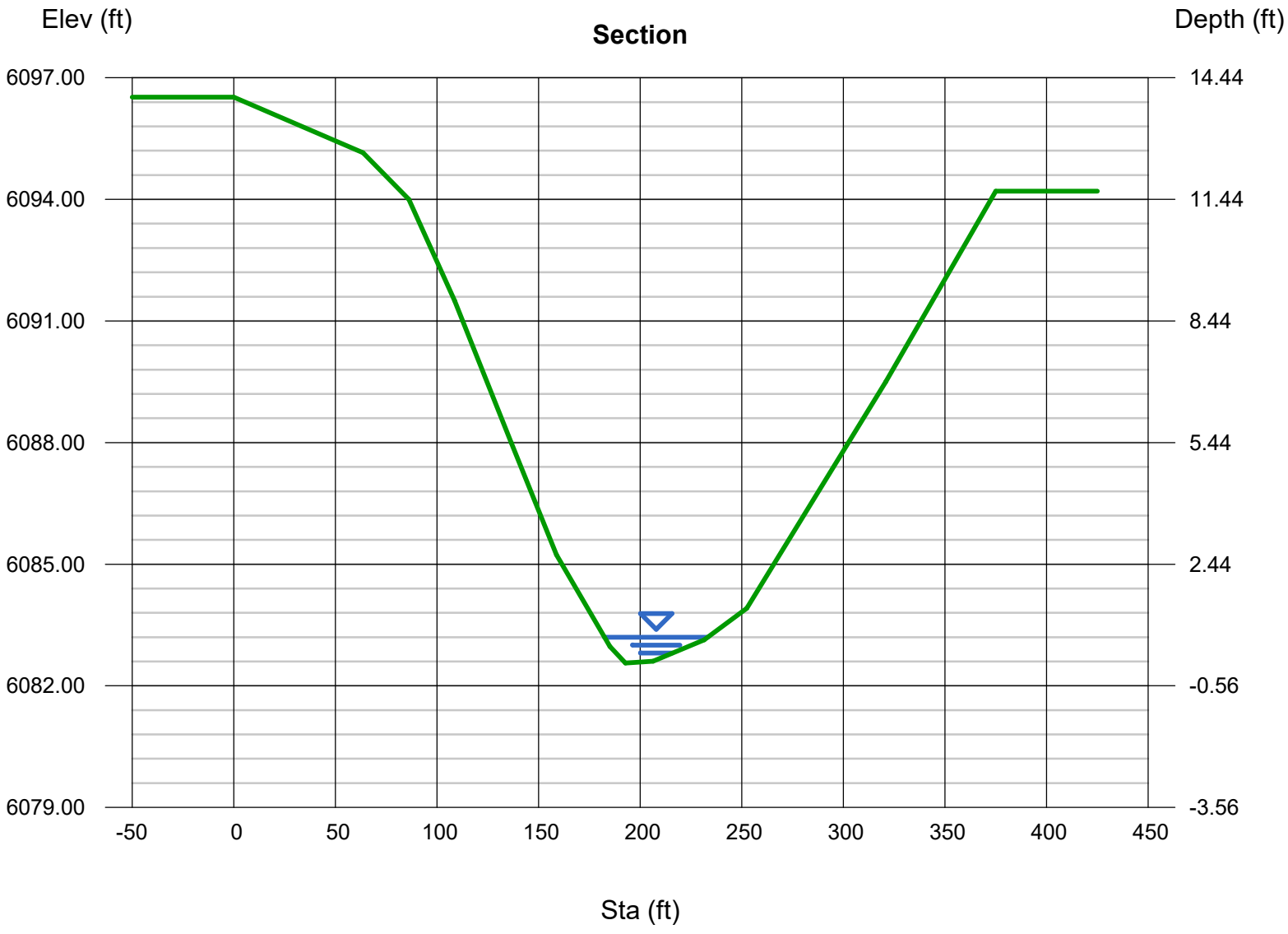
| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 69.32 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.64 |
| Q (cfs) | = 69.32 |
| Area (sqft) | = 20.34 |
| Velocity (ft/s) | = 3.41 |
| Wetted Perim (ft) | = 50.92 |
| Crit Depth, Yc (ft) | = 0.63 |
| Top Width (ft) | = 50.90 |
| EGL (ft) | = 0.82 |

**(Sta, El, n)-(Sta, El, n)...**

( 0.00, 6096.52)-(63.55, 6095.15, 0.030)-(86.14, 6094.00, 0.030)-(108.67, 6091.50, 0.030)-(136.53, 6088.00, 0.030)-(158.75, 6085.23, 0.030)-(185.11, 6082.97, 0.03
-(192.74, 6082.56, 0.030)-(206.32, 6082.61, 0.030)-(231.43, 6083.13, 0.030)-(252.44, 6083.91, 0.030)-(320.83, 6089.50, 0.030)-(375.02, 6094.20, 0.030)



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jun 29 2022

## Drainageway 1 (100-Year)

**User-defined**

| | |
|---|---|
| Invert Elev (ft) | = 6082.56 |
| Slope (%) | = 1.70 |
| N-Value | = 0.030 |

**Calculations**

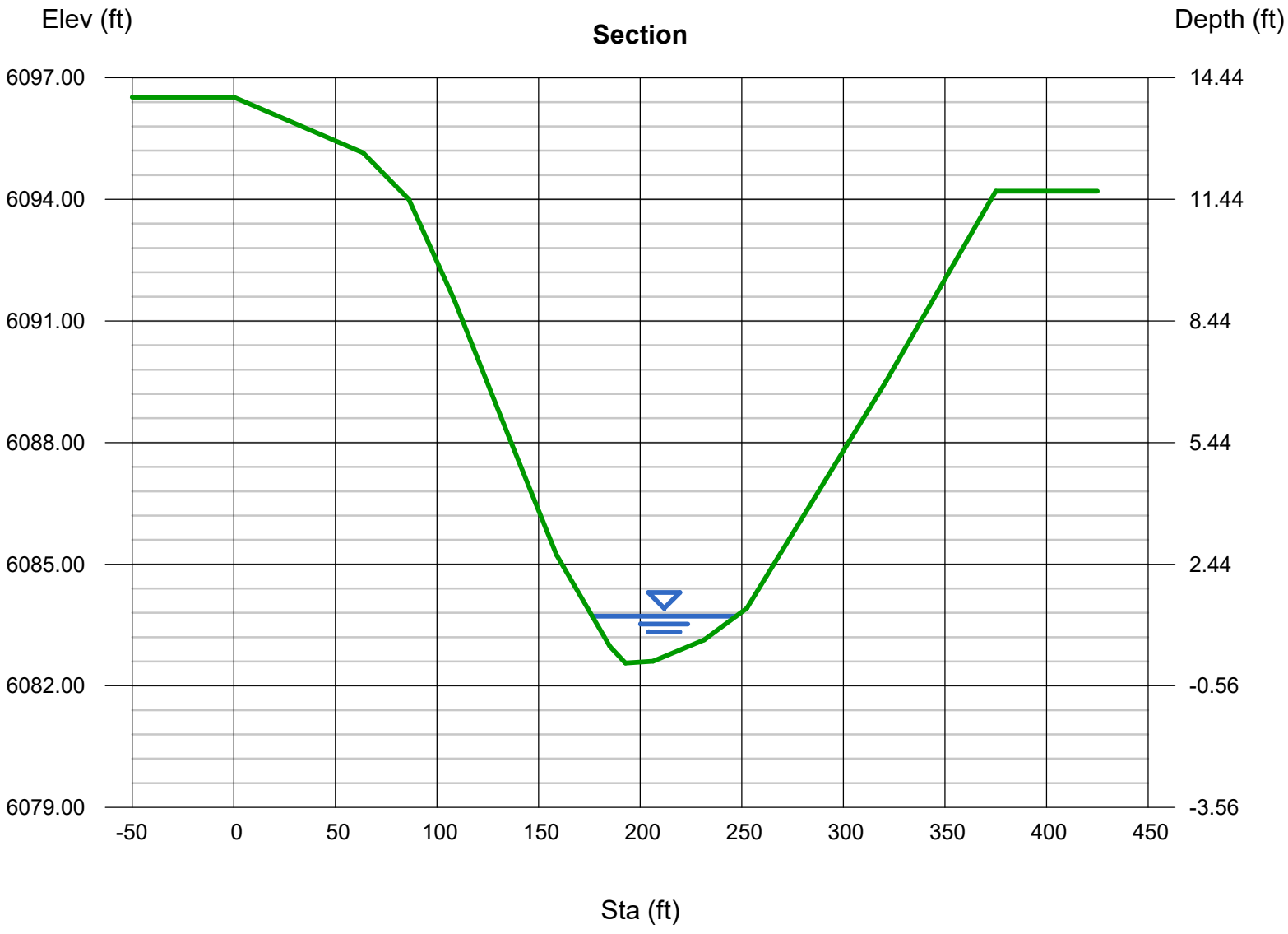
| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 273.26 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.16 |
| Q (cfs) | = 273.26 |
| Area (sqft) | = 52.03 |
| Velocity (ft/s) | = 5.25 |
| Wetted Perim (ft) | = 71.02 |
| Crit Depth, Yc (ft) | = 1.21 |
| Top Width (ft) | = 70.96 |
| EGL (ft) | = 1.59 |

**(Sta, El, n)-(Sta, El, n)...**

( 0.00, 6096.52)-(63.55, 6095.15, 0.030)-(86.14, 6094.00, 0.030)-(108.67, 6091.50, 0.030)-(136.53, 6088.00, 0.030)-(158.75, 6085.23, 0.030)-(185.11, 6082.97, 0.03
-(192.74, 6082.56, 0.030)-(206.32, 6082.61, 0.030)-(231.43, 6083.13, 0.030)-(252.44, 6083.91, 0.030)-(320.83, 6089.50, 0.030)-(375.02, 6094.20, 0.030)



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3A (2-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6158.29 |
| Pipe Length (ft) | = | 39.18 |
| Slope (%) | = | 4.62 |
| Invert Elev Up (ft) | = | 6160.10 |
| Rise (in) | = | 18.0 |
| Shape | = | Circular |
| Span (in) | = | 18.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.013 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

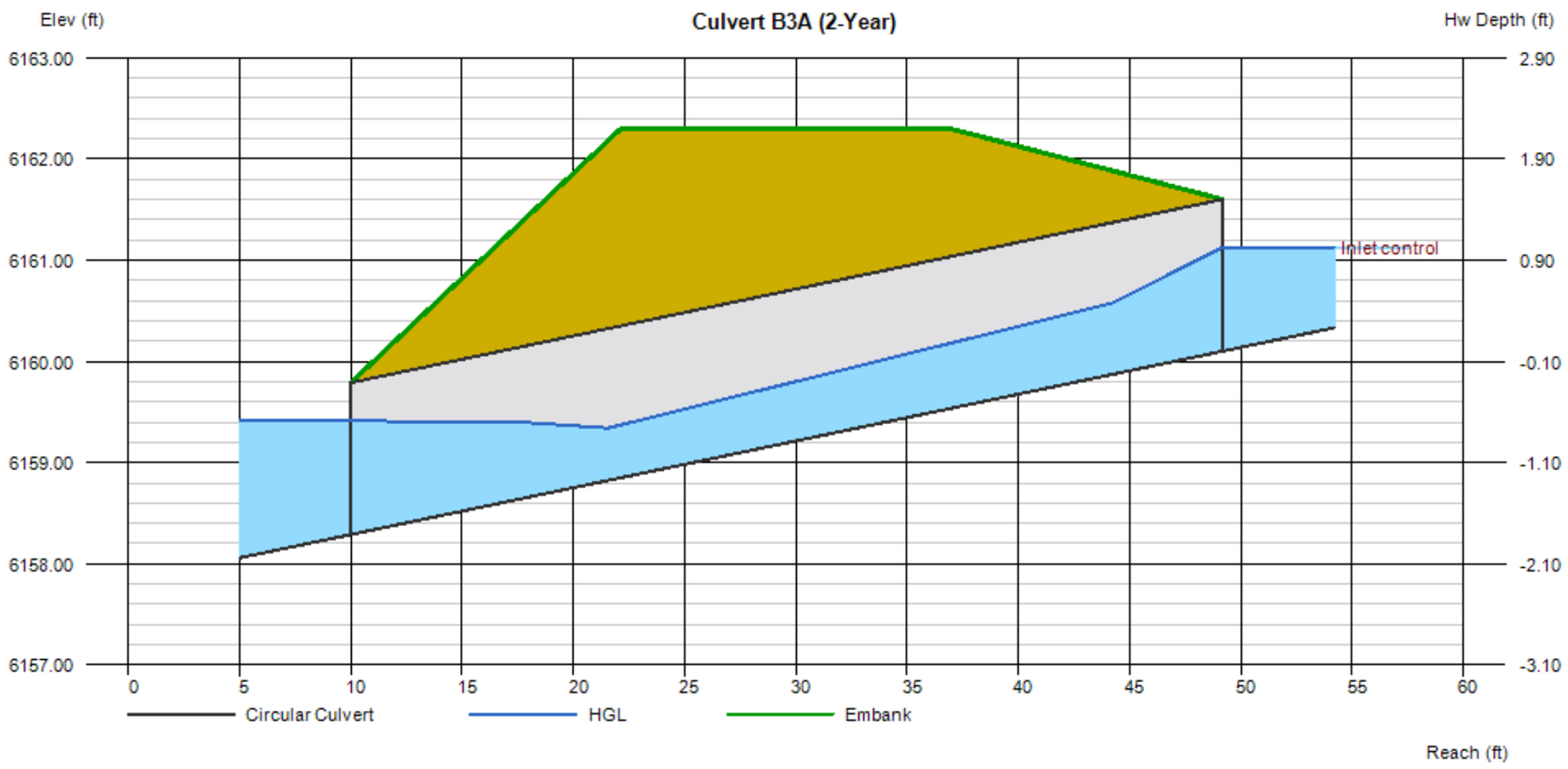
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6162.29 |
| Top Width (ft) | = | 15.00 |
| Crest Width (ft) | = | 27.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 3.80 |
| Qmax (cfs) | = | 14.65 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 3.80 |
| Qpipe (cfs) | = | 3.80 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 2.68 |
| Veloc Up (ft/s) | = | 4.34 |
| HGL Dn (ft) | = | 6159.41 |
| HGL Up (ft) | = | 6160.85 |
| Hw Elev (ft) | = | 6161.12 |
| Hw/D (ft) | = | 0.68 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3A (100-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6158.29 |
| Pipe Length (ft) | = | 39.18 |
| Slope (%) | = | 4.62 |
| Invert Elev Up (ft) | = | 6160.10 |
| Rise (in) | = | 18.0 |
| Shape | = | Circular |
| Span (in) | = | 18.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.013 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

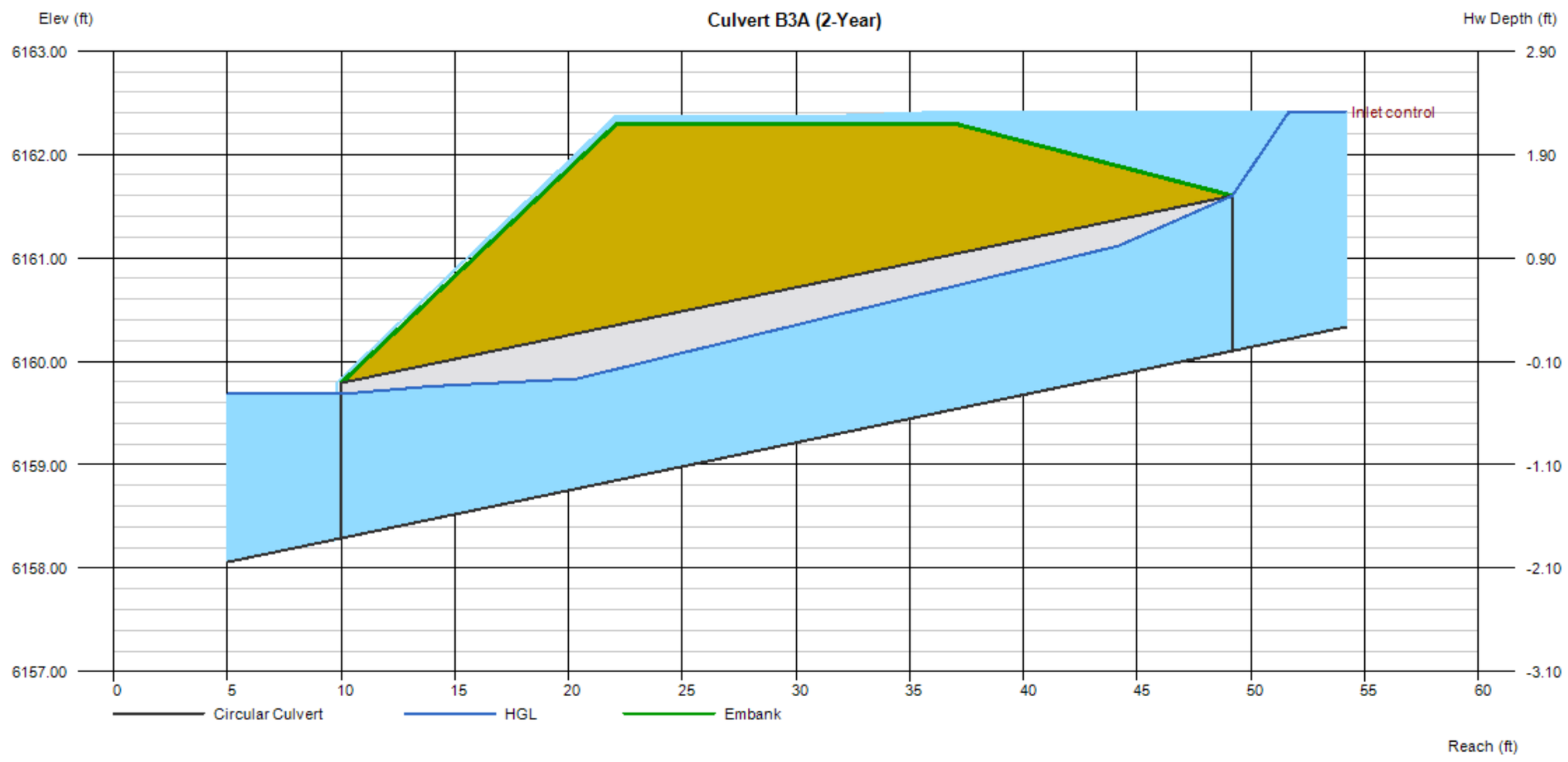
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6162.29 |
| Top Width (ft) | = | 15.00 |
| Crest Width (ft) | = | 27.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 3.80 |
| Qmax (cfs) | = | 14.65 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 14.64 |
| Qpipe (cfs) | = | 11.38 |
| Qovertop (cfs) | = | 3.26 |
| Veloc Dn (ft/s) | = | 6.65 |
| Veloc Up (ft/s) | = | 7.05 |
| HGL Dn (ft) | = | 6159.68 |
| HGL Up (ft) | = | 6161.39 |
| Hw Elev (ft) | = | 6162.42 |
| Hw/D (ft) | = | 1.54 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3B (2-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6141.31 |
| Pipe Length (ft) | = | 69.92 |
| Slope (%) | = | 3.15 |
| Invert Elev Up (ft) | = | 6143.51 |
| Rise (in) | = | 24.0 |
| Shape | = | Circular |
| Span (in) | = | 24.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

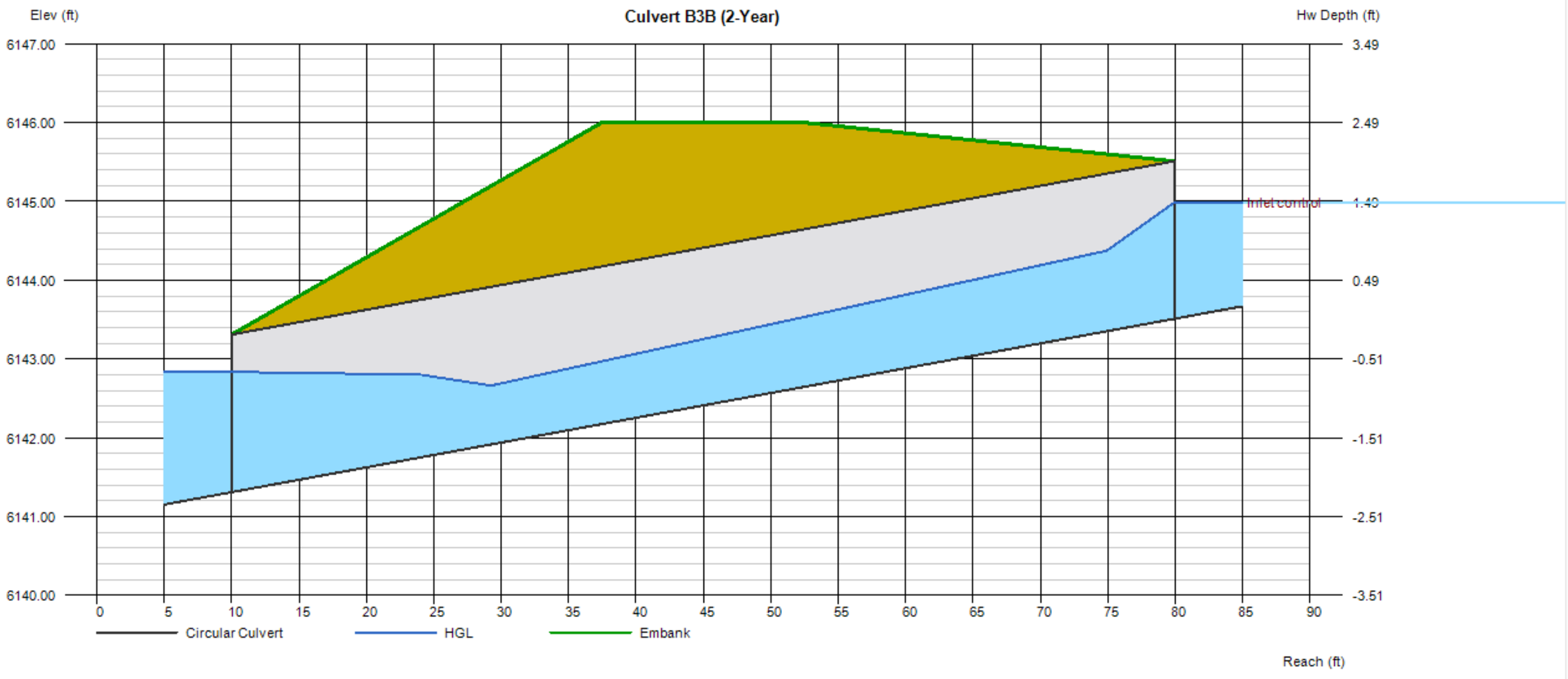
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6146.00 |
| Top Width (ft) | = | 15.00 |
| Crest Width (ft) | = | 27.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 8.71 |
| Qmax (cfs) | = | 42.03 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 8.71 |
| Qpipe (cfs) | = | 8.71 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 3.39 |
| Veloc Up (ft/s) | = | 5.20 |
| HGL Dn (ft) | = | 6142.84 |
| HGL Up (ft) | = | 6144.56 |
| Hw Elev (ft) | = | 6144.99 |
| Hw/D (ft) | = | 0.74 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3B (100-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6141.31 |
| Pipe Length (ft) | = | 69.92 |
| Slope (%) | = | 3.15 |
| Invert Elev Up (ft) | = | 6143.51 |
| Rise (in) | = | 24.0 |
| Shape | = | Circular |
| Span (in) | = | 24.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

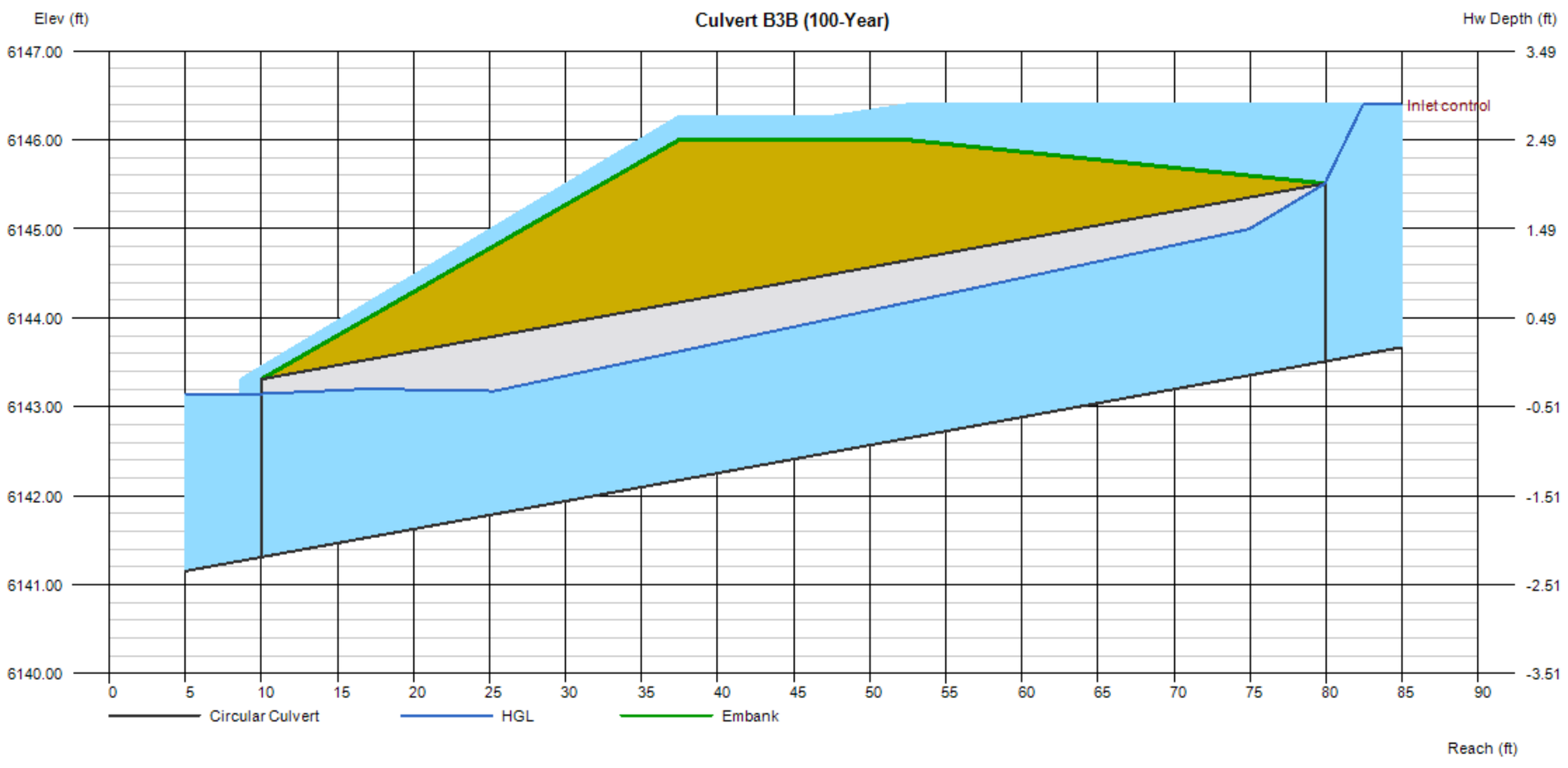
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6146.00 |
| Top Width (ft) | = | 15.00 |
| Crest Width (ft) | = | 27.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 8.71 |
| Qmax (cfs) | = | 42.03 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 42.03 |
| Qpipe (cfs) | = | 21.89 |
| Qovertop (cfs) | = | 20.14 |
| Veloc Dn (ft/s) | = | 7.25 |
| Veloc Up (ft/s) | = | 7.81 |
| HGL Dn (ft) | = | 6143.15 |
| HGL Up (ft) | = | 6145.18 |
| Hw Elev (ft) | = | 6146.40 |
| Hw/D (ft) | = | 1.44 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3C (2-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6133.90 |
| Pipe Length (ft) | = | 49.25 |
| Slope (%) | = | 2.50 |
| Invert Elev Up (ft) | = | 6135.13 |
| Rise (in) | = | 18.0 |
| Shape | = | Circular |
| Span (in) | = | 18.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

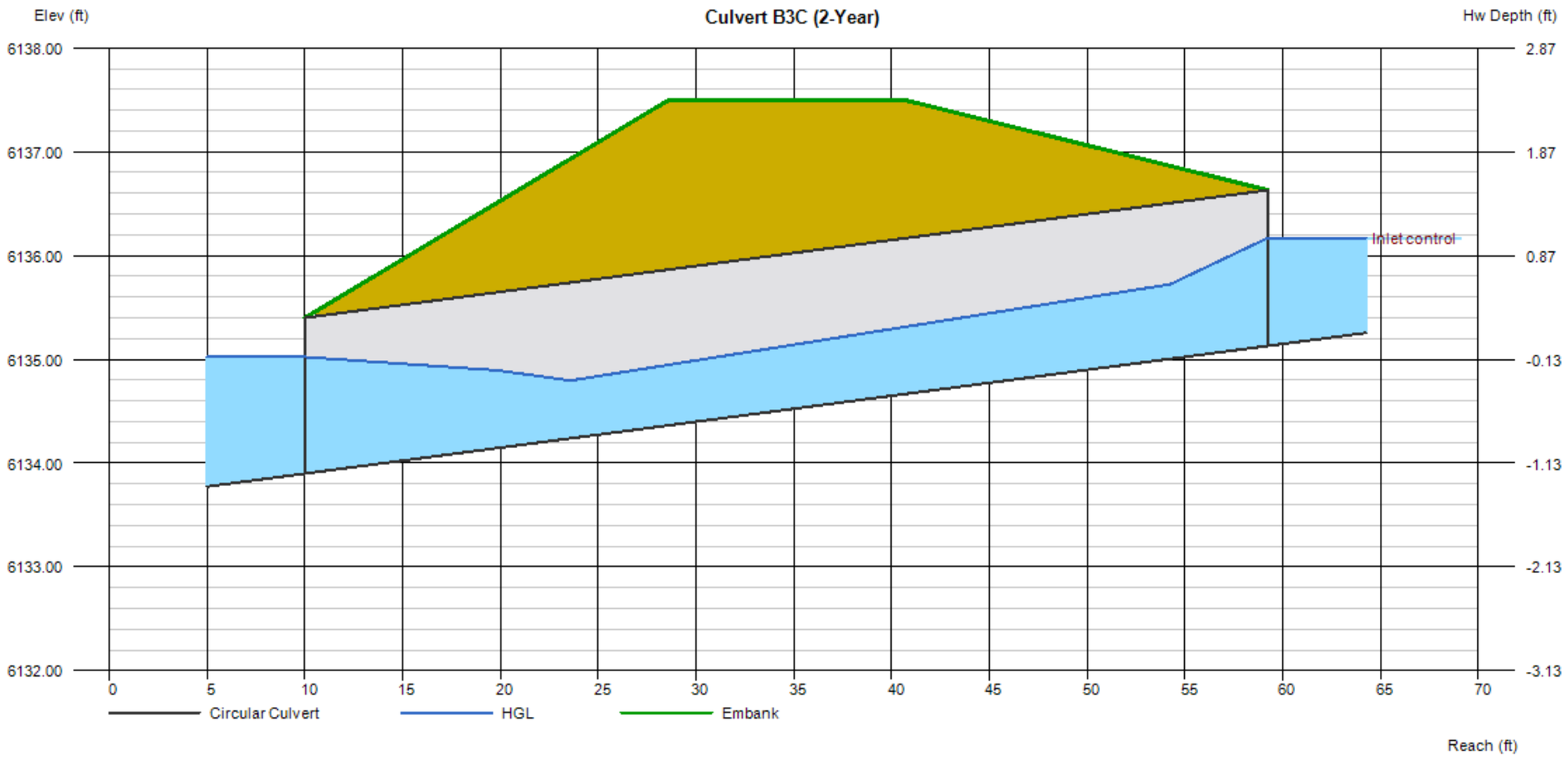
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6137.50 |
| Top Width (ft) | = | 12.00 |
| Crest Width (ft) | = | 12.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 3.80 |
| Qmax (cfs) | = | 14.65 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 3.80 |
| Qpipe (cfs) | = | 3.80 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 2.68 |
| Veloc Up (ft/s) | = | 4.34 |
| HGL Dn (ft) | = | 6135.02 |
| HGL Up (ft) | = | 6135.88 |
| Hw Elev (ft) | = | 6136.17 |
| Hw/D (ft) | = | 0.69 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3C (100-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6133.90 |
| Pipe Length (ft) | = | 49.25 |
| Slope (%) | = | 2.50 |
| Invert Elev Up (ft) | = | 6135.13 |
| Rise (in) | = | 18.0 |
| Shape | = | Circular |
| Span (in) | = | 18.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

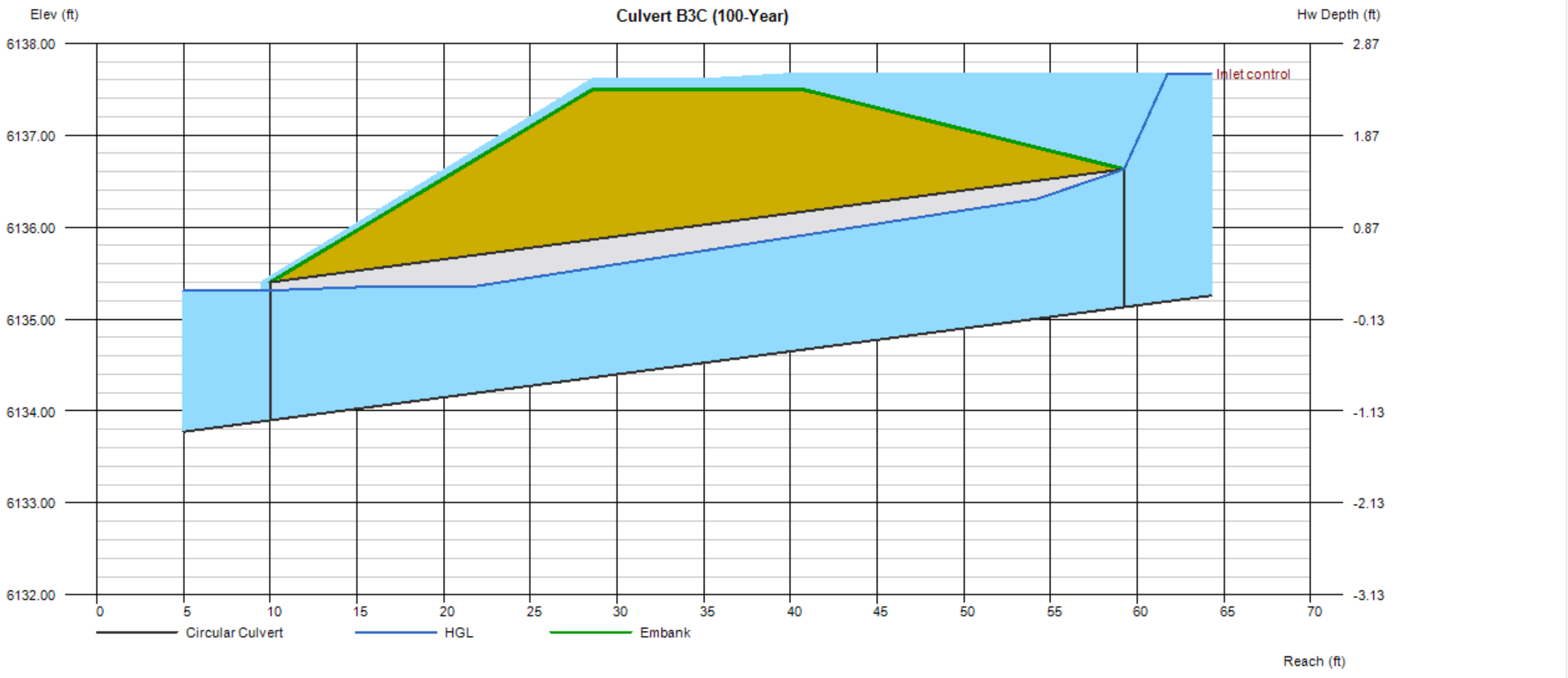
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6137.50 |
| Top Width (ft) | = | 12.00 |
| Crest Width (ft) | = | 12.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 3.80 |
| Qmax (cfs) | = | 14.65 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 14.64 |
| Qpipe (cfs) | = | 12.25 |
| Qovertop (cfs) | = | 2.39 |
| Veloc Dn (ft/s) | = | 7.10 |
| Veloc Up (ft/s) | = | 7.43 |
| HGL Dn (ft) | = | 6135.31 |
| HGL Up (ft) | = | 6136.45 |
| Hw Elev (ft) | = | 6137.67 |
| Hw/D (ft) | = | 1.69 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3D (2-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6138.27 |
| Pipe Length (ft) | = | 40.25 |
| Slope (%) | = | 5.61 |
| Invert Elev Up (ft) | = | 6140.53 |
| Rise (in) | = | 24.0 |
| Shape | = | Circular |
| Span (in) | = | 24.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

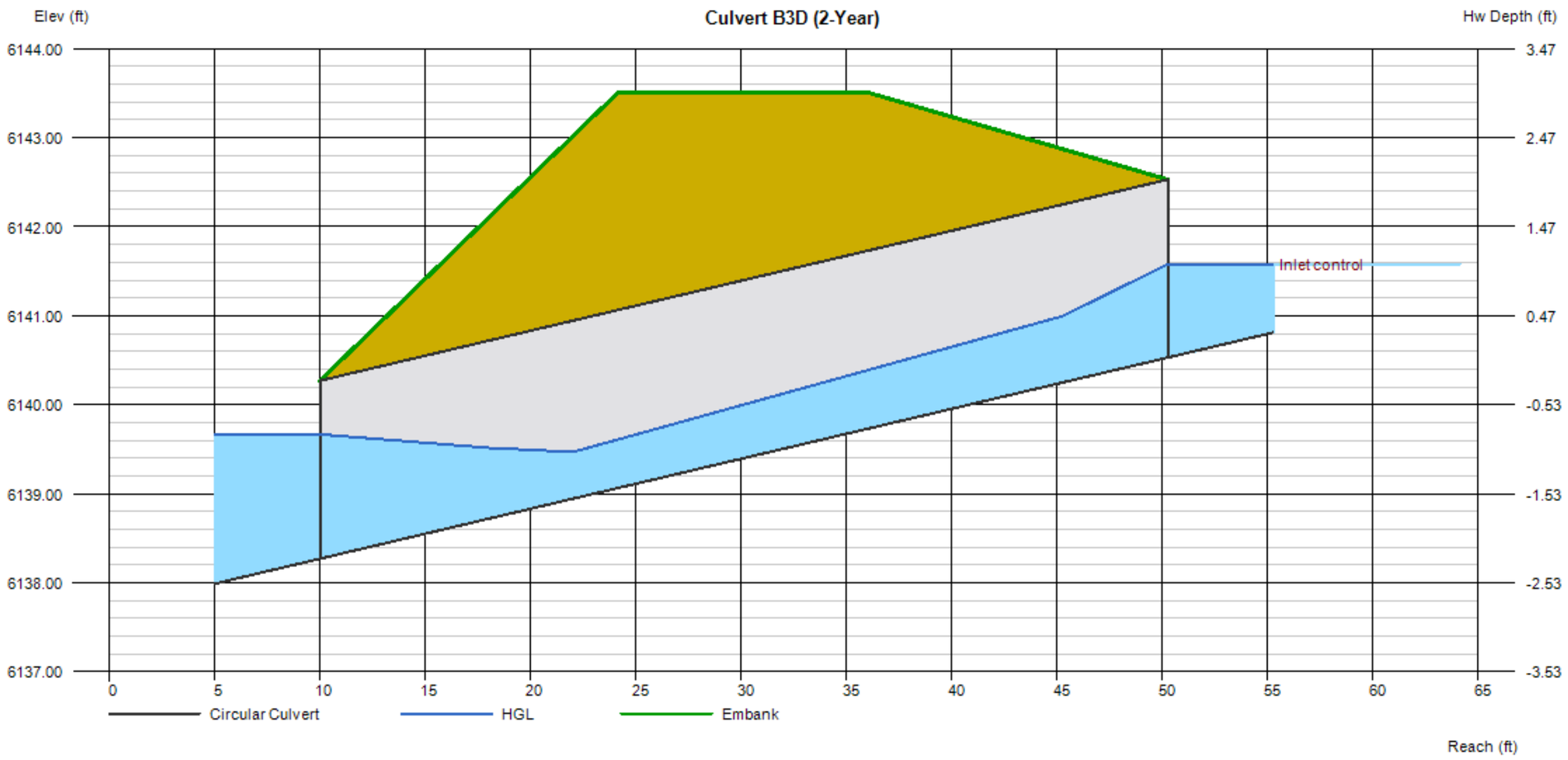
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6143.50 |
| Top Width (ft) | = | 12.00 |
| Crest Width (ft) | = | 12.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 5.08 |
| Qmax (cfs) | = | 40.50 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 5.08 |
| Qpipe (cfs) | = | 5.08 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 2.17 |
| Veloc Up (ft/s) | = | 4.38 |
| HGL Dn (ft) | = | 6139.67 |
| HGL Up (ft) | = | 6141.32 |
| Hw Elev (ft) | = | 6141.58 |
| Hw/D (ft) | = | 0.52 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3D (100-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6138.27 |
| Pipe Length (ft) | = | 40.25 |
| Slope (%) | = | 5.61 |
| Invert Elev Up (ft) | = | 6140.53 |
| Rise (in) | = | 24.0 |
| Shape | = | Circular |
| Span (in) | = | 24.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

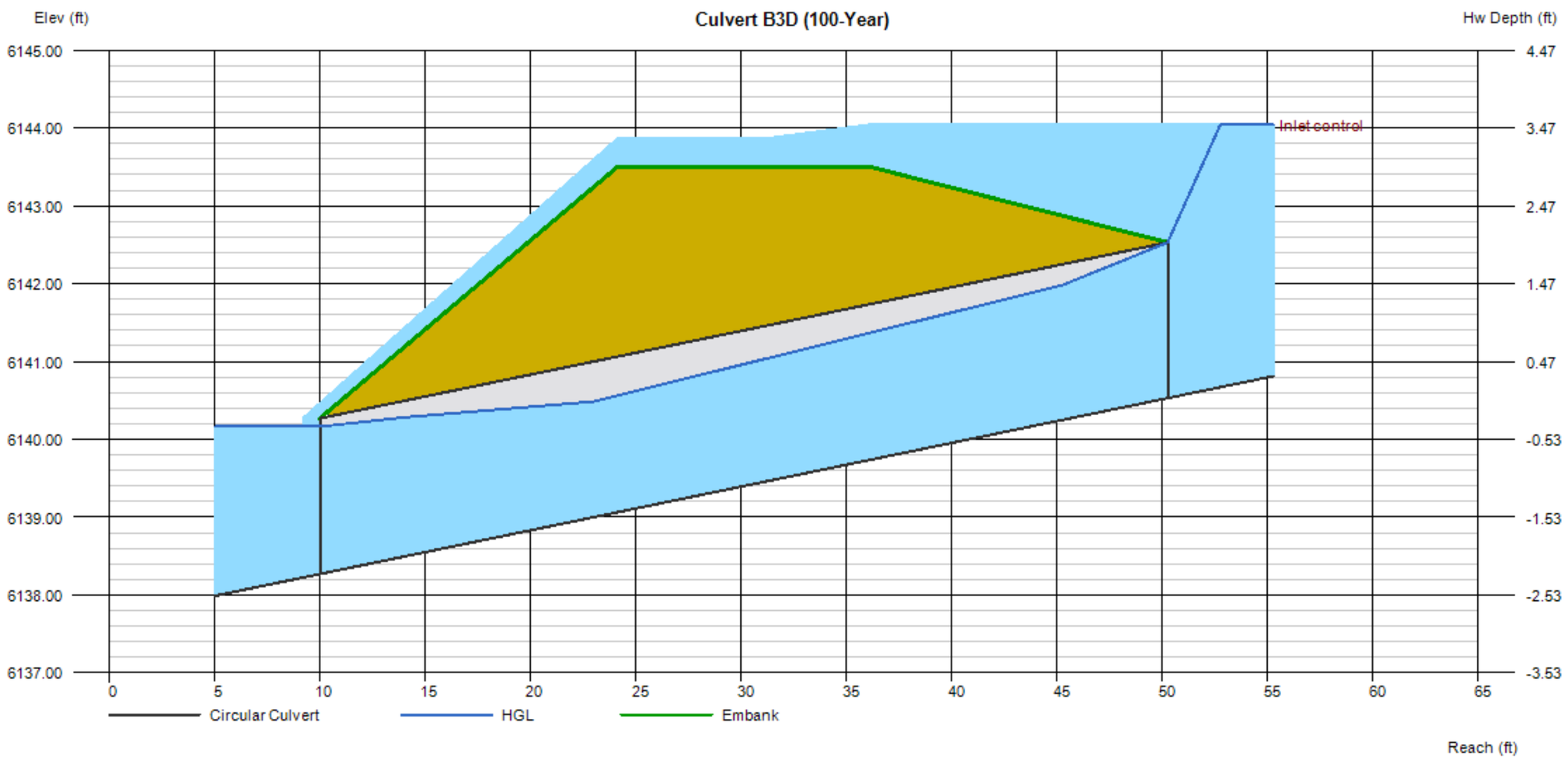
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6143.50 |
| Top Width (ft) | = | 12.00 |
| Crest Width (ft) | = | 12.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 5.08 |
| Qmax (cfs) | = | 40.50 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 40.50 |
| Qpipe (cfs) | = | 26.10 |
| Qovertop (cfs) | = | 14.40 |
| Veloc Dn (ft/s) | = | 8.48 |
| Veloc Up (ft/s) | = | 8.81 |
| HGL Dn (ft) | = | 6140.16 |
| HGL Up (ft) | = | 6142.32 |
| Hw Elev (ft) | = | 6144.04 |
| Hw/D (ft) | = | 1.76 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3E (2-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6131.16 |
| Pipe Length (ft) | = | 44.73 |
| Slope (%) | = | 5.59 |
| Invert Elev Up (ft) | = | 6133.66 |
| Rise (in) | = | 24.0 |
| Shape | = | Circular |
| Span (in) | = | 24.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

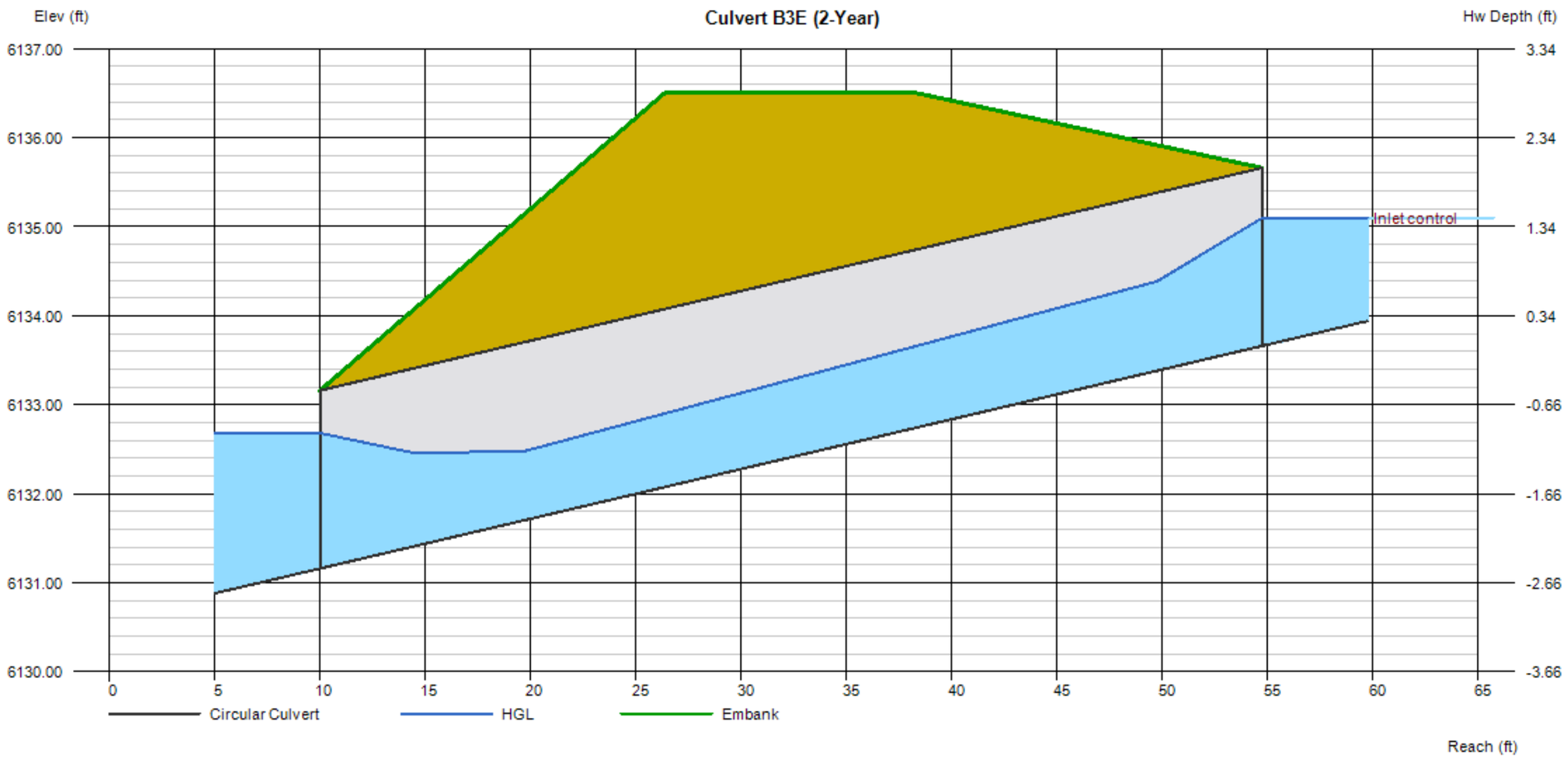
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6136.50 |
| Top Width (ft) | = | 12.00 |
| Crest Width (ft) | = | 12.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 8.56 |
| Qmax (cfs) | = | 53.10 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 8.56 |
| Qpipe (cfs) | = | 8.56 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 3.34 |
| Veloc Up (ft/s) | = | 5.17 |
| HGL Dn (ft) | = | 6132.68 |
| HGL Up (ft) | = | 6134.70 |
| Hw Elev (ft) | = | 6135.10 |
| Hw/D (ft) | = | 0.72 |
| Flow Regime | = | Inlet Control |



# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Oct 17 2022

## Culvert B3E (100-Year)

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6131.16 |
| Pipe Length (ft) | = | 44.73 |
| Slope (%) | = | 5.59 |
| Invert Elev Up (ft) | = | 6133.66 |
| Rise (in) | = | 24.0 |
| Shape | = | Circular |
| Span (in) | = | 24.0 |
| No. Barrels | = | 1 |
| n-Value | = | 0.012 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

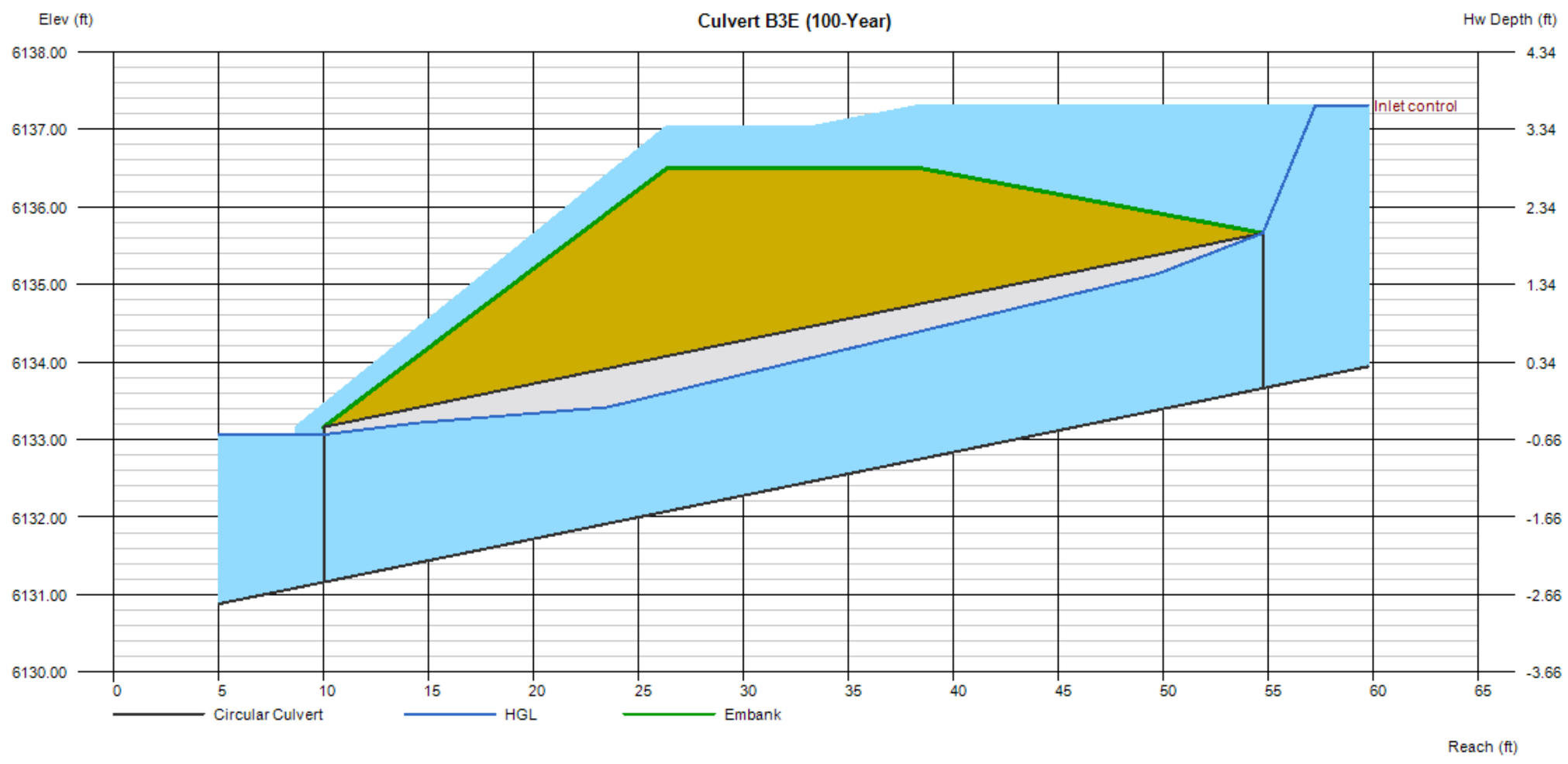
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6136.50 |
| Top Width (ft) | = | 12.00 |
| Crest Width (ft) | = | 12.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 8.56 |
| Qmax (cfs) | = | 53.10 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 8.56 |
| Qpipe (cfs) | = | 8.56 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 3.34 |
| Veloc Up (ft/s) | = | 5.17 |
| HGL Dn (ft) | = | 6132.68 |
| HGL Up (ft) | = | 6134.70 |
| Hw Elev (ft) | = | 6135.10 |
| Hw/D (ft) | = | 0.72 |
| Flow Regime | = | Inlet Control |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 26 2022

## Emergency Overflow Section A-A

**Trapezoidal**

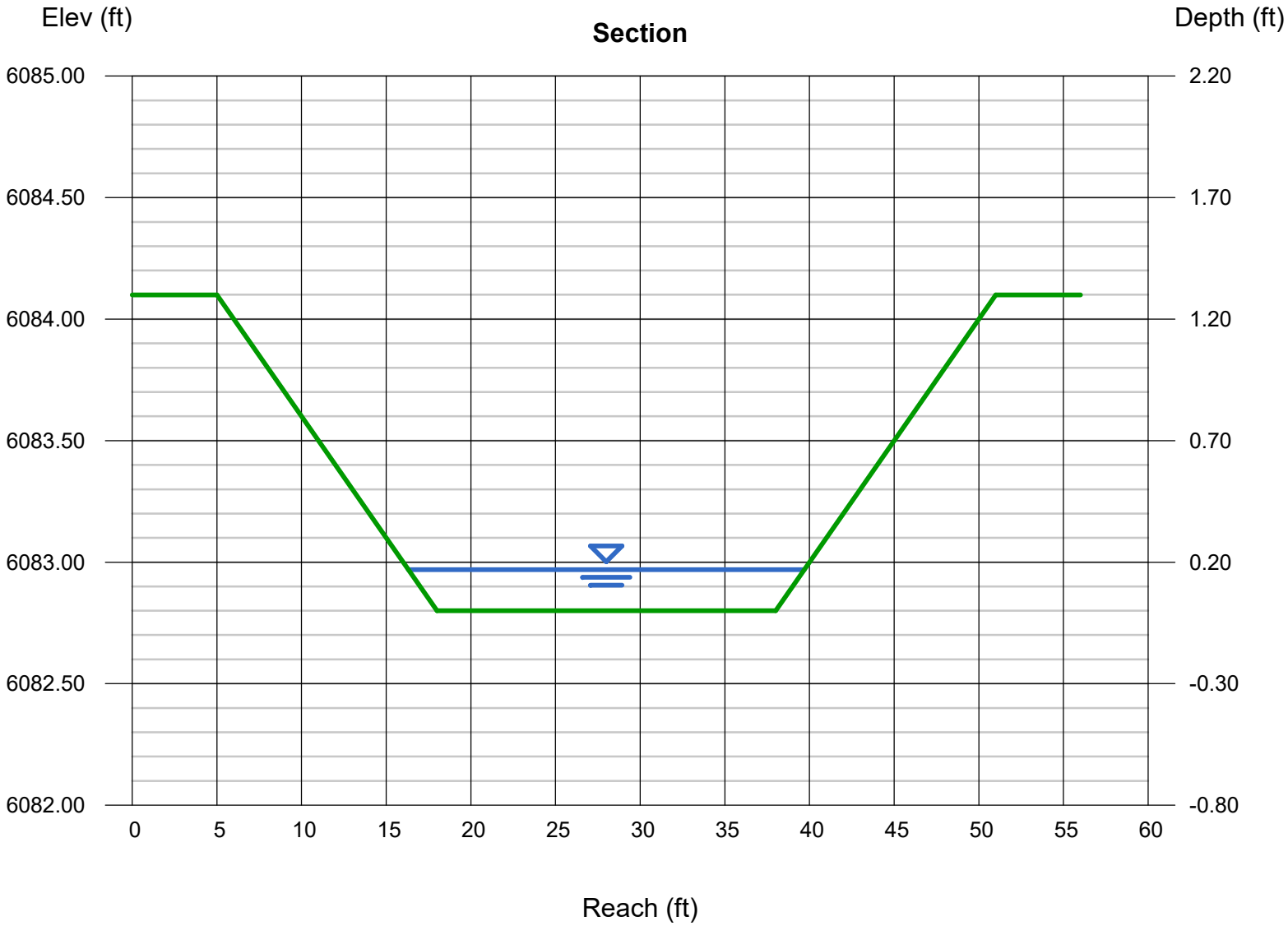
| | |
|---|---|
| Bottom Width (ft) | = 20.00 |
| Side Slopes (z:1) | = 10.00, 10.00 |
| Total Depth (ft) | = 1.30 |
| Invert Elev (ft) | = 6082.80 |
| Slope (%) | = 5.00 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 11.89 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.17 |
| Q (cfs) | = 11.89 |
| Area (sqft) | = 3.69 |
| Velocity (ft/s) | = 3.22 |
| Wetted Perim (ft) | = 23.42 |
| Crit Depth, Yc (ft) | = 0.22 |
| Top Width (ft) | = 23.40 |
| EGL (ft) | = 0.33 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 26 2022

## Emergency Overflow Section B-B

**Trapezoidal**

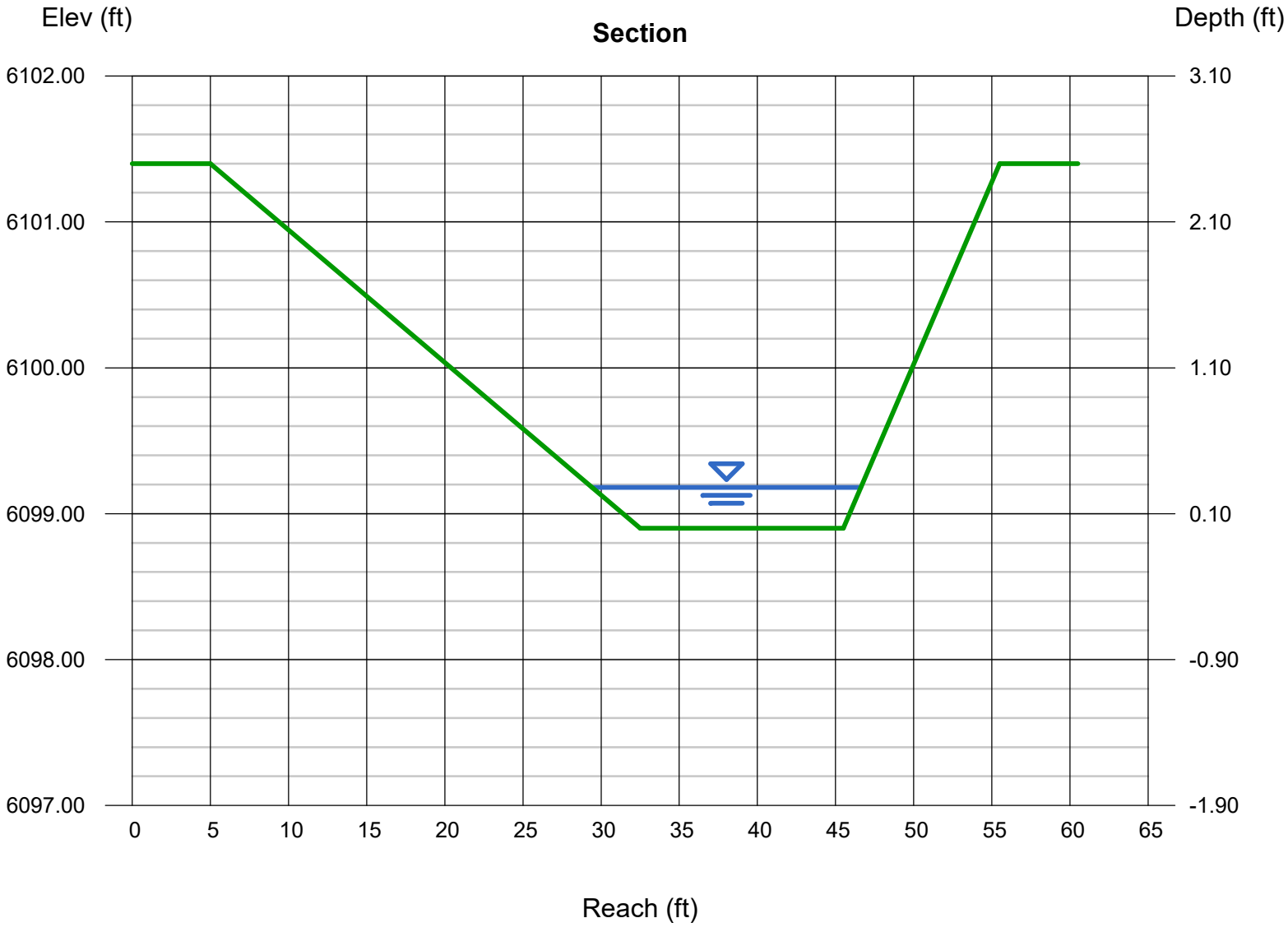
| | |
|---|---|
| Bottom Width (ft) | = 13.00 |
| Side Slopes (z:1) | = 11.00, 4.00 |
| Total Depth (ft) | = 2.50 |
| Invert Elev (ft) | = 6098.90 |
| Slope (%) | = 9.00 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 23.96 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.28 |
| Q (cfs) | = 23.96 |
| Area (sqft) | = 4.23 |
| Velocity (ft/s) | = 5.67 |
| Wetted Perim (ft) | = 17.25 |
| Crit Depth, Yc (ft) | = 0.44 |
| Top Width (ft) | = 17.20 |
| EGL (ft) | = 0.78 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 26 2022

## Emergency Overflow Section C-C

**Trapezoidal**

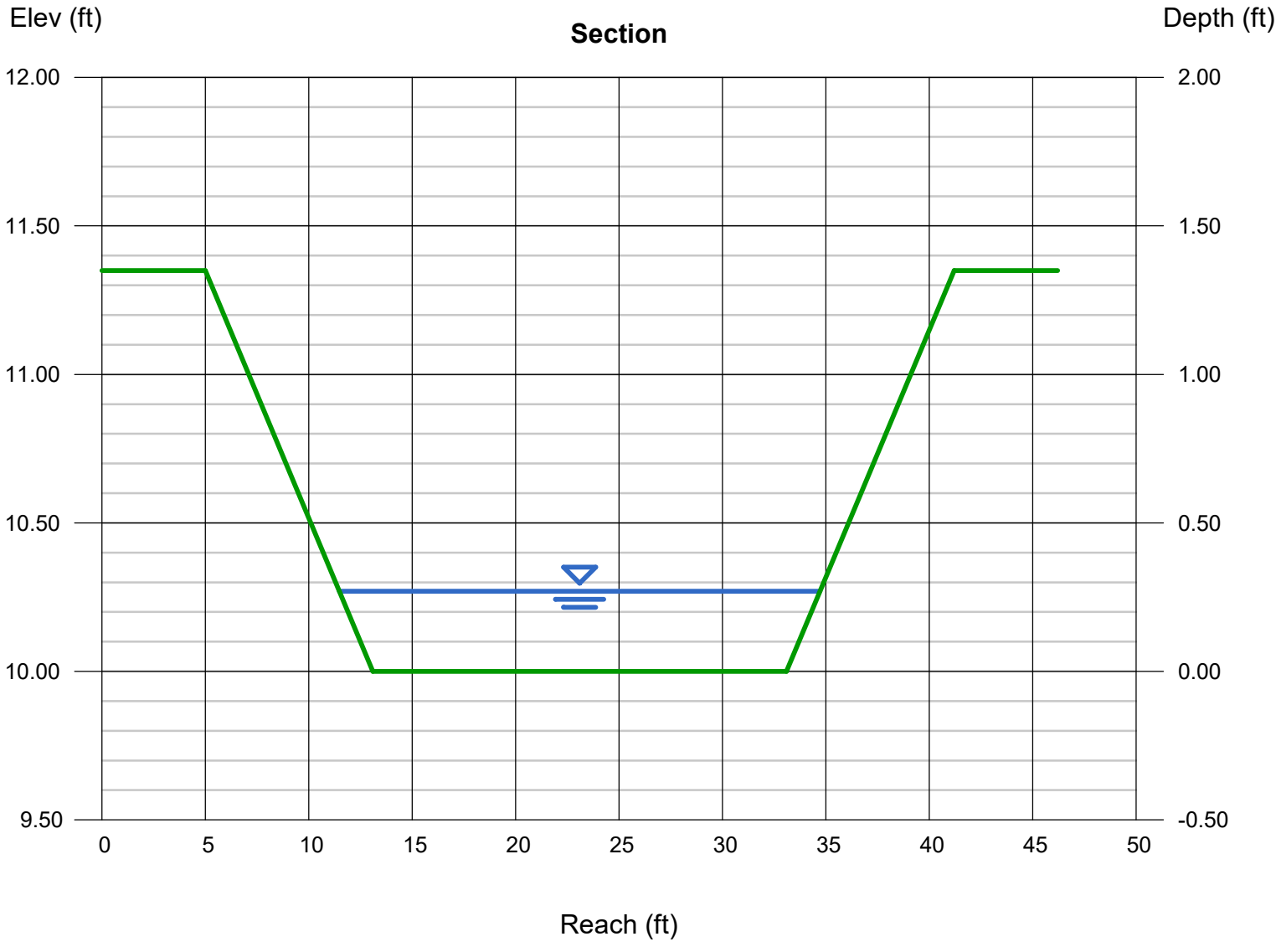
| | |
|---|---|
| Bottom Width (ft) | = 20.00 |
| Side Slopes (z:1) | = 6.00, 6.00 |
| Total Depth (ft) | = 1.35 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 10.00 |
| N-Value | = 0.030 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 35.61 |

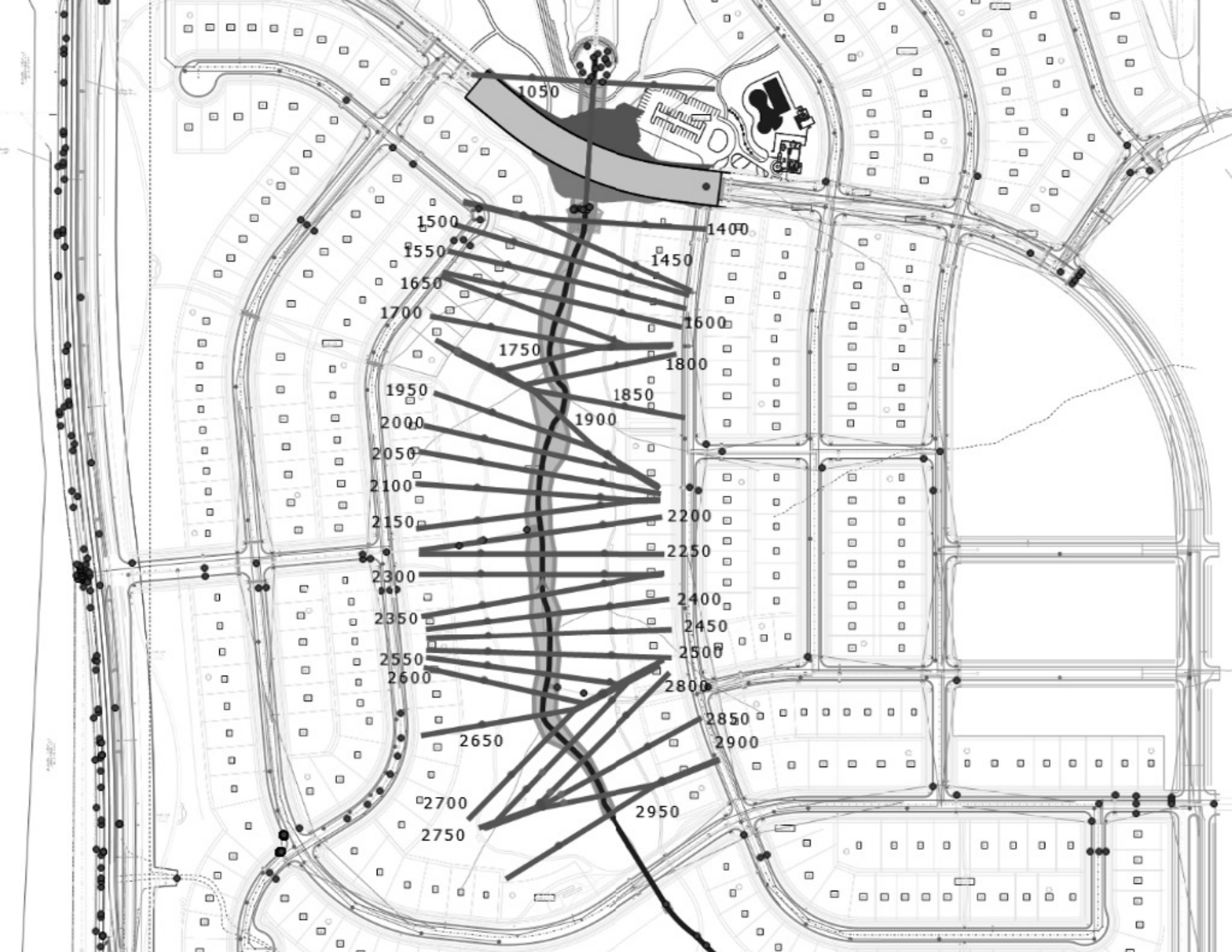
**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.27 |
| Q (cfs) | = 35.61 |
| Area (sqft) | = 5.84 |
| Velocity (ft/s) | = 6.10 |
| Wetted Perim (ft) | = 23.28 |
| Crit Depth, Yc (ft) | = 0.45 |
| Top Width (ft) | = 23.24 |
| EGL (ft) | = 0.85 |



HEC-RAS Plan: Default Scenario River: Channel 1 Reach: Centerline Profile: PF# 1

| Reach | River Sta | Profile | Q Total | Min Ch El | W.S. Elev | Crit W.S. | E.G. Elev | E.G. Slope | Vel Chnl | Flow Area | Top Width | Froude # Chl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft/ft) | (ft/s) | (sq ft) | (ft) | |
| Centerline | 2950 | PF# 1 | 125.56 | 6110.00 | 6111.06 | 6111.06 | 6111.49 | 0.019063 | 5.27 | 23.83 | 27.74 | 1.00 |
| Centerline | 2900 | PF# 1 | 125.56 | 6106.00 | 6107.65 | 6107.65 | 6108.17 | 0.017556 | 5.78 | 21.71 | 20.47 | 0.99 |
| Centerline | 2850 | PF# 1 | 125.56 | 6104.00 | 6105.87 | 6105.87 | 6106.40 | 0.017337 | 5.86 | 21.41 | 19.51 | 0.99 |
| Centerline | 2800 | PF# 1 | 125.56 | 6103.00 | 6104.49 | 6104.49 | 6104.95 | 0.019121 | 5.44 | 23.07 | 25.57 | 1.01 |
| Centerline | 2750 | PF# 1 | 125.56 | 6102.00 | 6103.50 | 6103.50 | 6103.89 | 0.018548 | 4.96 | 25.30 | 31.61 | 0.98 |
| Centerline | 2700 | PF# 1 | 125.56 | 6102.00 | 6102.69 | | 6102.91 | 0.015423 | 3.73 | 33.66 | 56.47 | 0.85 |
| Centerline | 2650 | PF# 1 | 125.56 | 6101.00 | 6101.72 | 6101.72 | 6102.00 | 0.021552 | 4.25 | 29.54 | 52.41 | 1.00 |
| Centerline | 2600 | PF# 1 | 125.56 | 6100.00 | 6100.57 | 6100.57 | 6100.84 | 0.022388 | 4.18 | 30.04 | 56.21 | 1.01 |
| Centerline | 2550 | PF# 1 | 140.42 | 6098.00 | 6098.75 | 6098.72 | 6099.04 | 0.017901 | 4.35 | 32.30 | 48.11 | 0.94 |
| Centerline | 2500 | PF# 1 | 140.42 | 6097.00 | 6097.76 | 6097.76 | 6098.06 | 0.021635 | 4.41 | 31.84 | 53.59 | 1.01 |
| Centerline | 2450 | PF# 1 | 140.42 | 6095.00 | 6095.83 | 6095.83 | 6096.13 | 0.021008 | 4.40 | 31.93 | 52.79 | 1.00 |
| Centerline | 2400 | PF# 1 | 140.42 | 6094.00 | 6094.53 | 6094.53 | 6094.78 | 0.022894 | 4.01 | 35.03 | 70.99 | 1.01 |
| Centerline | 2350 | PF# 1 | 140.42 | 6092.00 | 6092.89 | 6092.89 | 6093.20 | 0.021433 | 4.50 | 31.17 | 50.45 | 1.01 |
| Centerline | 2300 | PF# 1 | 140.42 | 6091.00 | 6091.80 | 6091.80 | 6092.08 | 0.022262 | 4.30 | 32.67 | 58.39 | 1.01 |
| Centerline | 2250 | PF# 1 | 140.42 | 6090.00 | 6090.56 | 6090.56 | 6090.81 | 0.022207 | 4.05 | 34.68 | 67.68 | 1.00 |
| Centerline | 2200 | PF# 1 | 140.42 | 6088.00 | 6088.82 | 6088.75 | 6089.08 | 0.015869 | 4.06 | 34.56 | 52.13 | 0.88 |
| Centerline | 2150 | PF# 1 | 174.72 | 6087.00 | 6087.84 | 6087.84 | 6088.16 | 0.020847 | 4.54 | 38.46 | 60.25 | 1.00 |
| Centerline | 2100 | PF# 1 | 174.72 | 6085.00 | 6086.32 | 6086.29 | 6086.66 | 0.017241 | 4.68 | 37.36 | 48.54 | 0.94 |
| Centerline | 2050 | PF# 1 | 174.72 | 6084.00 | 6085.49 | 6085.43 | 6085.82 | 0.016941 | 4.59 | 38.03 | 50.07 | 0.93 |
| Centerline | 2000 | PF# 1 | 174.72 | 6084.00 | 6084.67 | 6084.64 | 6084.93 | 0.018104 | 4.05 | 43.09 | 72.00 | 0.92 |
| Centerline | 1950 | PF# 1 | 174.72 | 6083.00 | 6083.65 | 6083.65 | 6083.93 | 0.022618 | 4.21 | 41.53 | 77.61 | 1.01 |
| Centerline | 1900 | PF# 1 | 174.72 | 6080.00 | 6081.18 | 6081.18 | 6081.41 | 0.026322 | 3.85 | 45.40 | 108.61 | 1.05 |
| Centerline | 1850 | PF# 1 | 174.72 | 6078.00 | 6079.83 | 6079.83 | 6080.31 | 0.017228 | 5.52 | 31.64 | 31.75 | 0.98 |
| Centerline | 1800 | PF# 1 | 174.72 | 6076.00 | 6078.95 | 6078.95 | 6079.36 | 0.018770 | 5.16 | 33.84 | 39.44 | 0.98 |
| Centerline | 1750 | PF# 1 | 174.72 | 6076.00 | 6077.84 | | 6078.08 | 0.010468 | 3.95 | 44.25 | 50.91 | 0.75 |
| Centerline | 1700 | PF# 1 | 174.72 | 6076.00 | 6077.02 | 6077.02 | 6077.36 | 0.020274 | 4.73 | 36.93 | 53.27 | 1.00 |
| Centerline | 1650 | PF# 1 | 174.72 | 6075.00 | 6075.68 | 6075.68 | 6075.97 | 0.021287 | 4.34 | 40.25 | 68.53 | 1.00 |
| Centerline | 1600 | PF# 1 | 174.72 | 6071.00 | 6072.07 | 6072.07 | 6072.38 | 0.022263 | 4.48 | 39.04 | 65.63 | 1.02 |
| Centerline | 1550 | PF# 1 | 174.72 | 6069.00 | 6070.05 | 6070.02 | 6070.41 | 0.017624 | 4.82 | 36.26 | 45.75 | 0.95 |
| Centerline | 1500 | PF# 1 | 174.72 | 6068.00 | 6069.85 | | 6070.00 | 0.003681 | 3.12 | 55.99 | 41.65 | 0.47 |
| Centerline | 1450 | PF# 1 | 174.72 | 6067.00 | 6069.82 | 6068.39 | 6069.89 | 0.000975 | 2.03 | 86.21 | 45.08 | 0.26 |
| Centerline | 1400 | PF# 1 | 174.72 | 6066.00 | 6069.14 | 6068.29 | 6069.74 | 0.004749 | 6.25 | 27.95 | 56.28 | 0.62 |
| Centerline | 1251.23 | | Culvert | | | | | | | | | |
| Centerline | 1050 | PF# 1 | 174.72 | 6044.00 | 6048.11 | 6044.70 | 6048.12 | 0.000070 | 0.78 | 224.94 | 56.96 | 0.07 |


1050
1500
1400
1550
1450
1650
1700
1600
1750
1800
1950
1850
2000
1900
2050
2100
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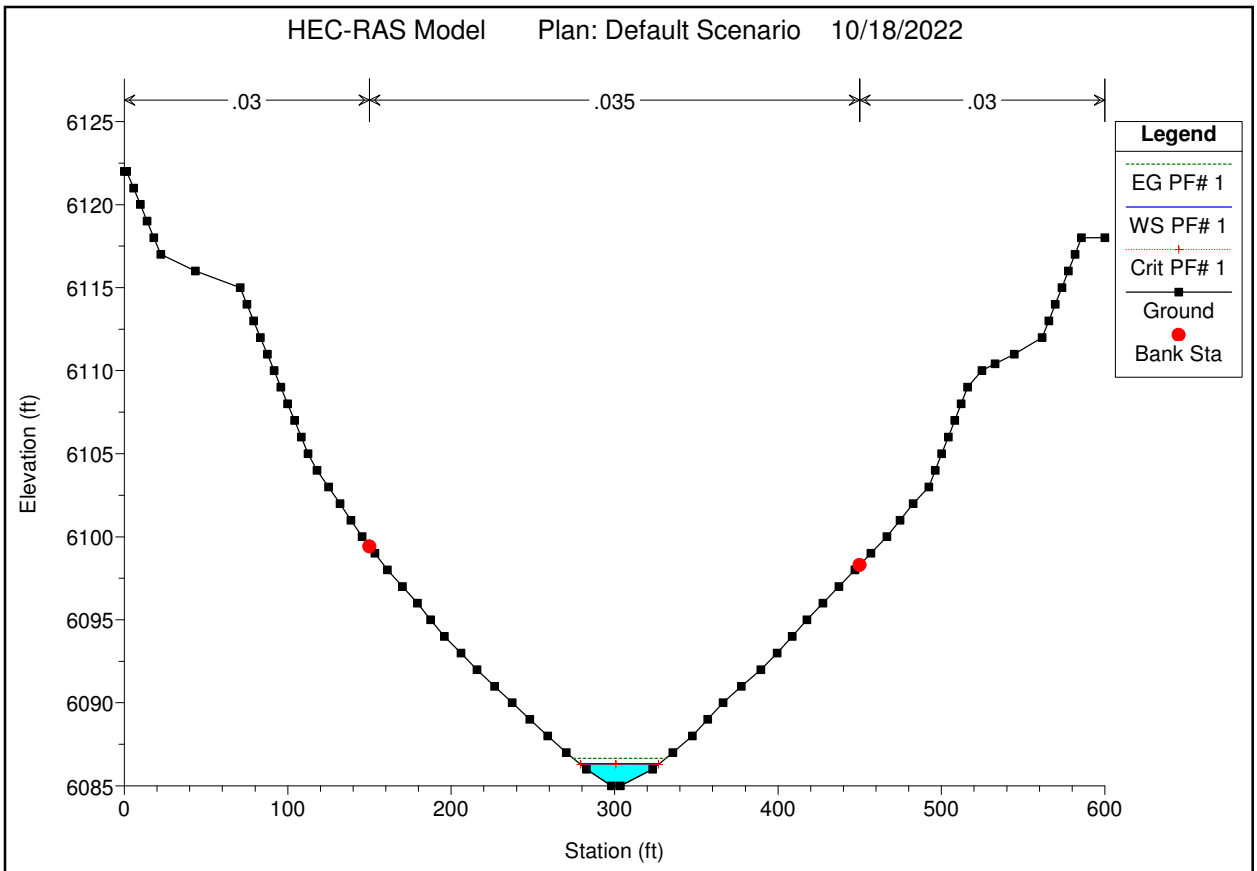
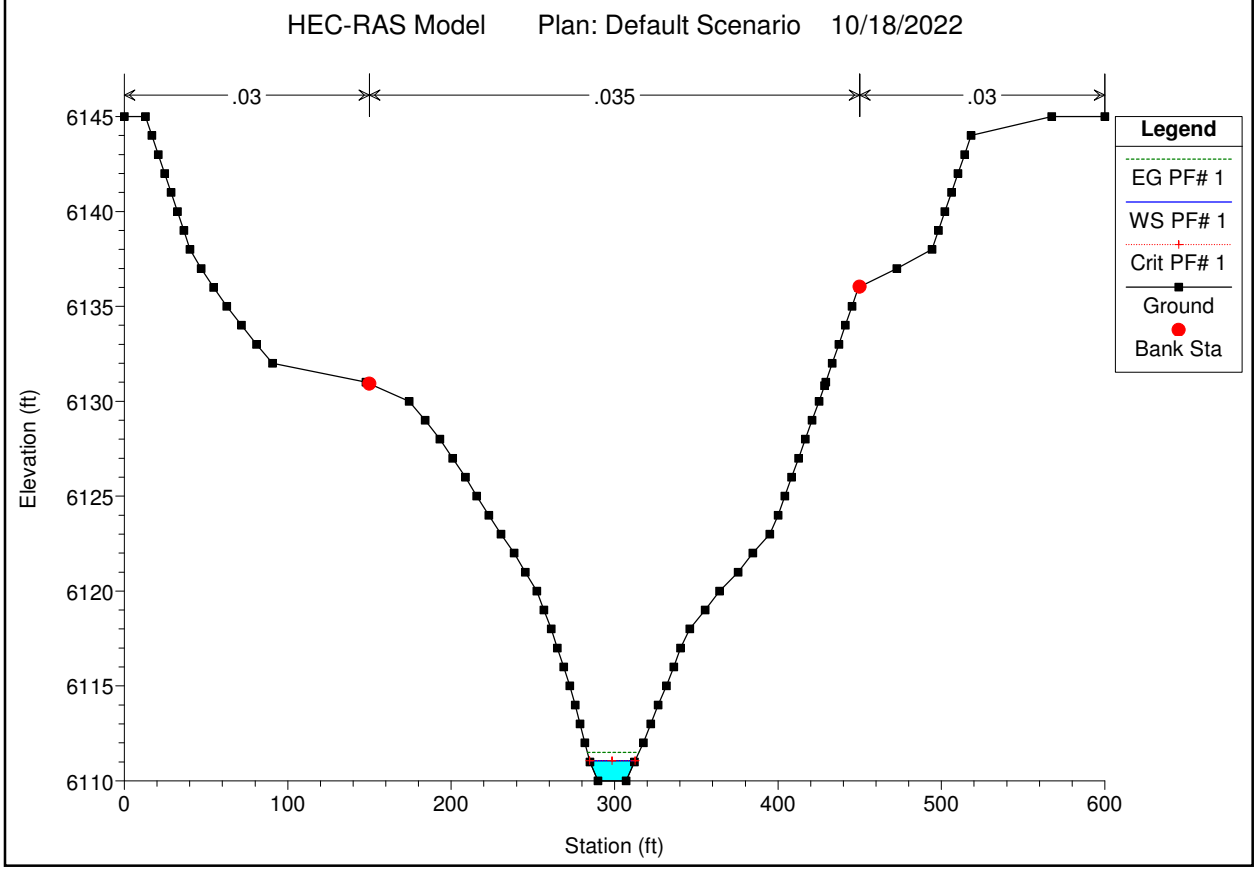
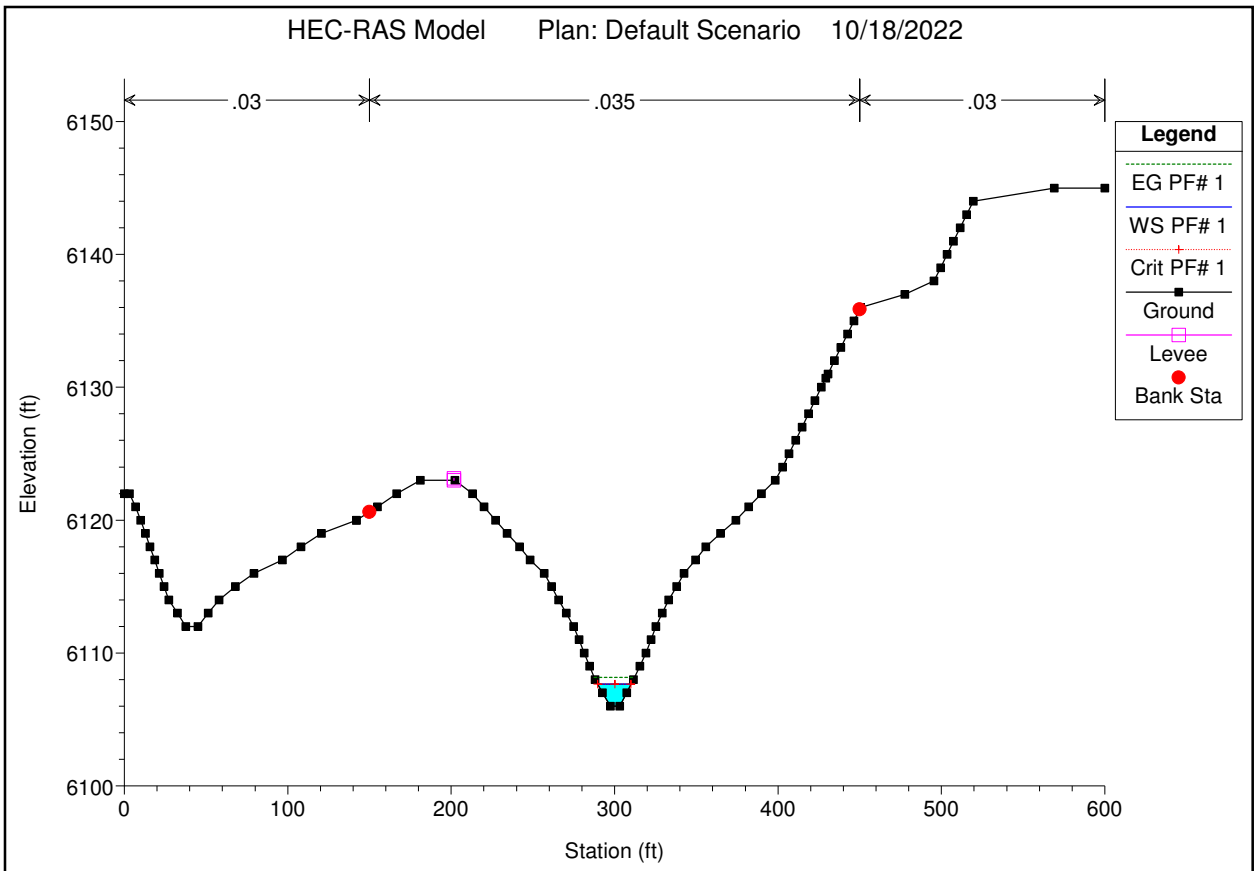
2800
2850
2650
2900
2700
2950
2750


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6125
6120
6115
6110
6105
6100
6095
6090
6085
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6145
6140
6135
6130
6125
6120
6115
6110
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
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Legend
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WS PF# 1
Crit PF# 1
Ground
Levee
Bank Sta
Elevation (ft)
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6140
6130
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6100
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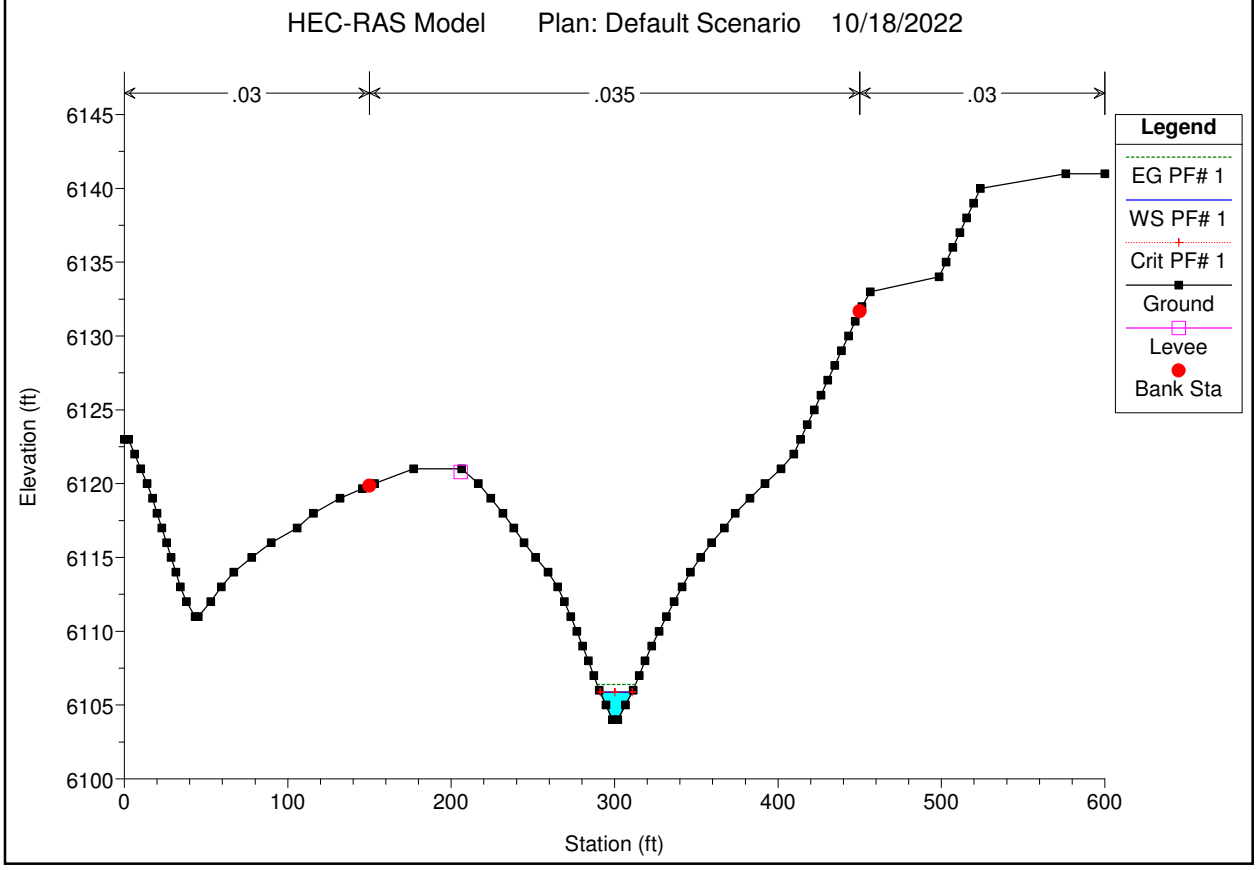
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Levee
Bank Sta
Elevation (ft)
6145
6140
6135
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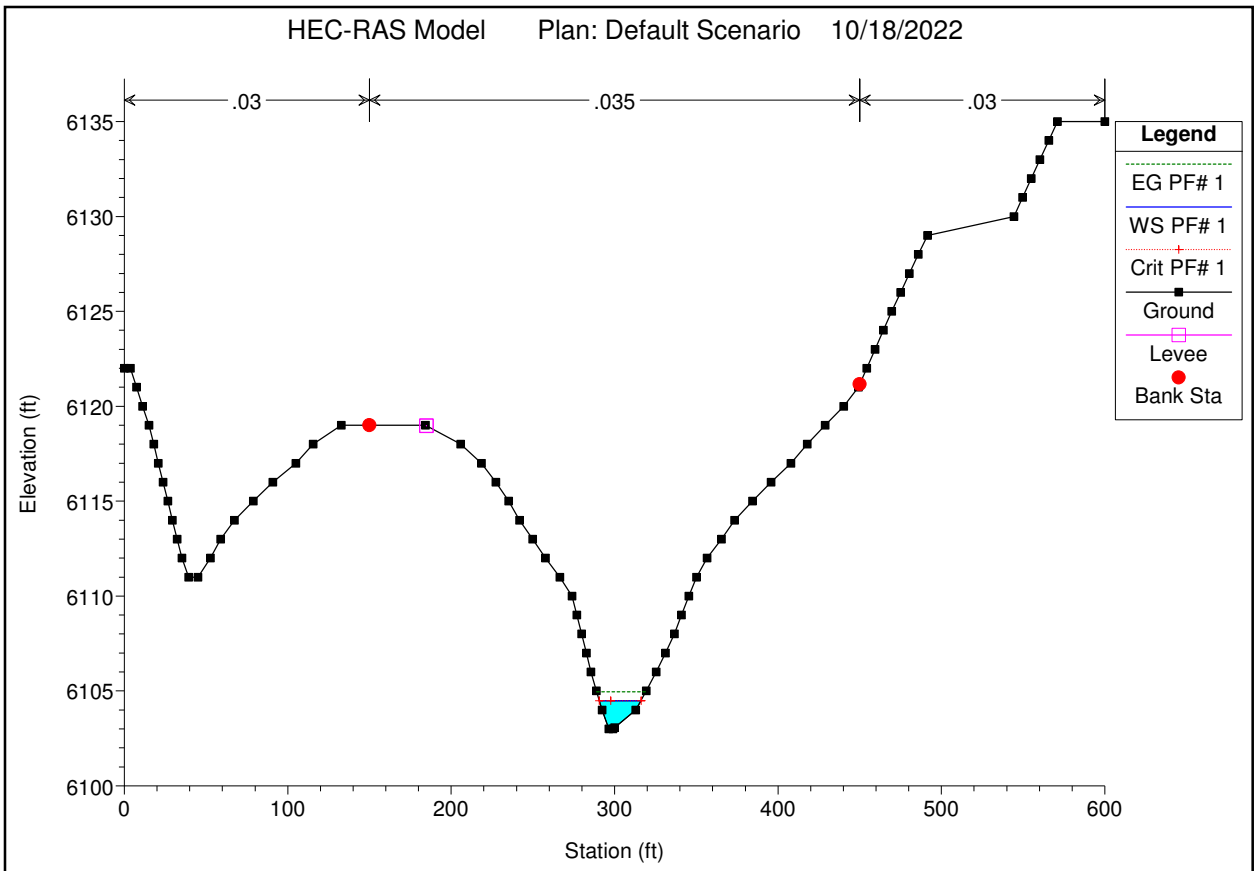
6120
6115
6110
6105
6100
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
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.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Levee
Bank Sta
Elevation (ft)
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6130
6125
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6115
6110
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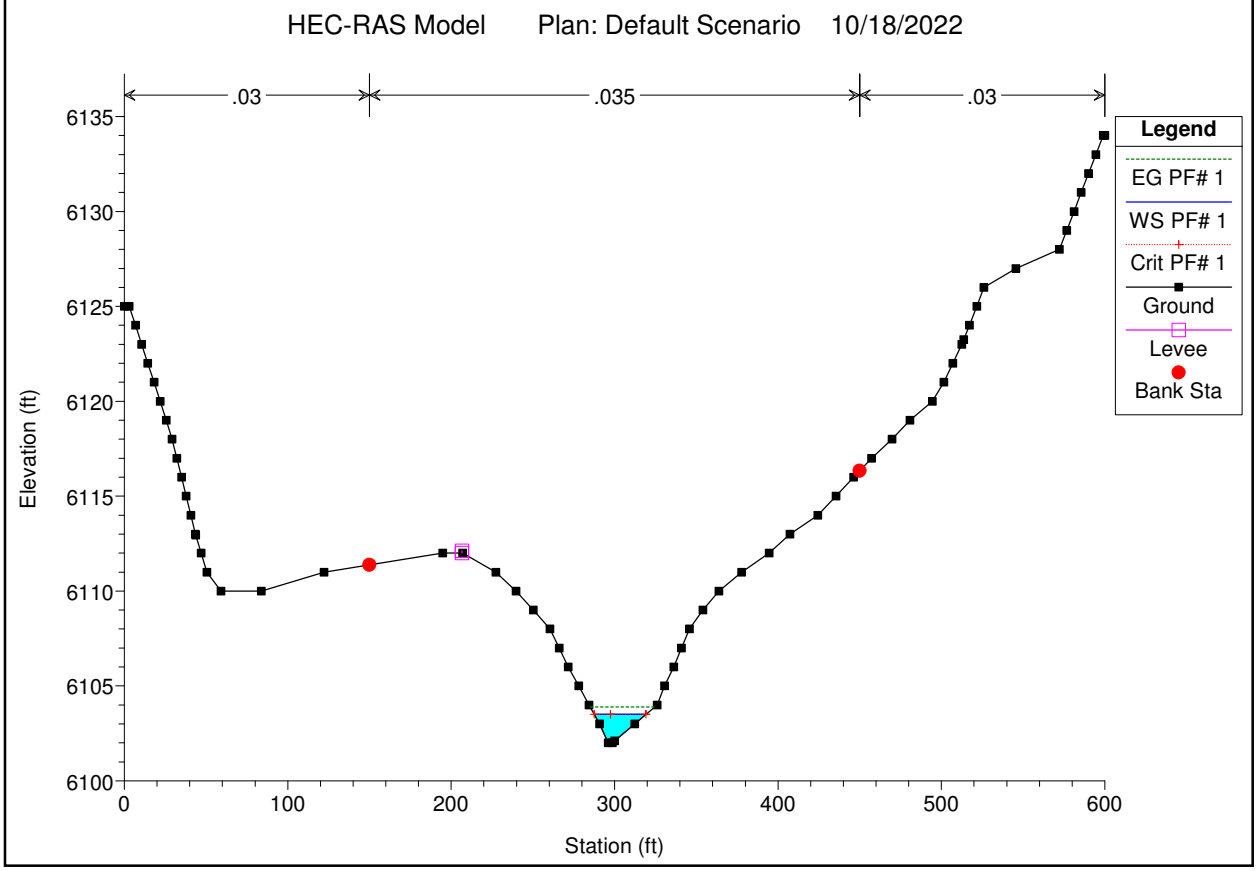
6100
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
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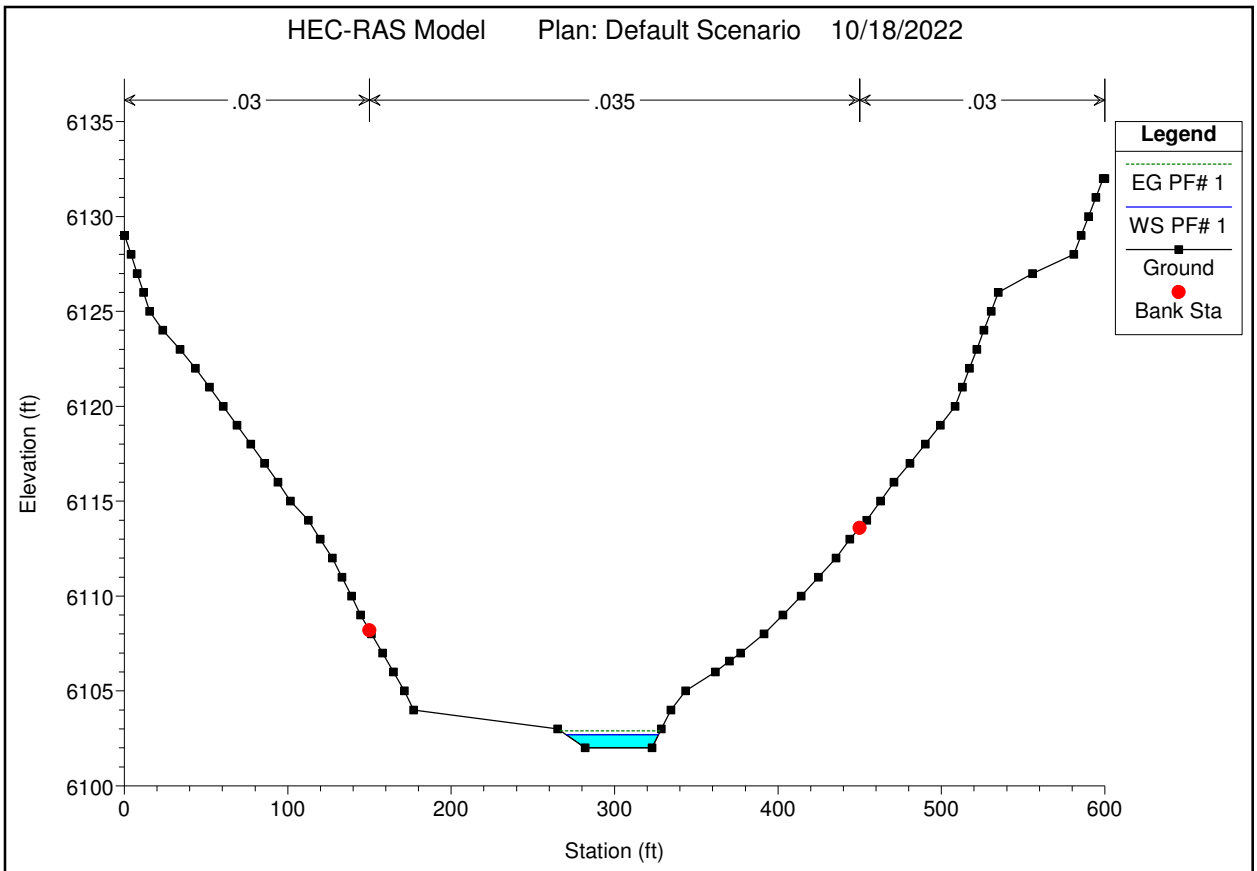
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Levee
Bank Sta
Elevation (ft)
6135
6130
6125
6120
6115
6110
6105
6100
0
100
200
300
400
500
600
Station (ft)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.035
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Legend
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WS PF# 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
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6130
6125
6120
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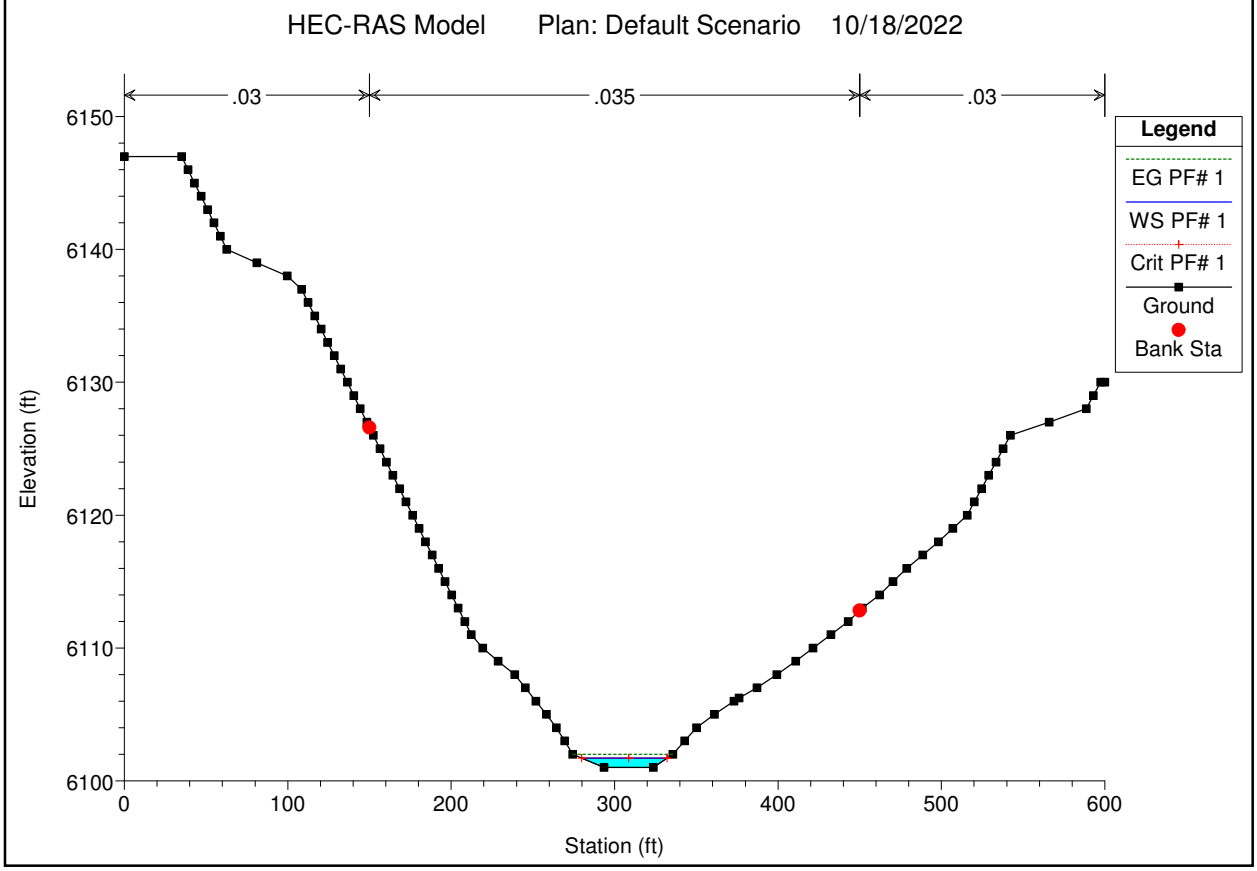
6110
6105
6100
0
100
200
300
400
500
600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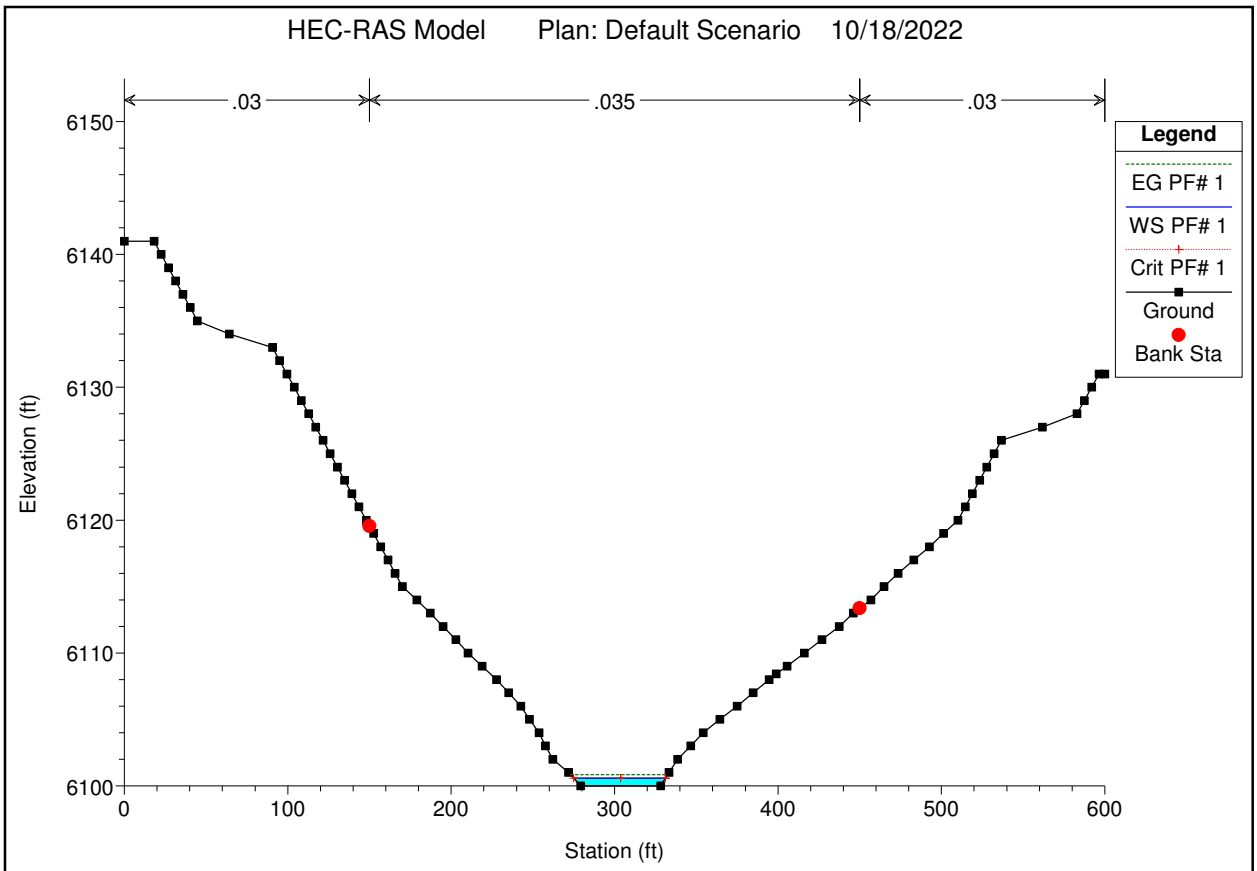
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
6150
6140
6130
6120
6110
6100
0
100
200
300
400
500
600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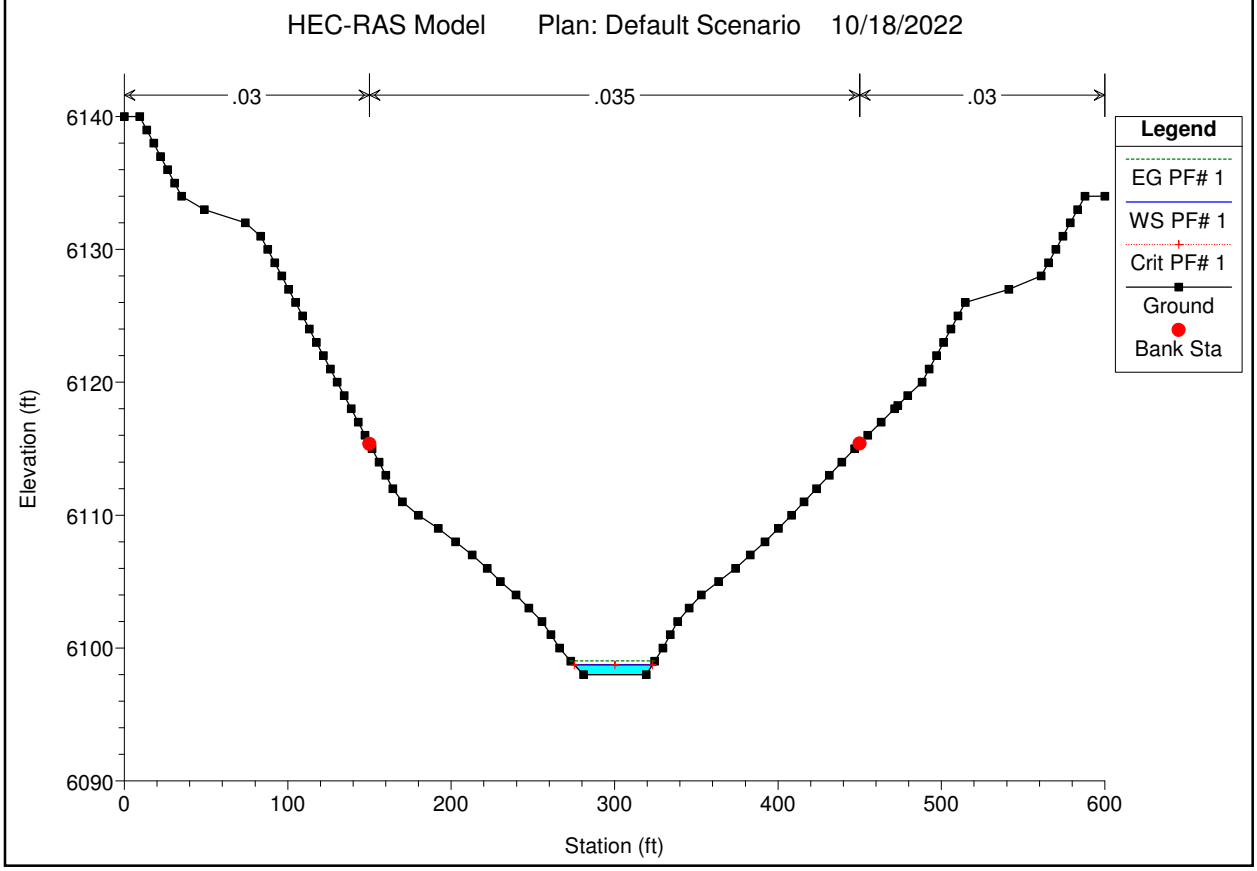
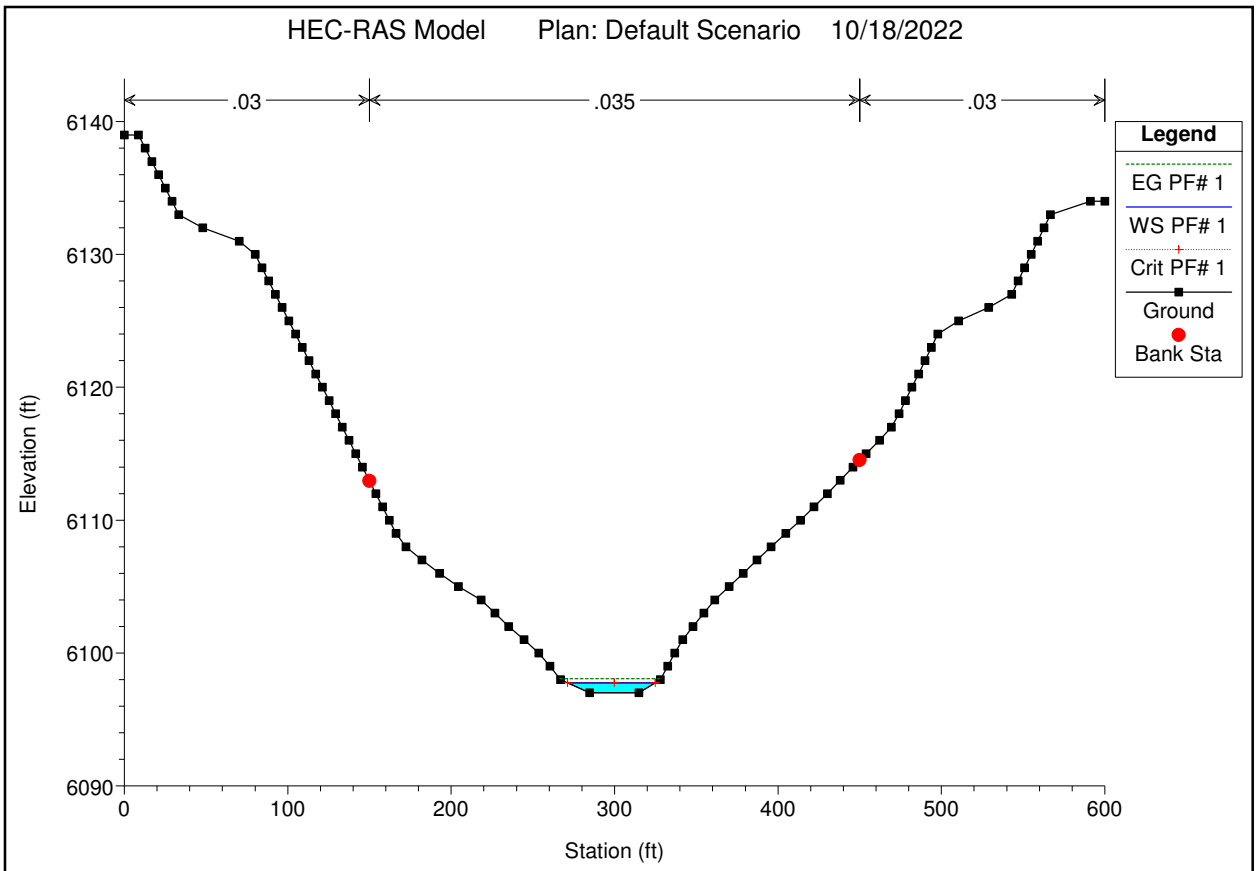
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6150
6140
6130
6120
6110
6100
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6140
6130
6120
6110
6100
6090
0
100
200
300
400
500
600
Station (ft)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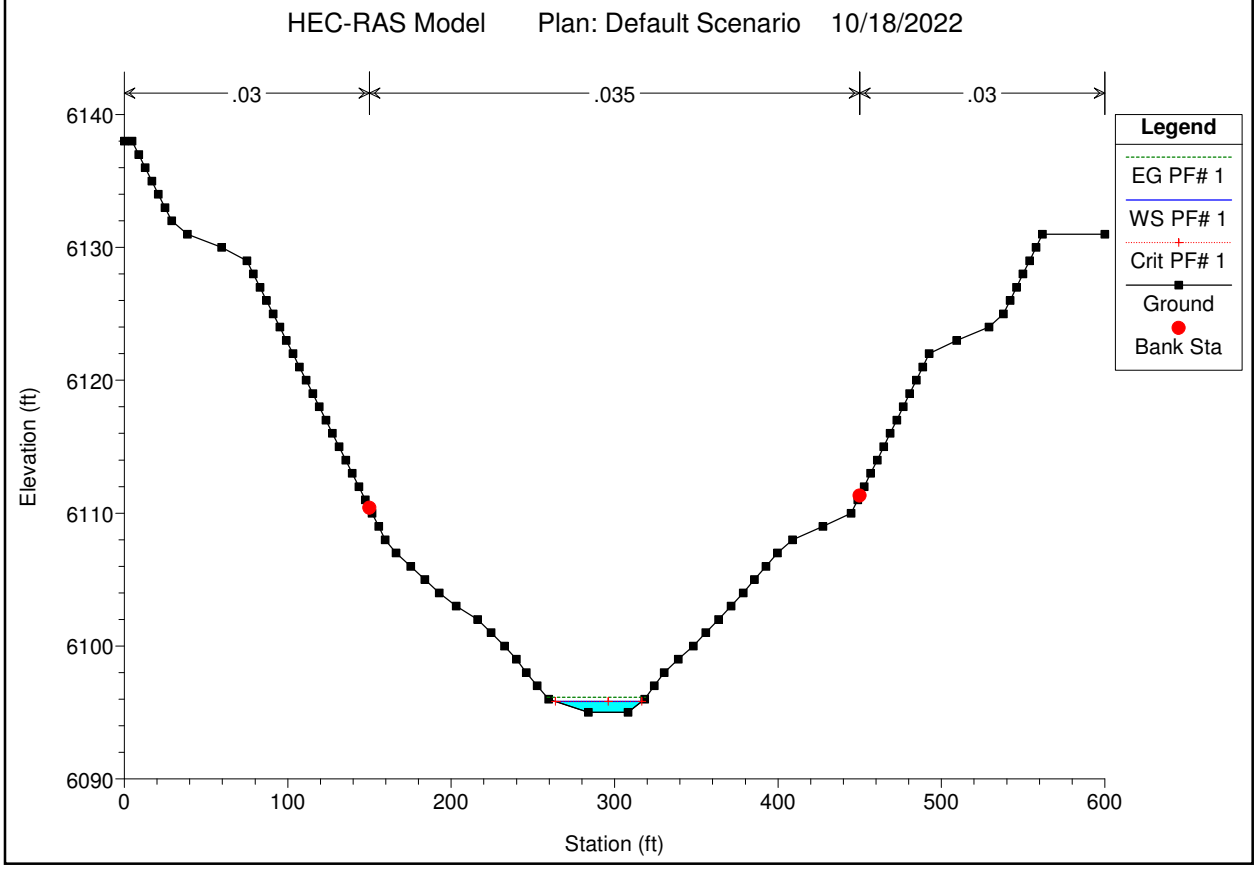
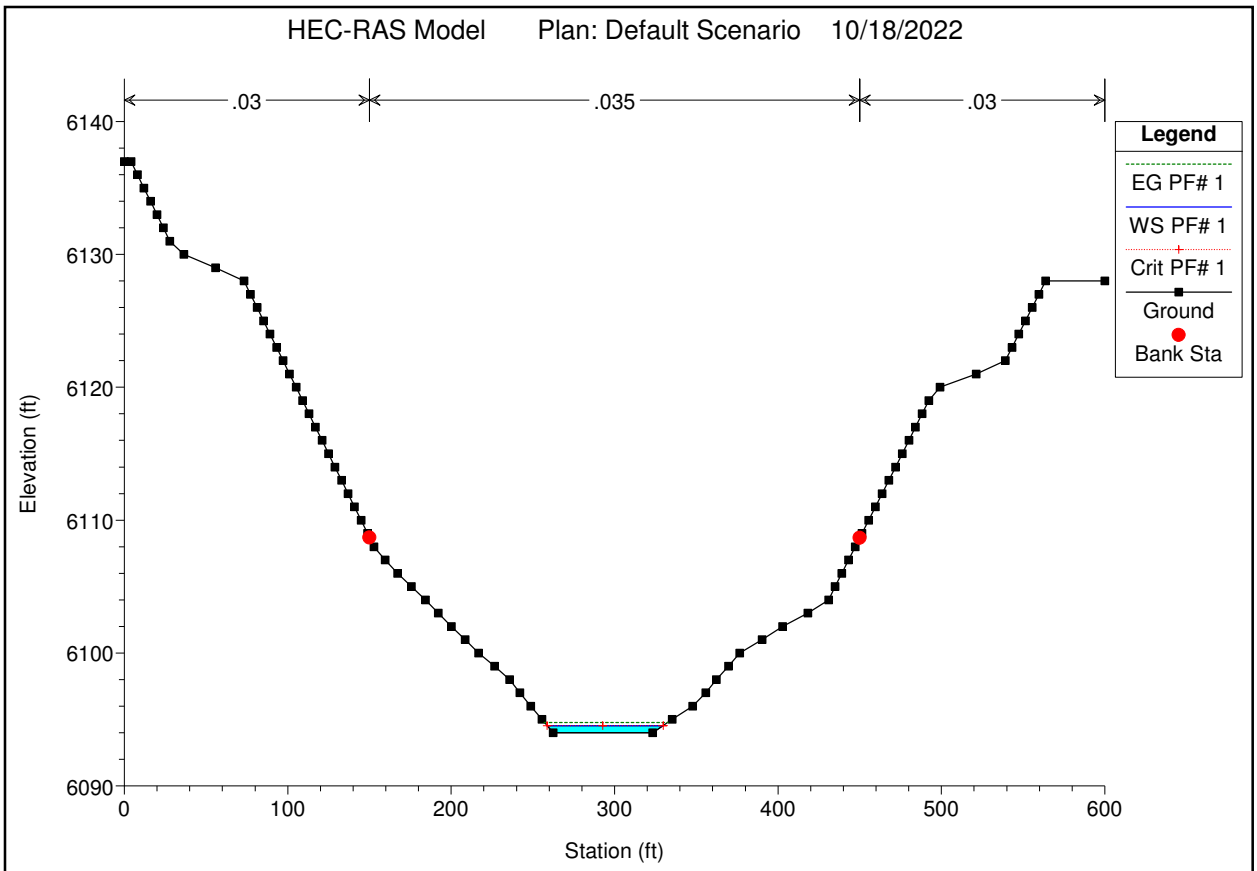
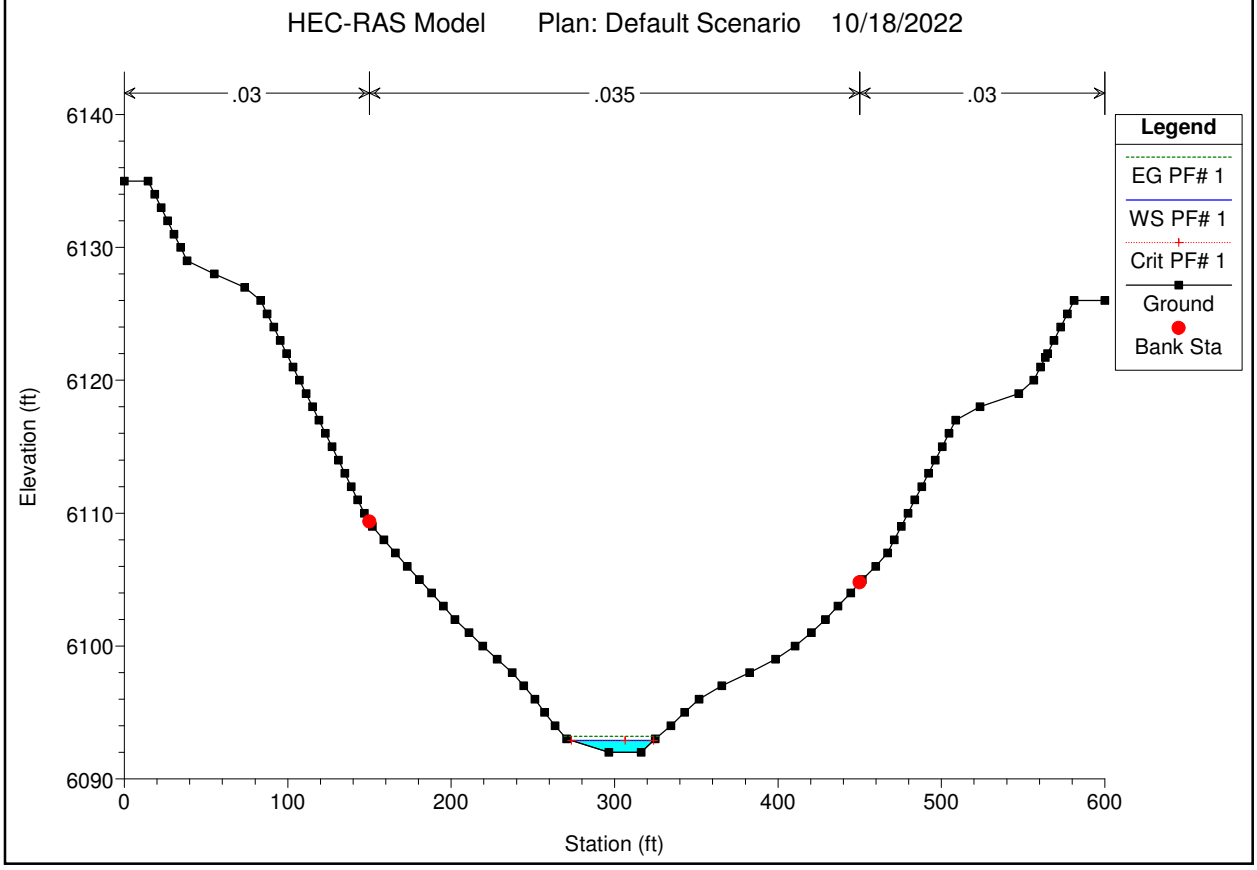
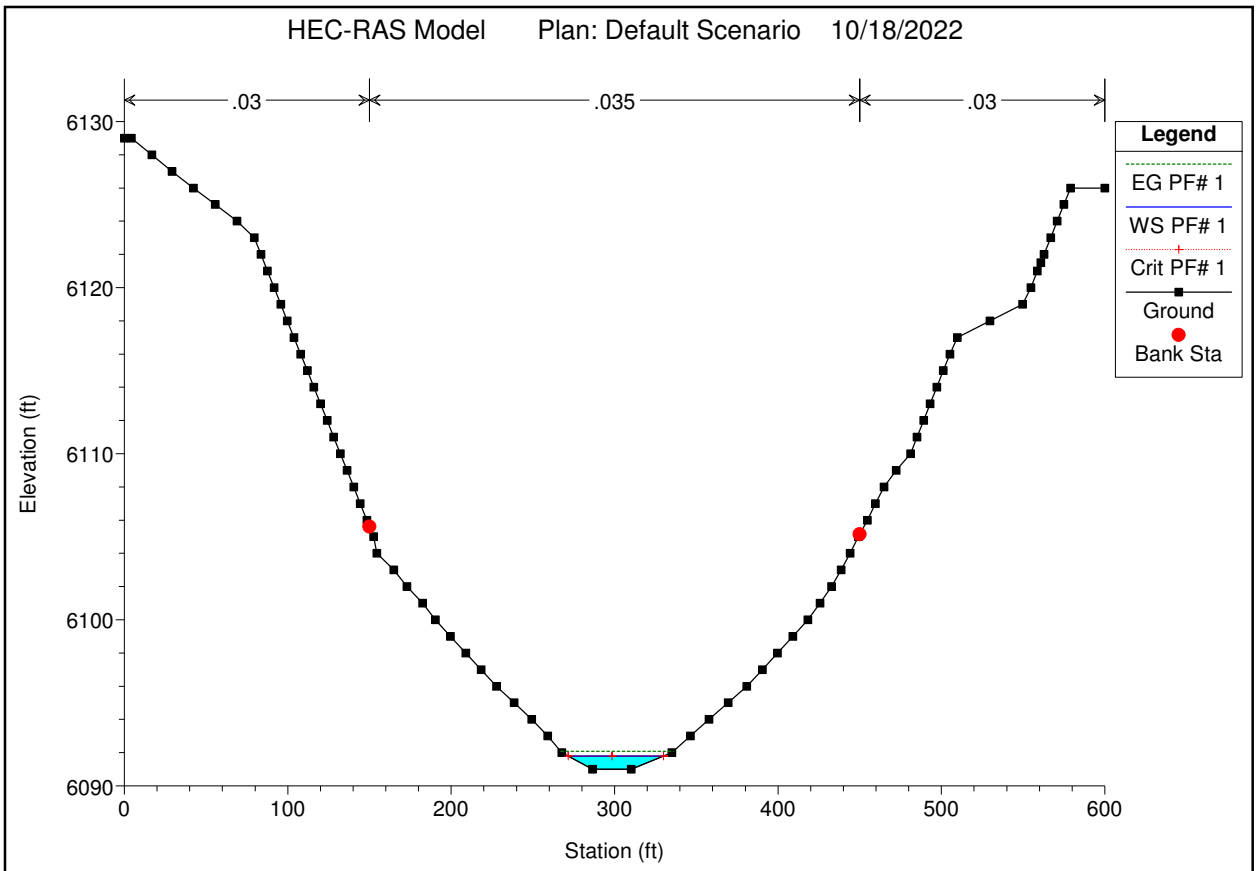
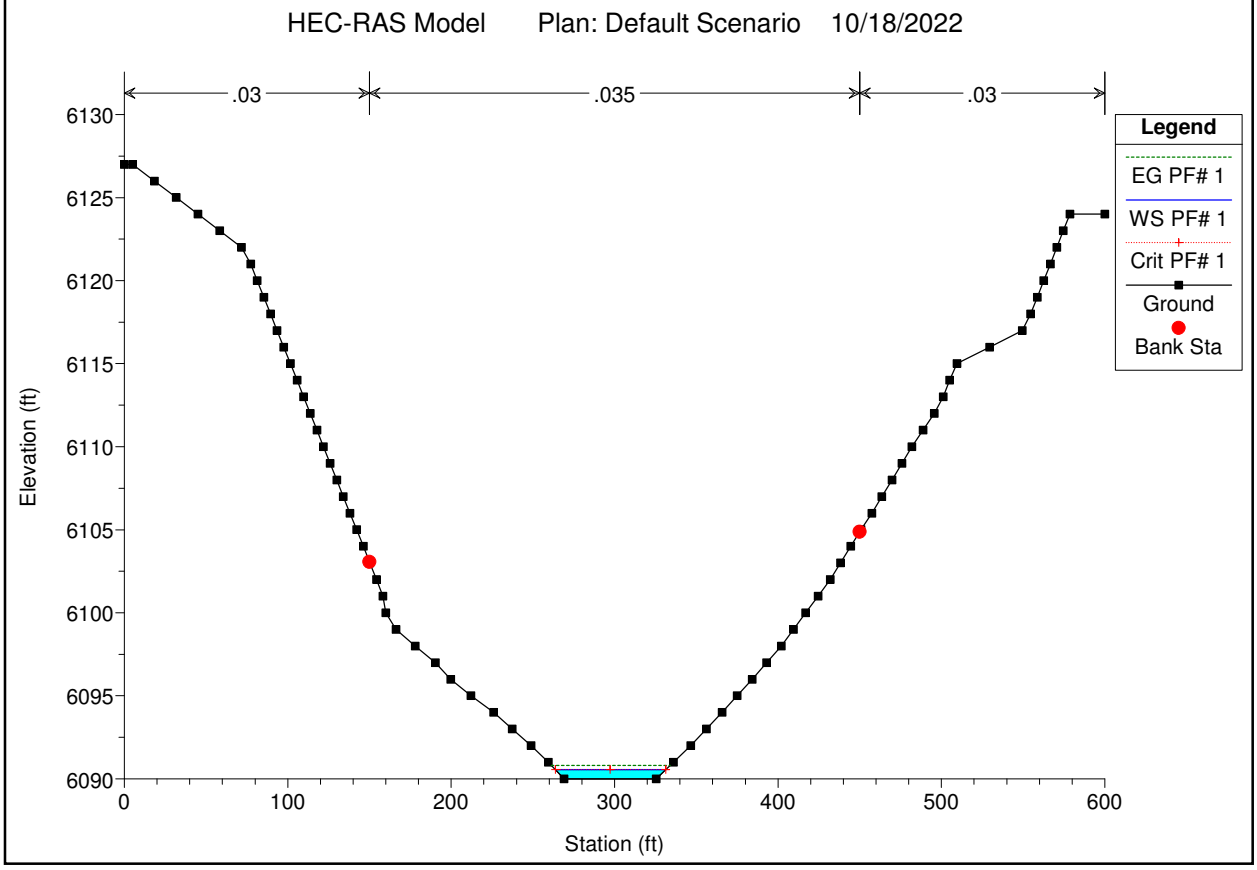
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6140
6130
6120
6110
6100
6090
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6140
6130
6120
6110
6100
6090
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6140
6130
6120
6110
6100
6090
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6140
6130
6120
6110
6100
6090
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6130
6120
6110
6100
6090
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6130
6125
6120
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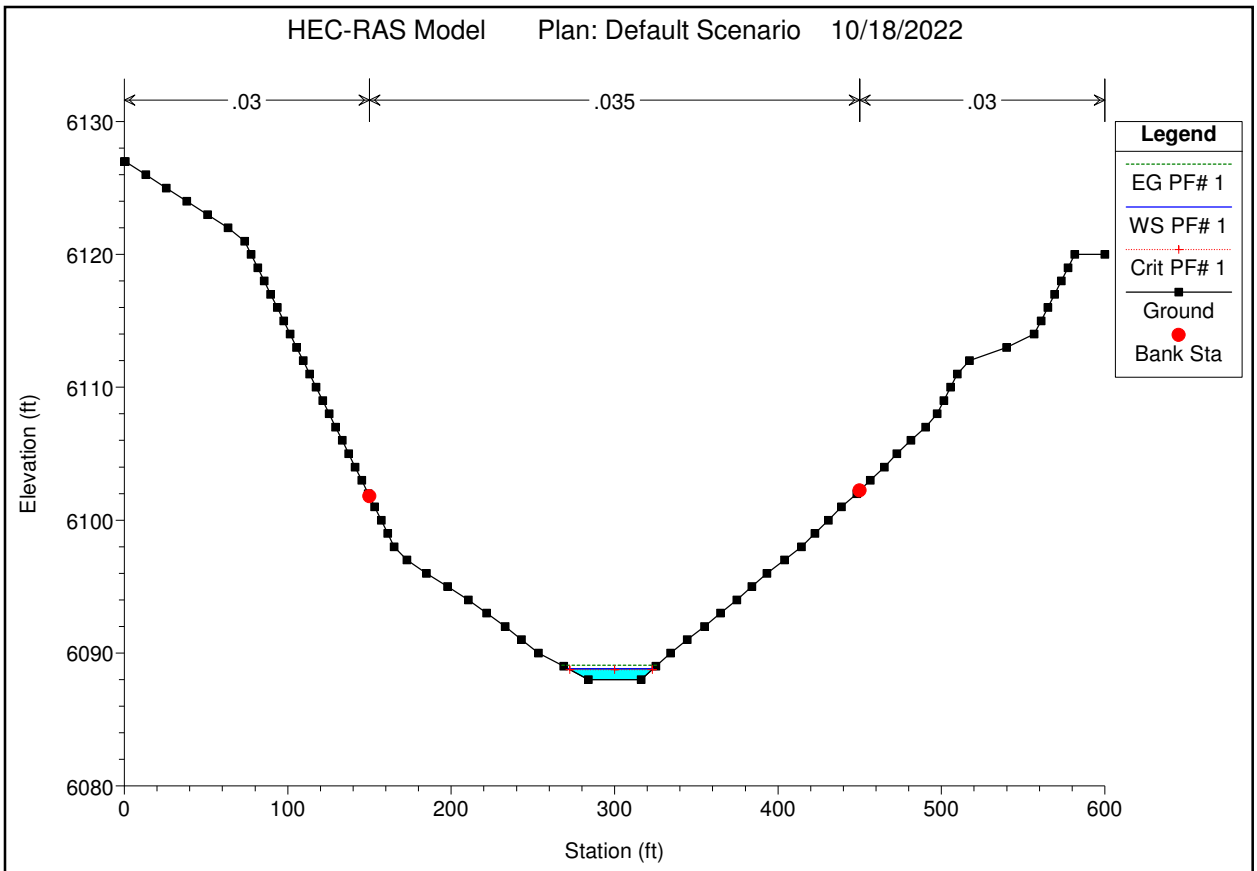
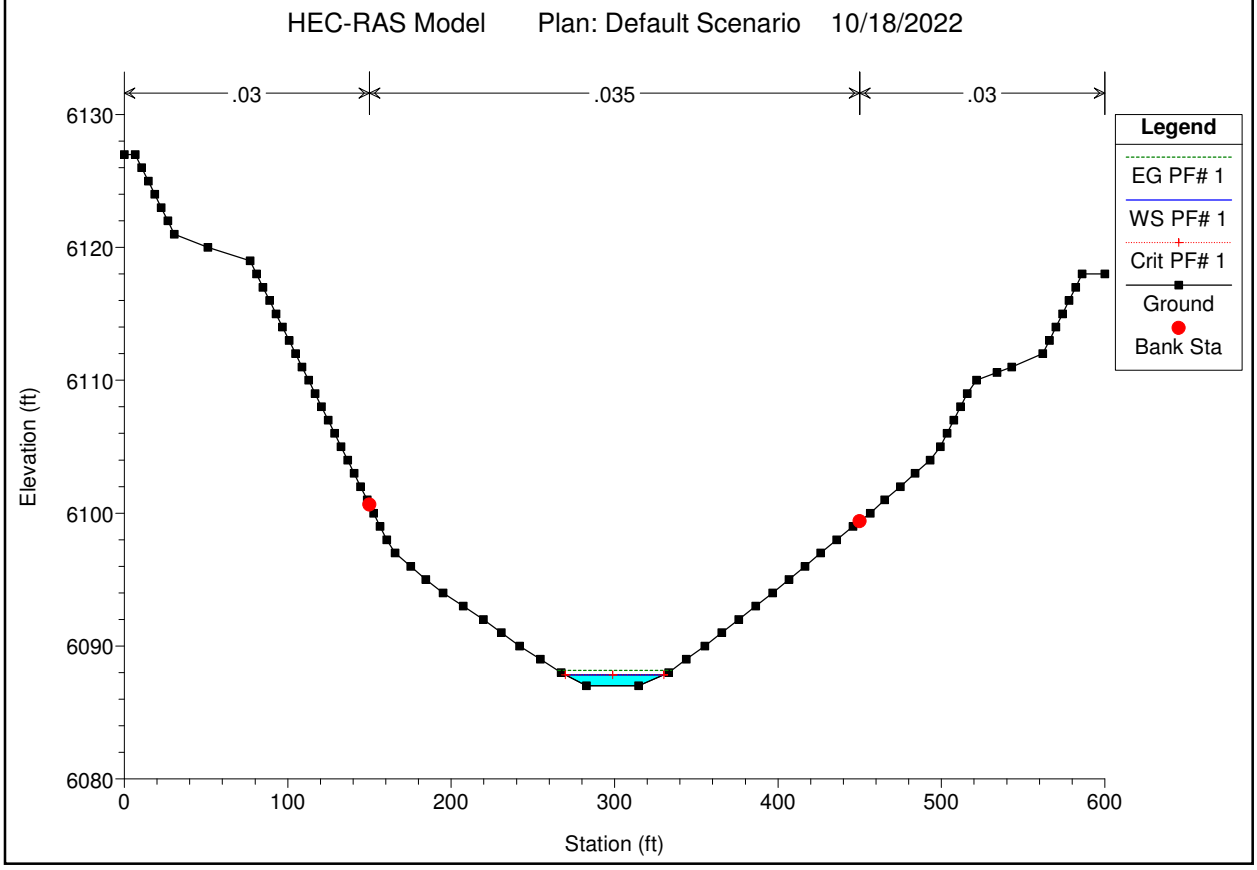
6110
6105
6100
6095
6090
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6130
6120
6110
6100
6090
6080
0
100
200
300
400
500
600
Station (ft)


HEC-RAS Model Plan: Default Scenario 10/18/2022
.03
.035
.03
Legend
EG PF# 1
WS PF# 1
Crit PF# 1
Ground
Bank Sta
Elevation (ft)
6130
6120
6110
6100
6090
6080
0
100
200
300
400
500
600
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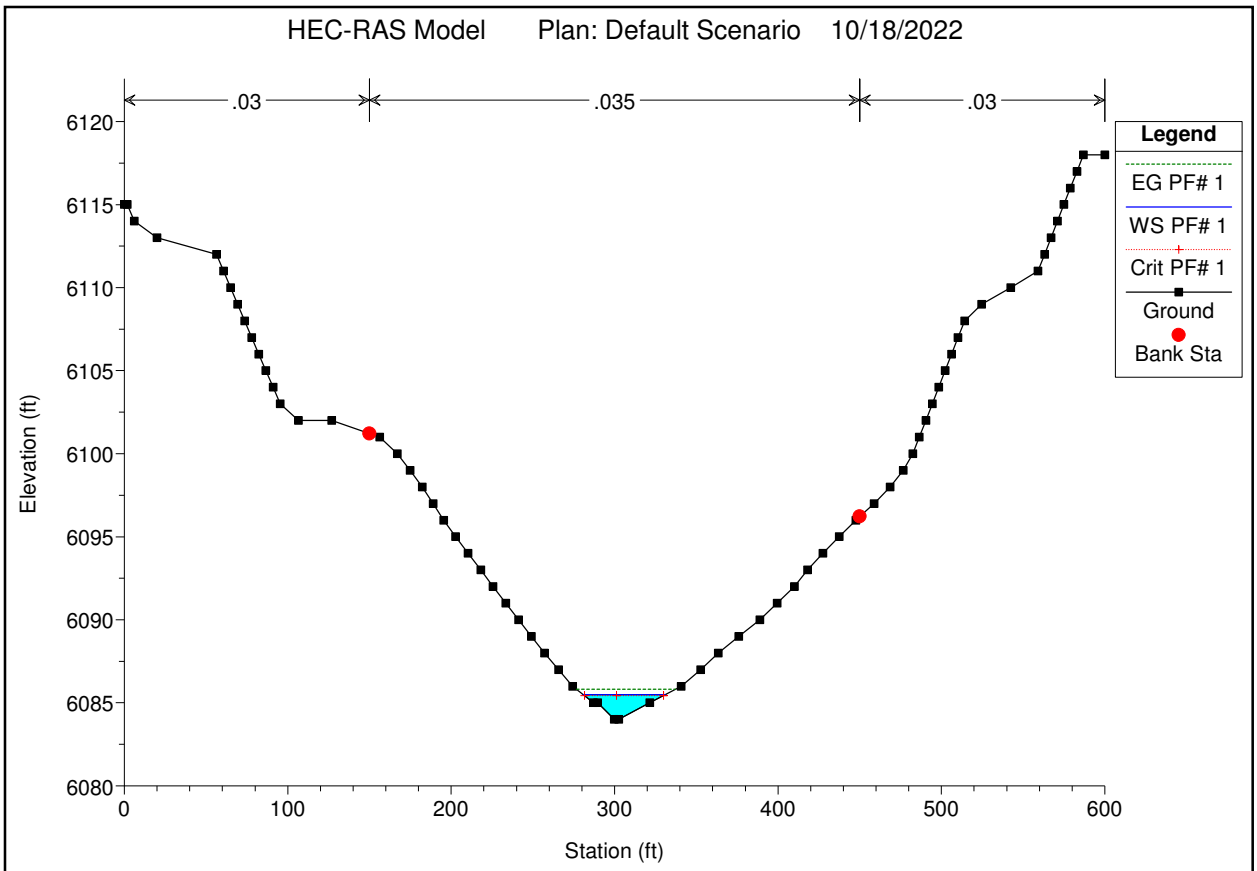
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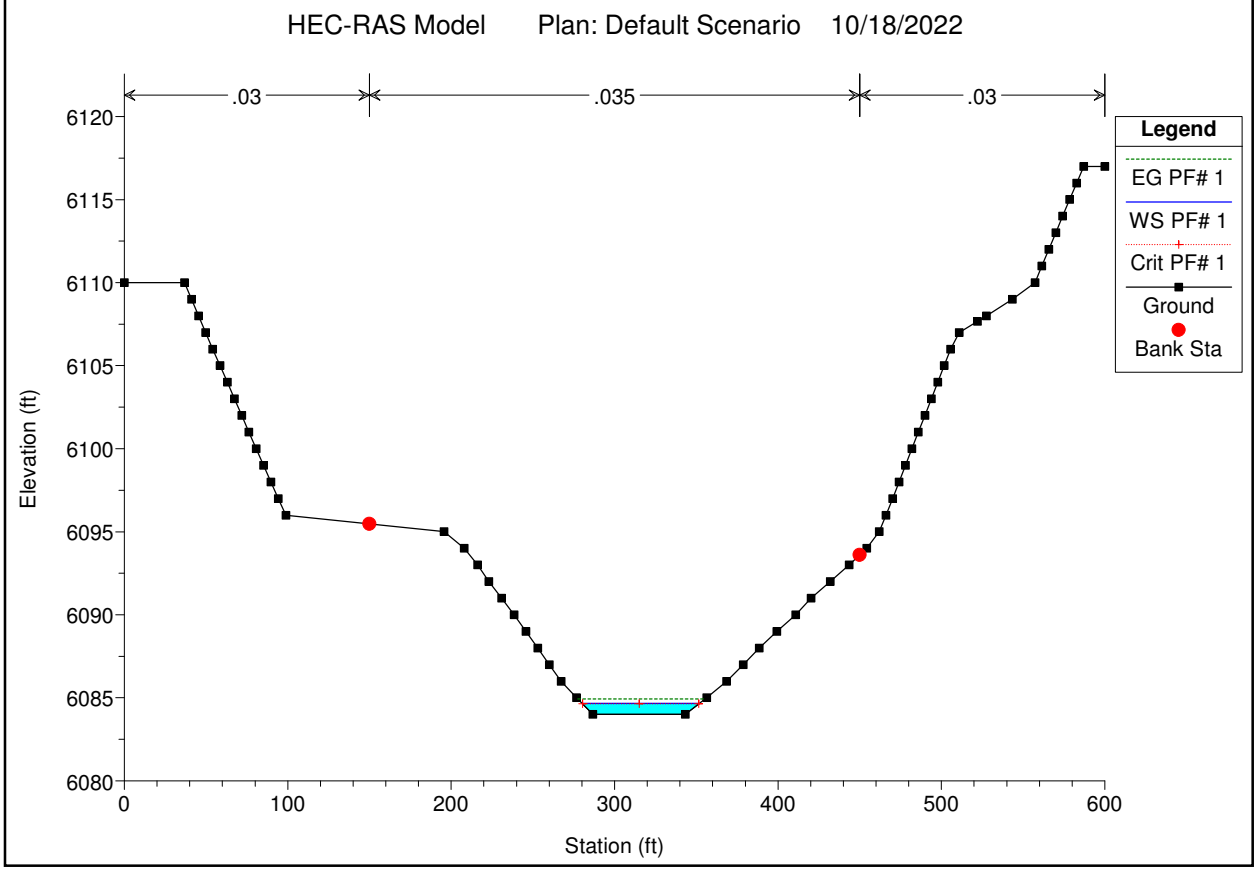
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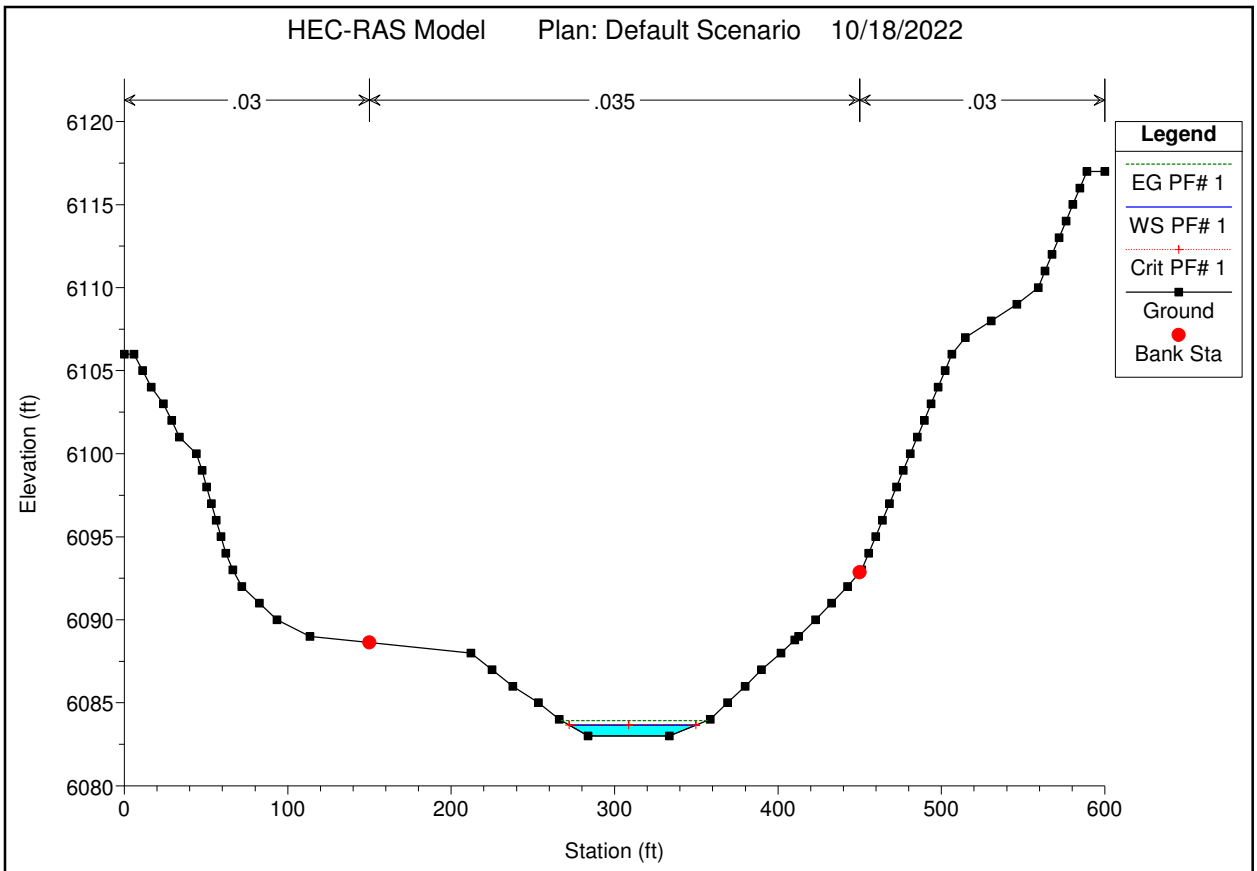
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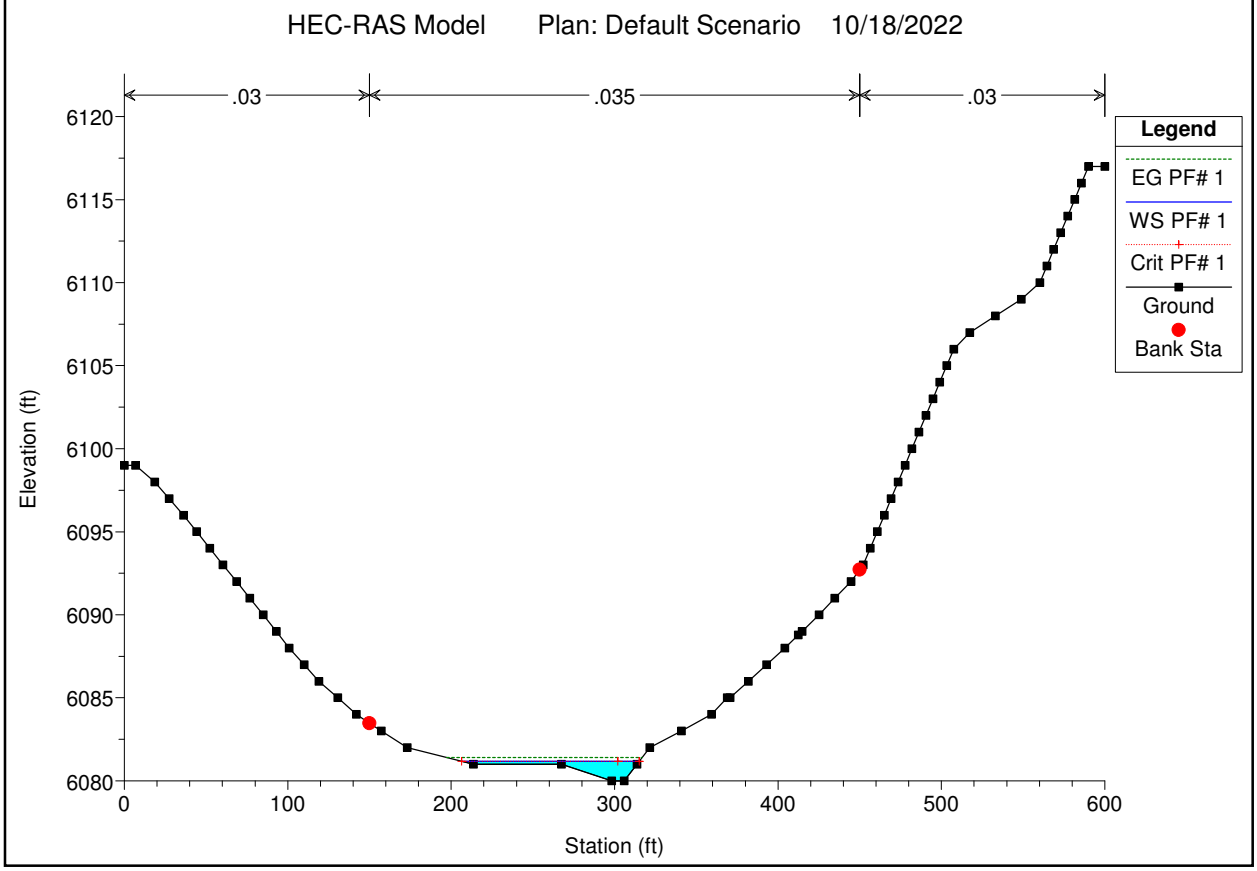
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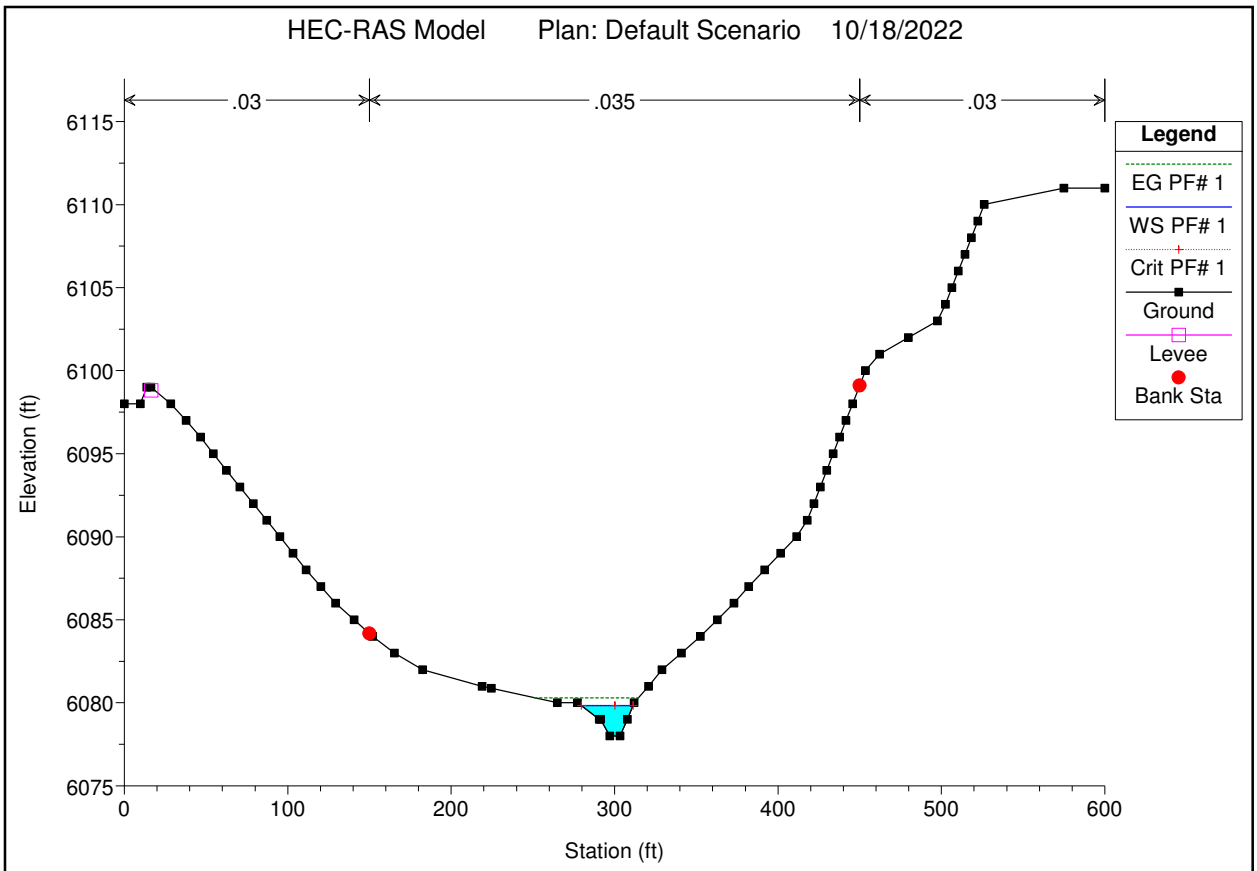
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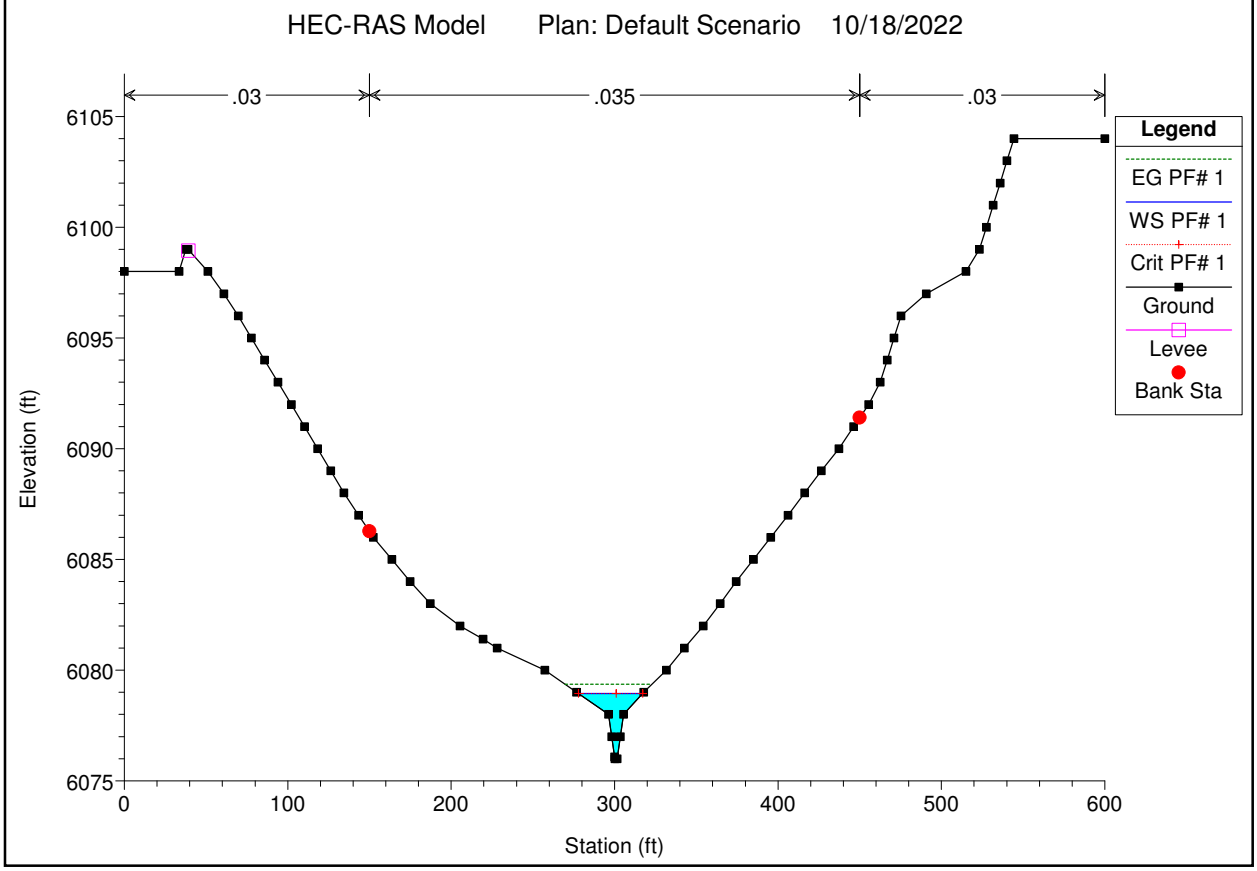
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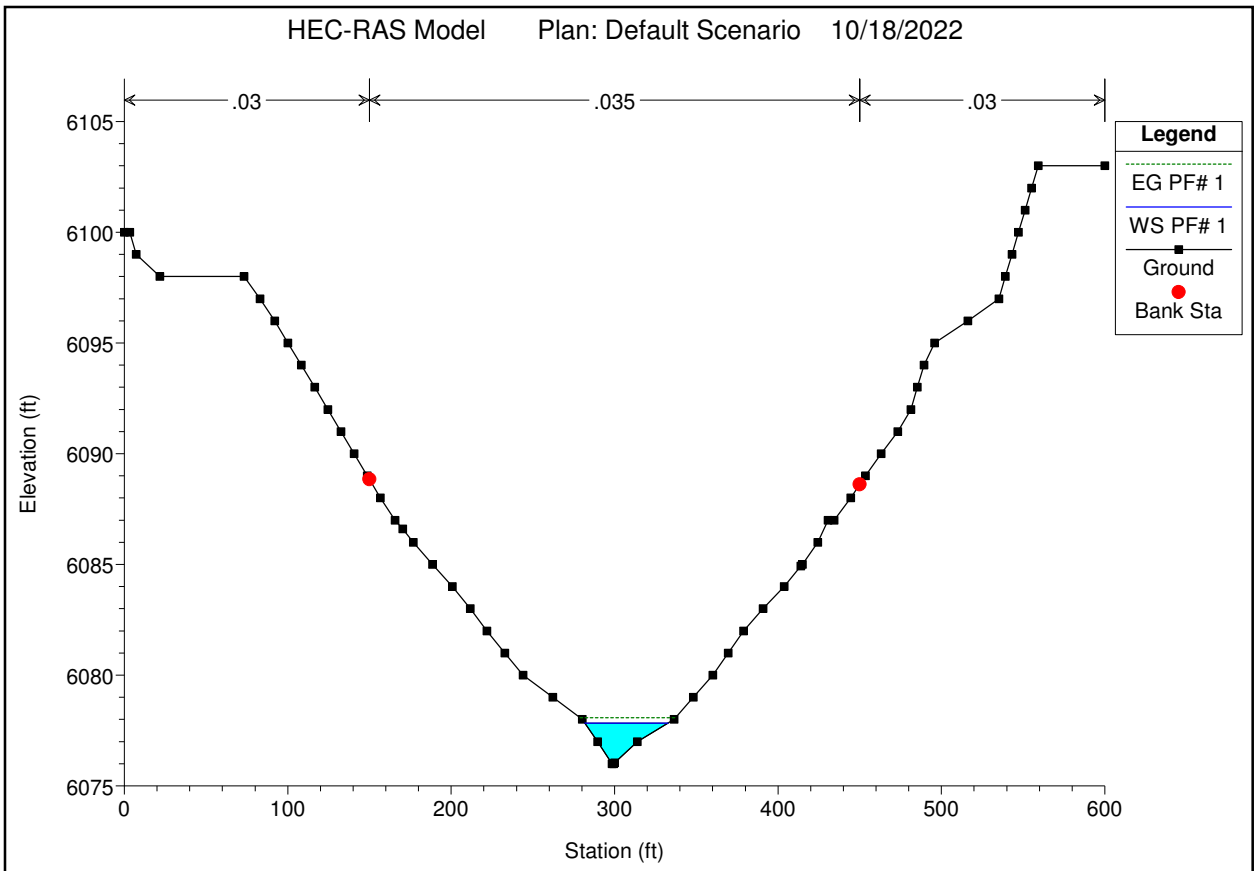
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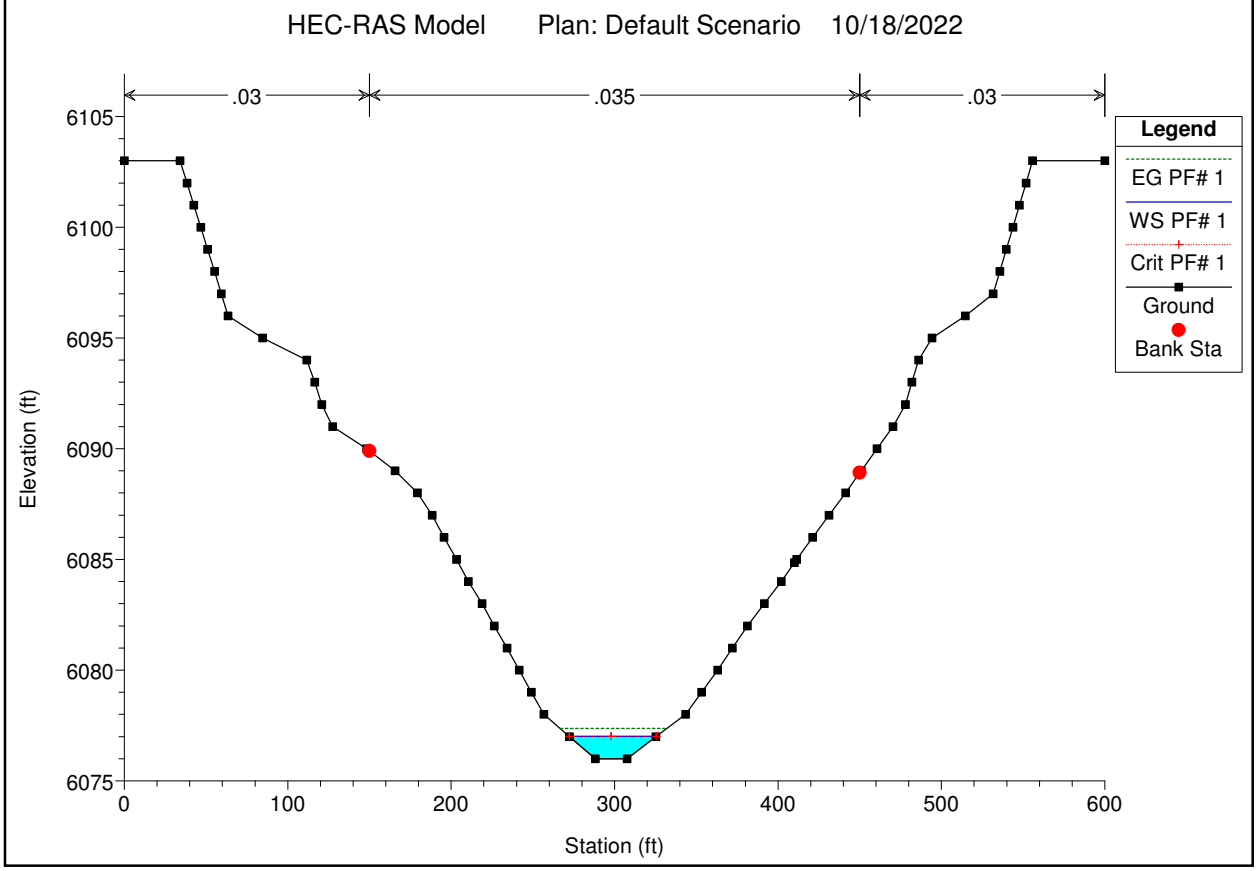
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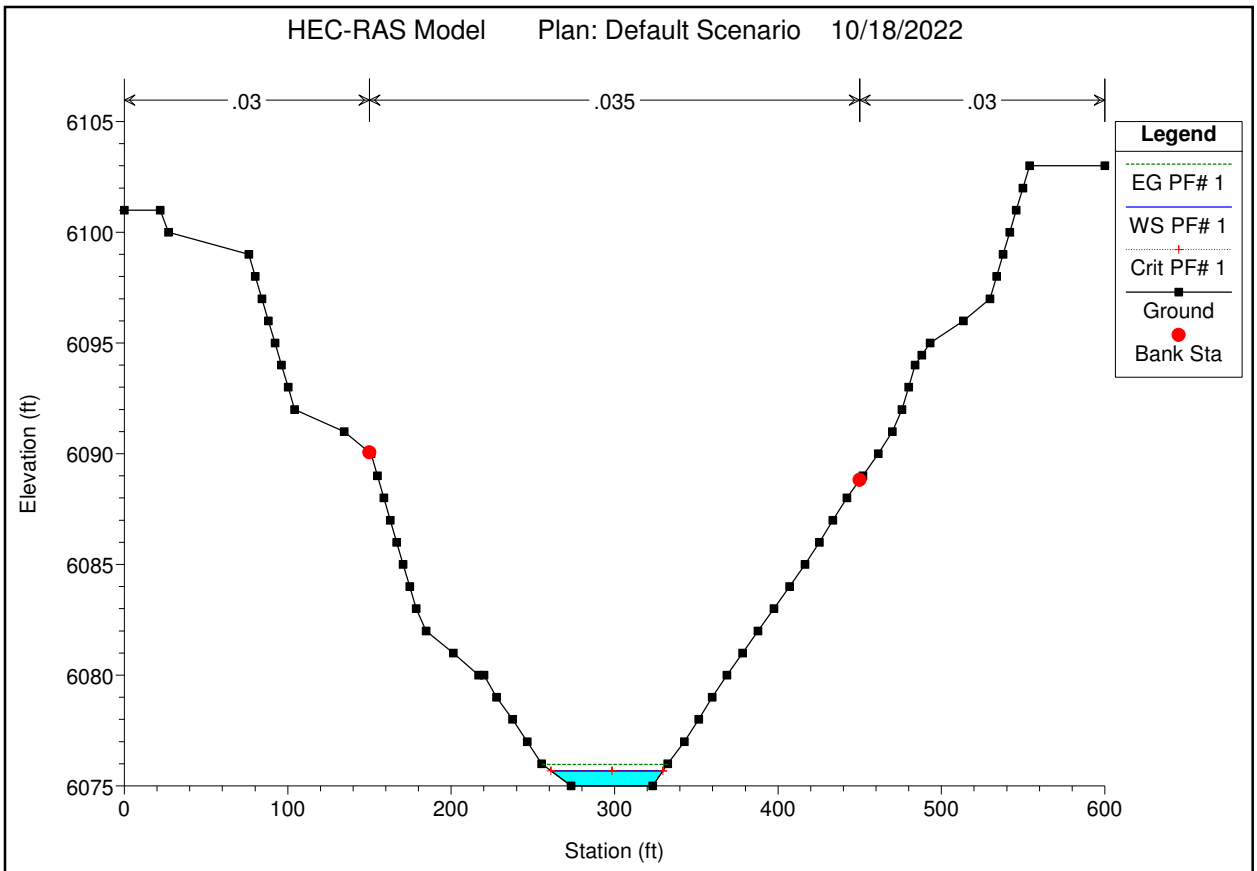
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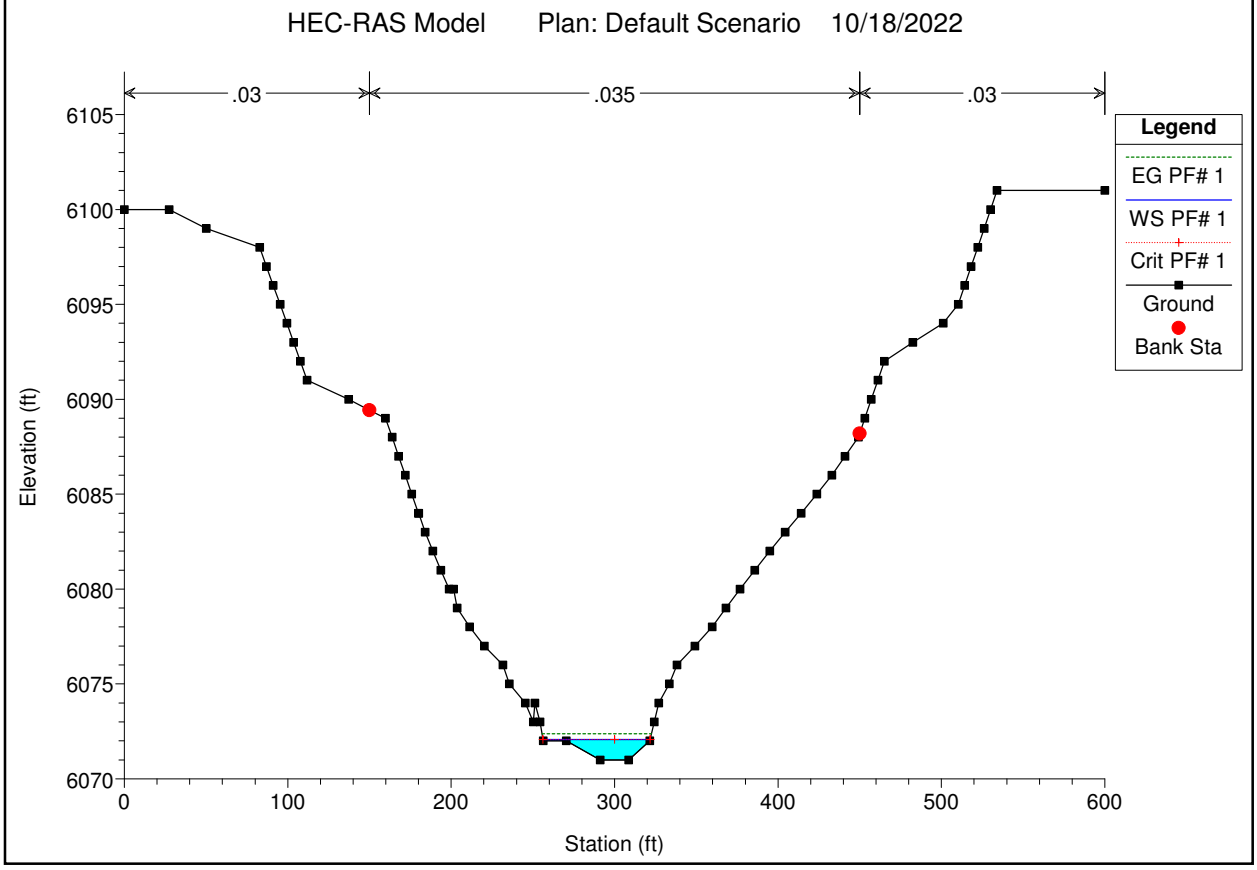
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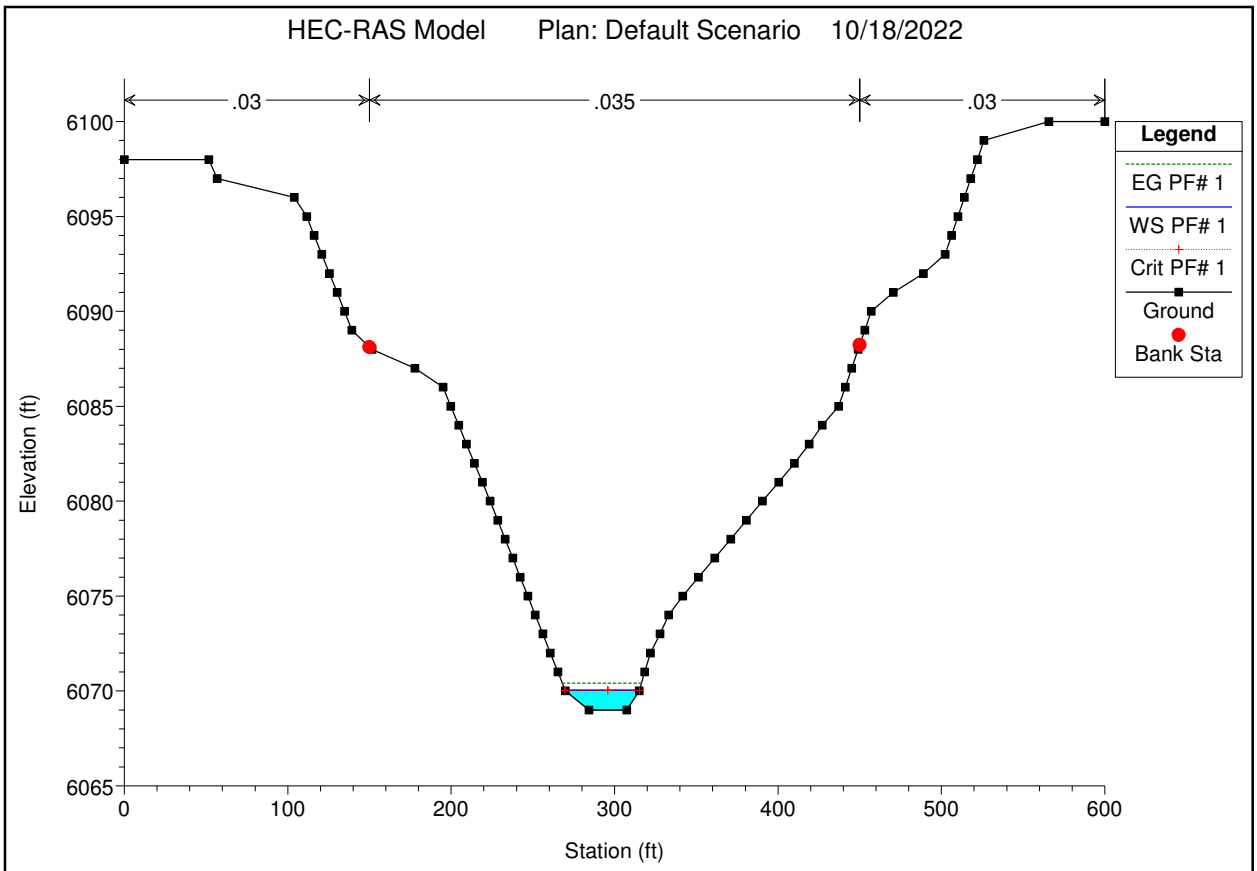
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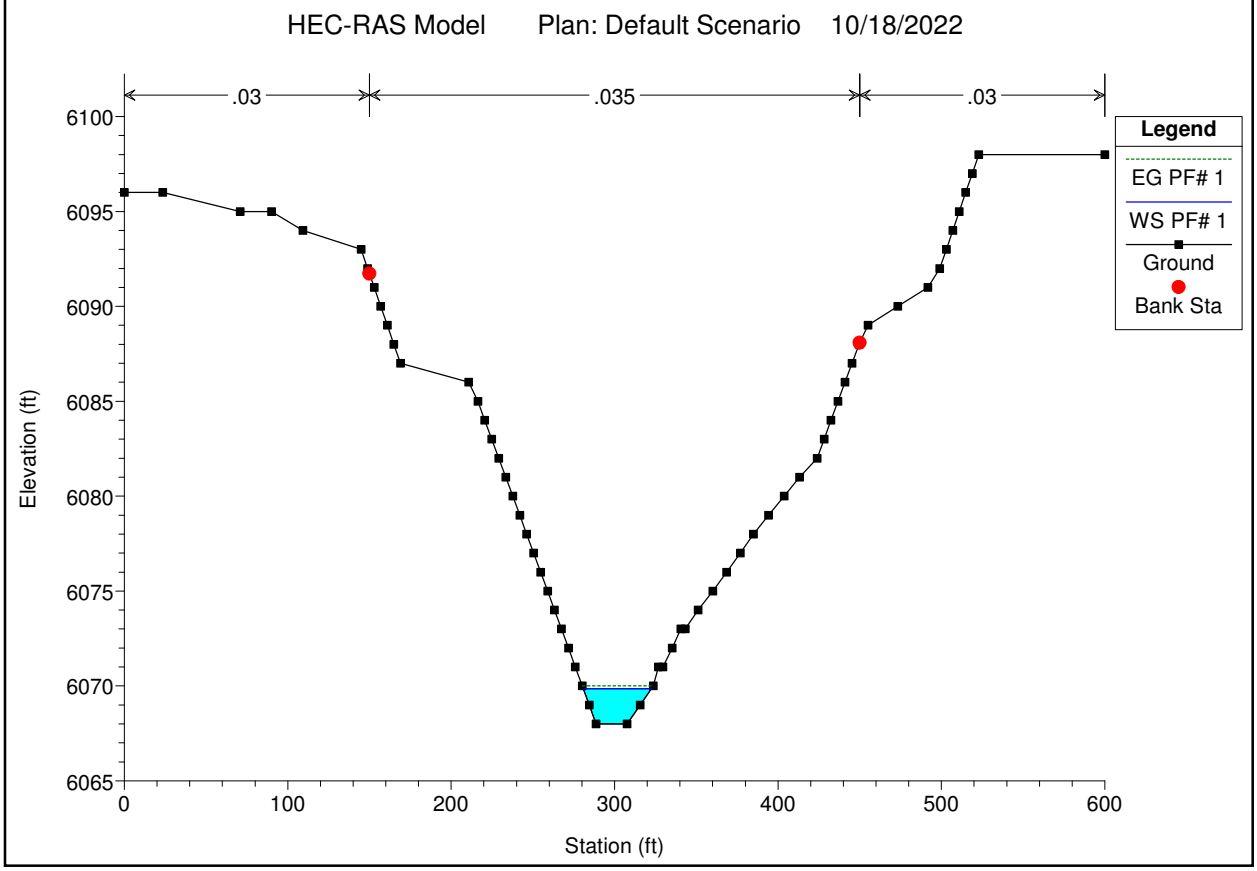
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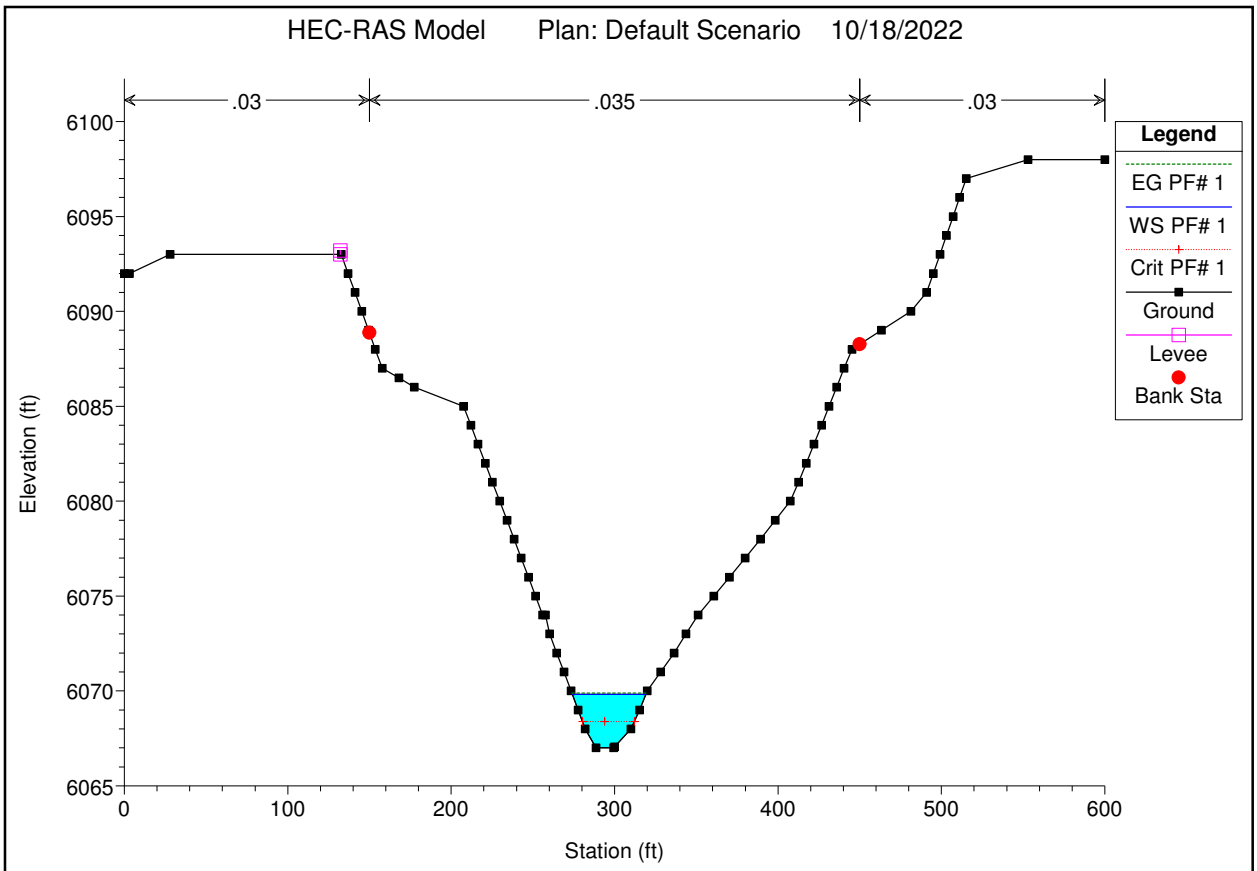
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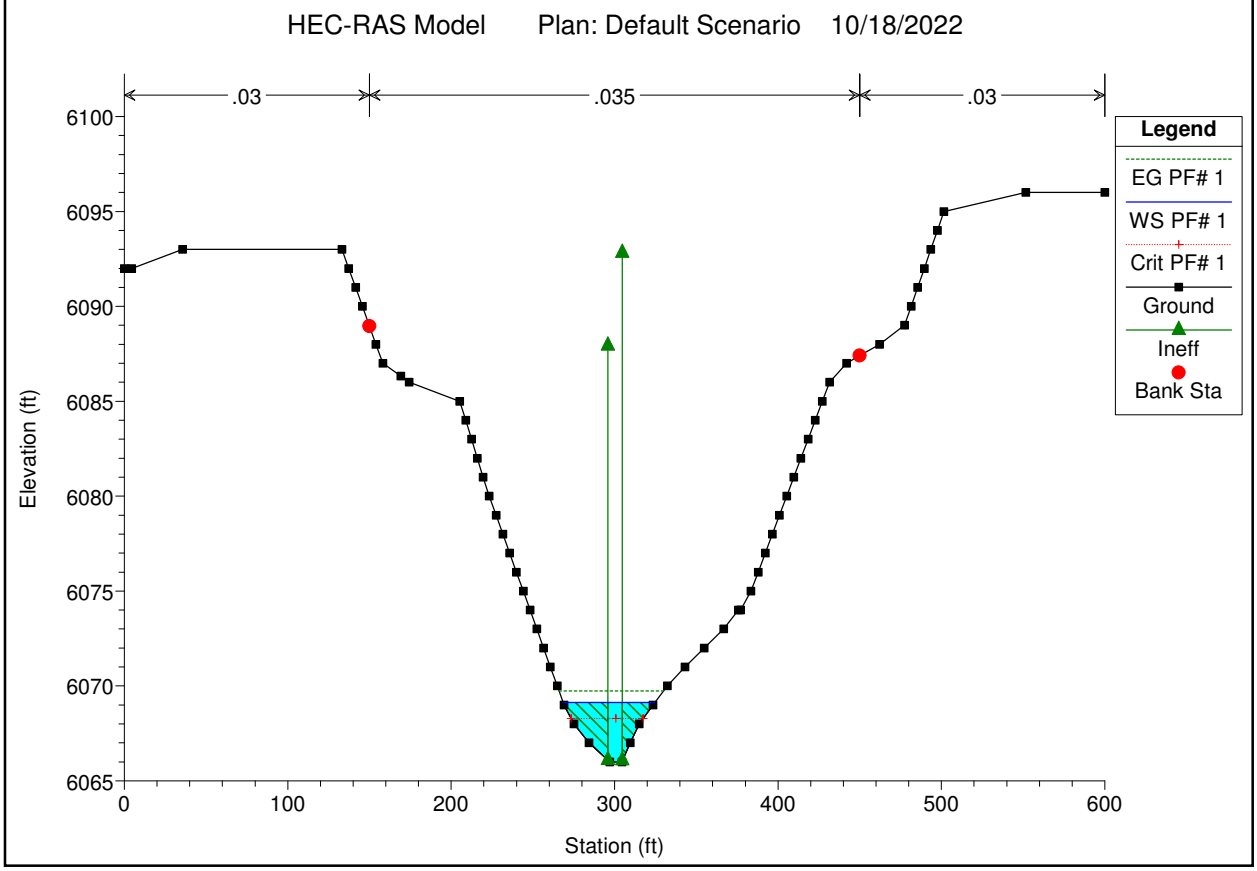
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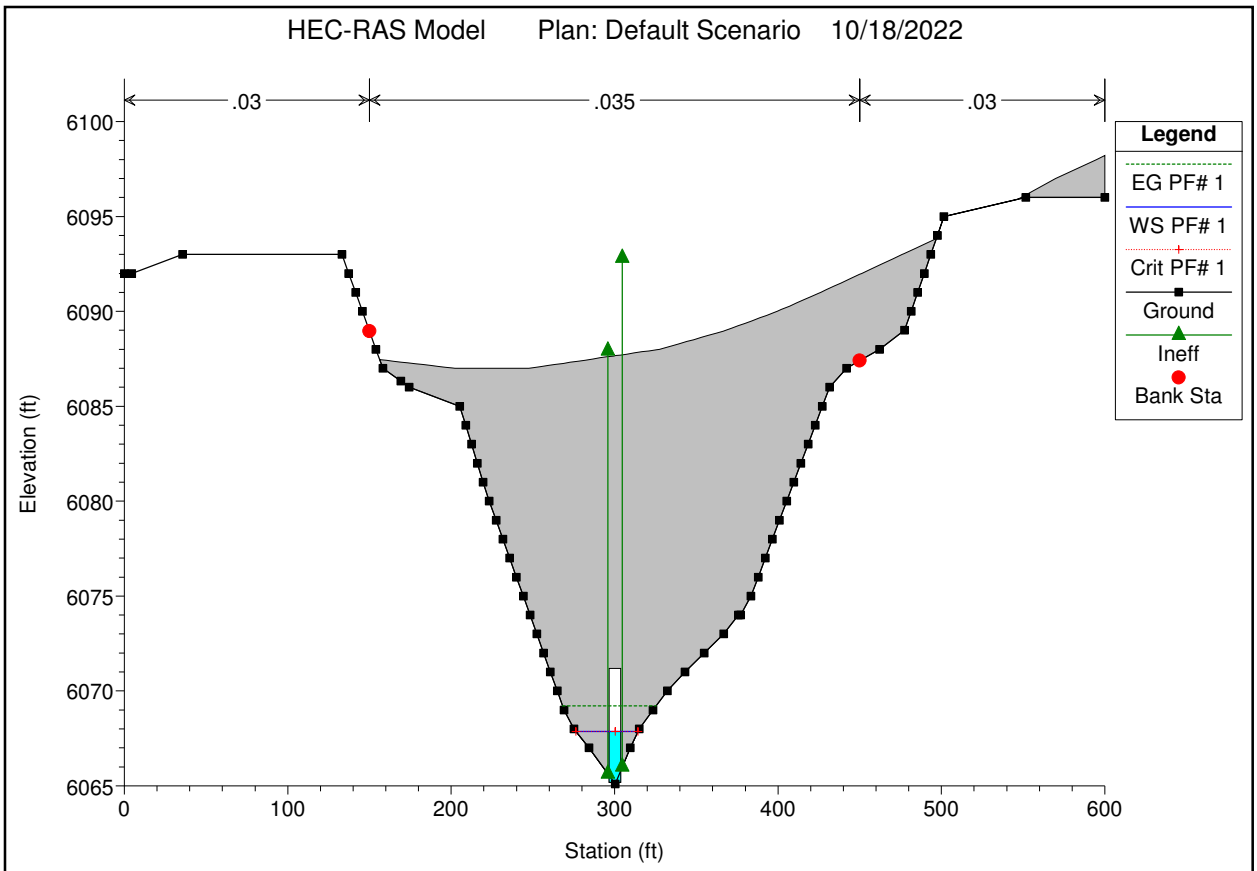
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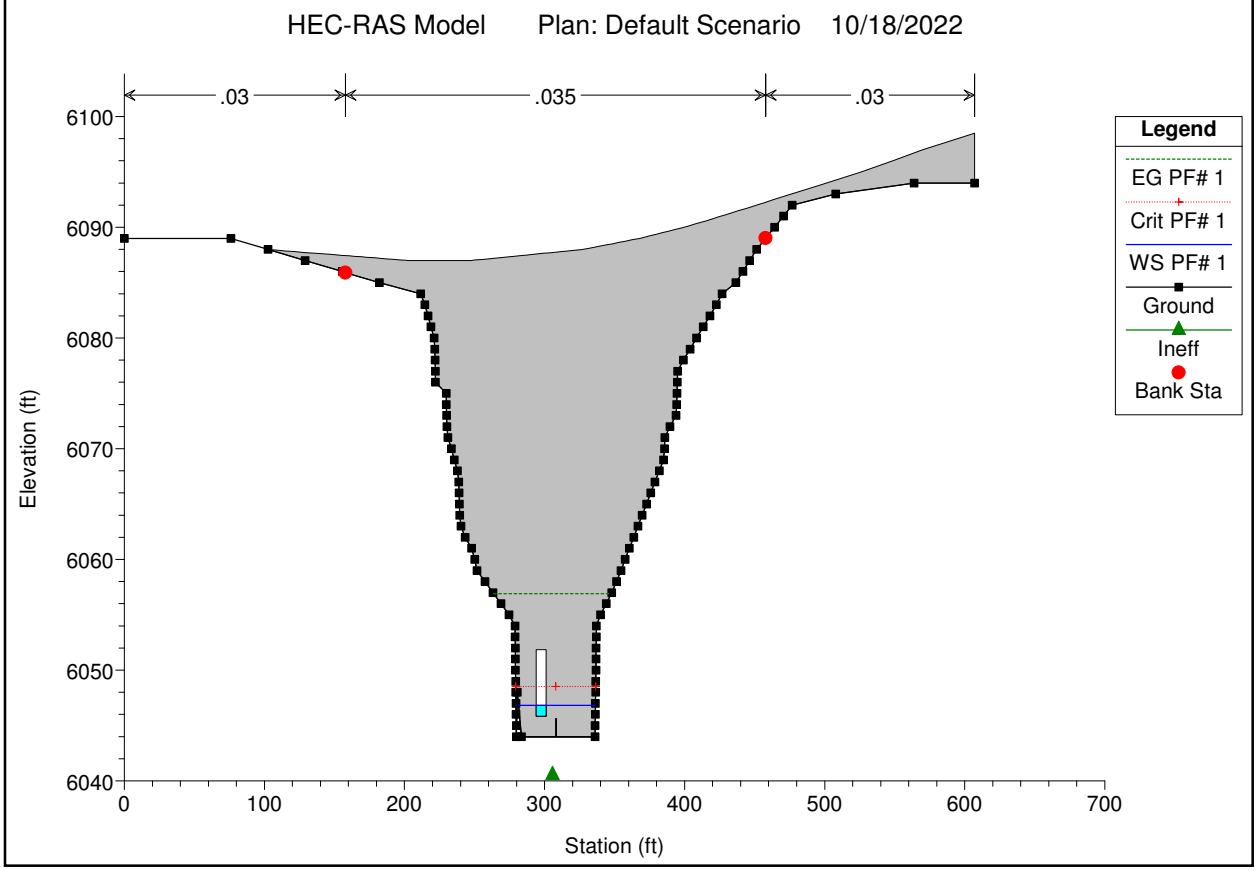
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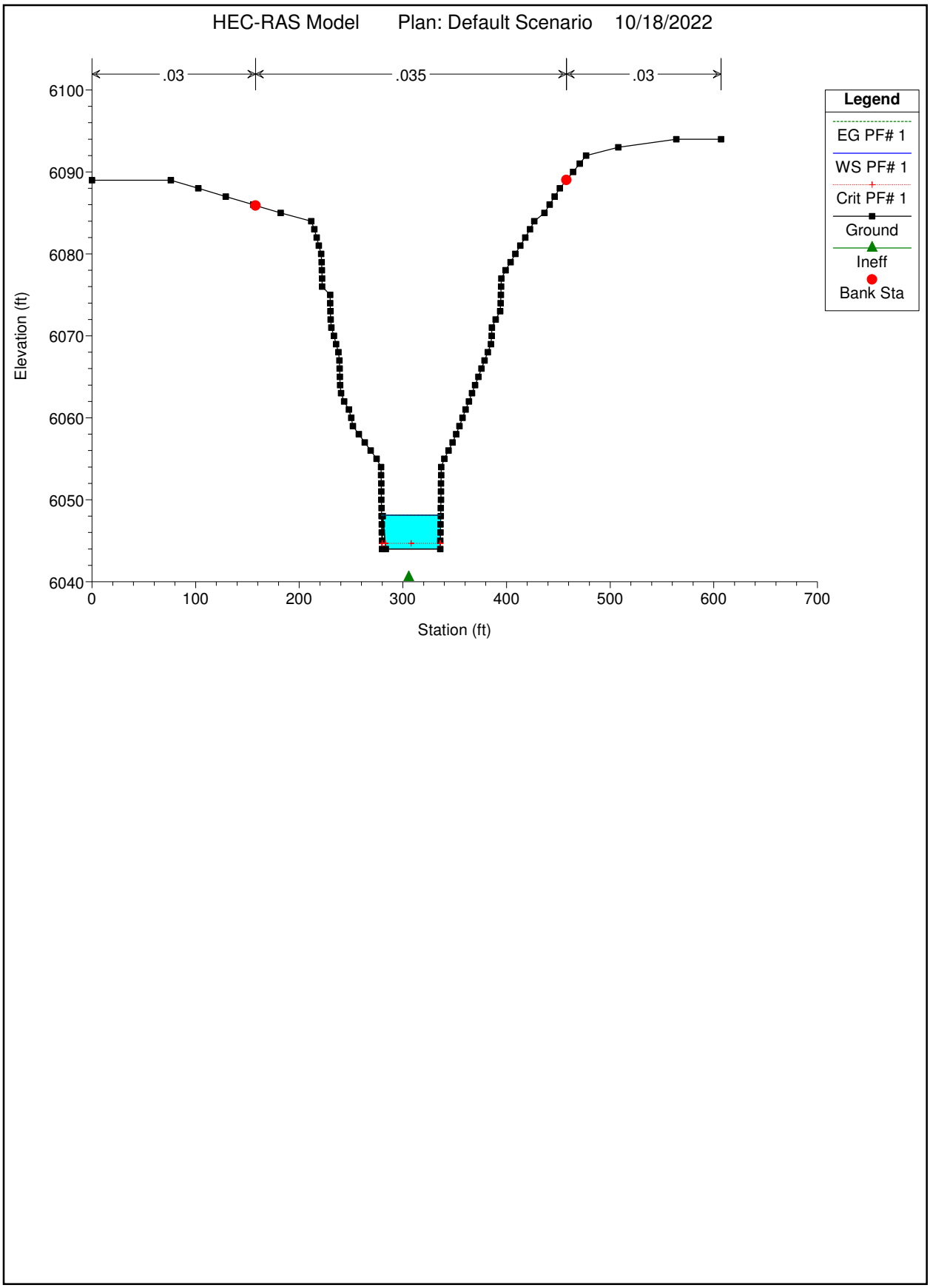
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Station (ft)

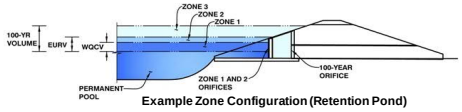
# APPENDIX D
# DETENTION POND CALCULATIONS

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Pond A




**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 11.28 | acres |
| Watershed Length = | 1,621 | ft |
| Watershed Length to Centroid = | 785 | ft |
| Watershed Slope = | 0.060 | ft/ft |
| Watershed Imperviousness = | 31.20% | percent |
| Percentage Hydrologic Soil Group A = | 0.0% | percent |
| Percentage Hydrologic Soil Group B = | 63.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 37.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | Aurora - Municipal Center | |

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

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.175 | acre-feet | 0.175 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.347 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.83 in.) = | 0.190 | acre-feet | 0.83 | inches |
| 5-yr Runoff Volume (P1 = 1.14 in.) = | 0.333 | acre-feet | | inches |
| 10-yr Runoff Volume (P1 = 1.37 in.) = | 0.494 | acre-feet | 1.37 | inches |
| 25-yr Runoff Volume (P1 = 1.76 in.) = | 0.905 | acre-feet | | inches |
| 50-yr Runoff Volume (P1 = 2.08 in.) = | 1.198 | acre-feet | | inches |
| 100-yr Runoff Volume (P1 = 2.38 in.) = | 1.528 | acre-feet | 2.38 | inches |
| 500-yr Runoff Volume (P1 = 3.3 in.) = | 2.417 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.185 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.306 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.418 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.536 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 0.592 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 0.720 | acre-feet | | |

## Define Zones and Basin Geometry

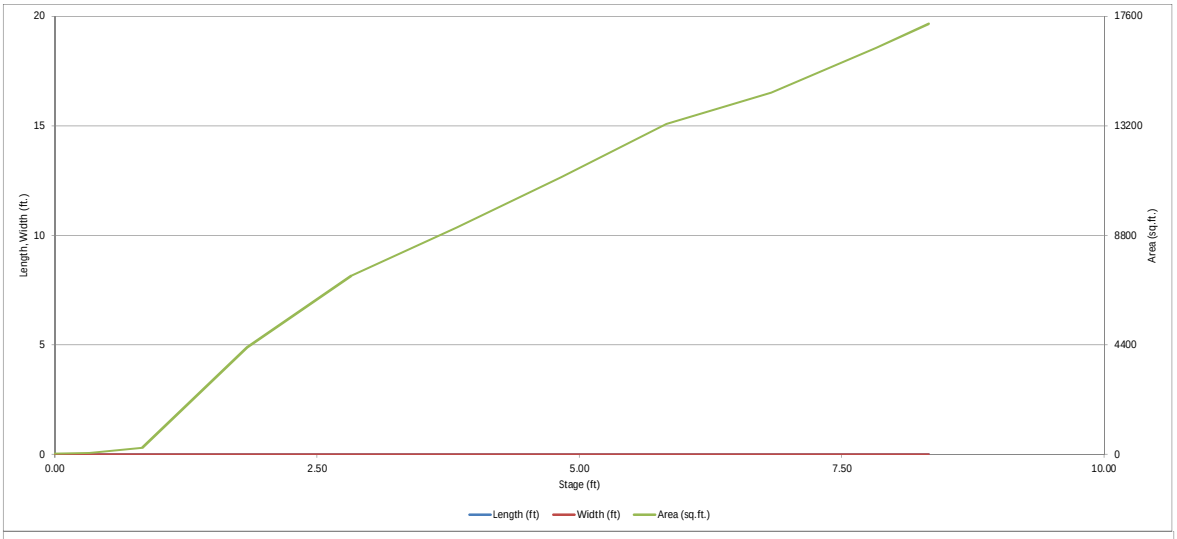
| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.175 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.172 | acre-feet |
| Zone 3 Volume (User Defined - Zones 1 & 2) = | 0.506 | acre-feet |
| Total Detention Basin Volume = | 0.852 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | $ft^3$ |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | user | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

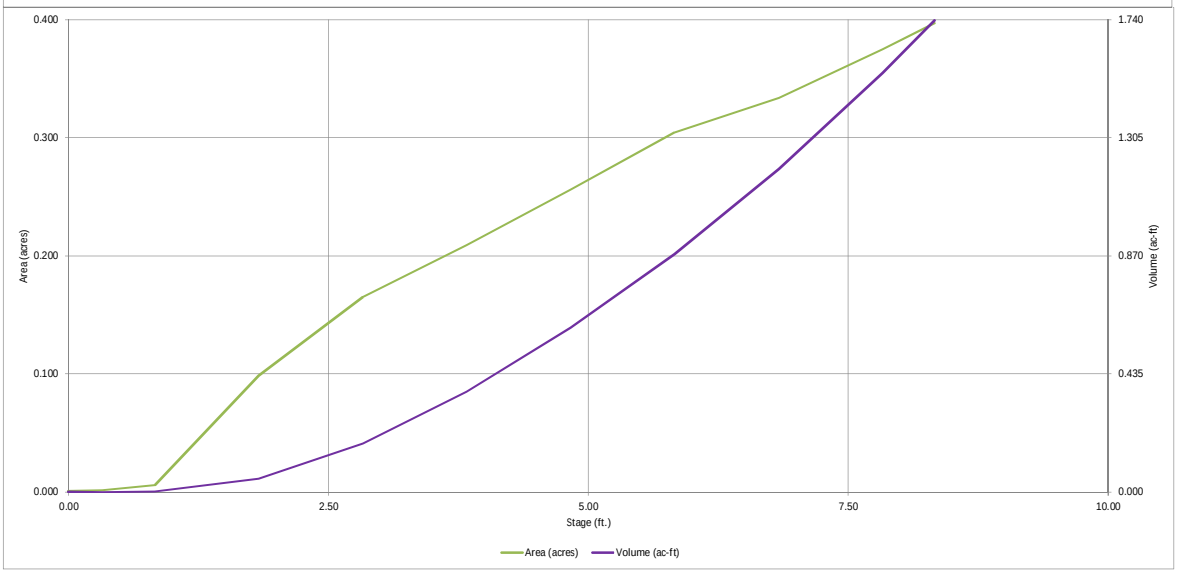
Depth Increment = ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| 6066.17 Top of Micropool | -- | 0.00 | -- | -- | -- | 32 | 0.001 | | |
| 6066.5 | -- | 0.33 | -- | -- | -- | 60 | 0.001 | 15 | 0.000 |
| 6067 | -- | 0.83 | -- | -- | -- | 253 | 0.006 | 95 | 0.002 |
| 6068 | -- | 1.83 | -- | -- | -- | 4,294 | 0.099 | 2,147 | 0.049 |
| 6069 | -- | 2.83 | -- | -- | -- | 7,185 | 0.165 | 7,745 | 0.178 |
| 6070 | -- | 3.83 | -- | -- | -- | 9,120 | 0.209 | 16,124 | 0.370 |
| 6071 | -- | 4.83 | -- | -- | -- | 11,151 | 0.256 | 26,330 | 0.604 |
| 6072 | -- | 5.83 | -- | -- | -- | 13,274 | 0.305 | 38,195 | 0.877 |
| 6072 | -- | 6.83 | -- | -- | -- | 14,543 | 0.334 | 51,827 | 1.190 |
| 6073 | -- | 7.83 | -- | -- | -- | 16,339 | 0.375 | 67,268 | 1.544 |
| 6074 | -- | 8.33 | -- | -- | -- | 17,298 | 0.397 | 75,678 | 1.737 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.05 (January 2022)*



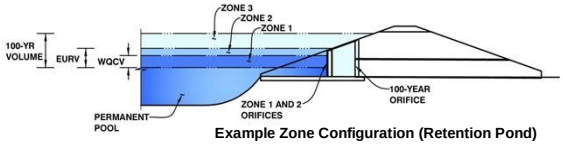



# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Pond A




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 2.82 | 0.175 | Orifice Plate |
| Zone 2 (EURV) | 3.73 | 0.172 | Orifice Plate |
| Zone 3 (User) | 5.75 | 0.506 | Weir&Pipe (Restrict) |
| Total (all zones) | | 0.852 | |

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

| | | | | | |
|---|---|---|---|---|---|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) | Underdrain Orifice Area = | N/A | ft² |
| Underdrain Orifice Diameter = | N/A | inches | Underdrain Orifice Centroid = | N/A | feet |

**Calculated Parameters for Underdrain**

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

| | | | | | |
|---|---|---|---|---|---|
| Centroid of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | 3.986E-03 | ft² |
| Depth at top of Zone using Orifice Plate = | 3.73 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | N/A | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | 0.57 | sq. inches (diameter = 13/16 inch) | Elliptical Slot Area = | N/A | ft² |

**Calculated Parameters for Plate**

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 0.94 | 1.88 | | | | | |
| Orifice Area (sq. inches) | 0.57 | 0.57 | 0.57 | | | | | |

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

**User Input: Vertical Orifice (Circular or Rectangular)**

| | Not Selected | Not Selected | | | Not Selected | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | N/A | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | N/A | N/A | ft² |
| Depth at top of Zone using Vertical Orifice = | N/A | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | N/A | N/A | feet |
| Vertical Orifice Diameter = | N/A | N/A | inches | | | | |

**Calculated Parameters for Vertical Orifice**

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

| | Zone 3 Weir | Not Selected | | | Zone 3 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 3.74 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 4.49 | N/A | feet |
| Overflow Weir Front Edge Length = | 4.00 | N/A | feet | Overflow Weir Slope Length = | 3.09 | N/A | feet |
| Overflow Weir Grate Slope = | 4.00 | N/A | H:V | Grate Open Area / 100-yr Orifice Area = | 9.35 | N/A | |
| Horiz. Length of Weir Sides = | 3.00 | N/A | feet | Overflow Grate Open Area w/o Debris = | 8.61 | N/A | ft² |
| Overflow Grate Type = | Type C Grate | N/A | | Overflow Grate Open Area w/ Debris = | 8.61 | N/A | ft² |
| Debris Clogging % = | 0% | N/A | % | | | | |

**Calculated Parameters for Overflow Weir**

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

| | Zone 3 Restrictor | Not Selected | | | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 0.00 | N/A | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 0.92 | N/A | ft² |
| Outlet Pipe Diameter = | 18.00 | N/A | inches | Outlet Orifice Centroid = | 0.45 | N/A | feet |
| Restrictor Plate Height Above Pipe Invert = | 9.30 | | inches | Half-Central Angle of Restrictor Plate on Pipe = | 1.60 | N/A | radians |

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

| | | | | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | 6.83 | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | 0.32 | feet |
| Spillway Crest Length = | 30.00 | feet | Stage at Top of Freeboard = | 8.15 | feet |
| Spillway End Slopes = | 4.00 | H:V | Basin Area at Top of Freeboard = | 0.39 | acres |
| Freeboard above Max Water Surface = | 1.00 | feet | Basin Volume at Top of Freeboard = | 1.67 | acre-ft |

**Calculated Parameters for Spillway**

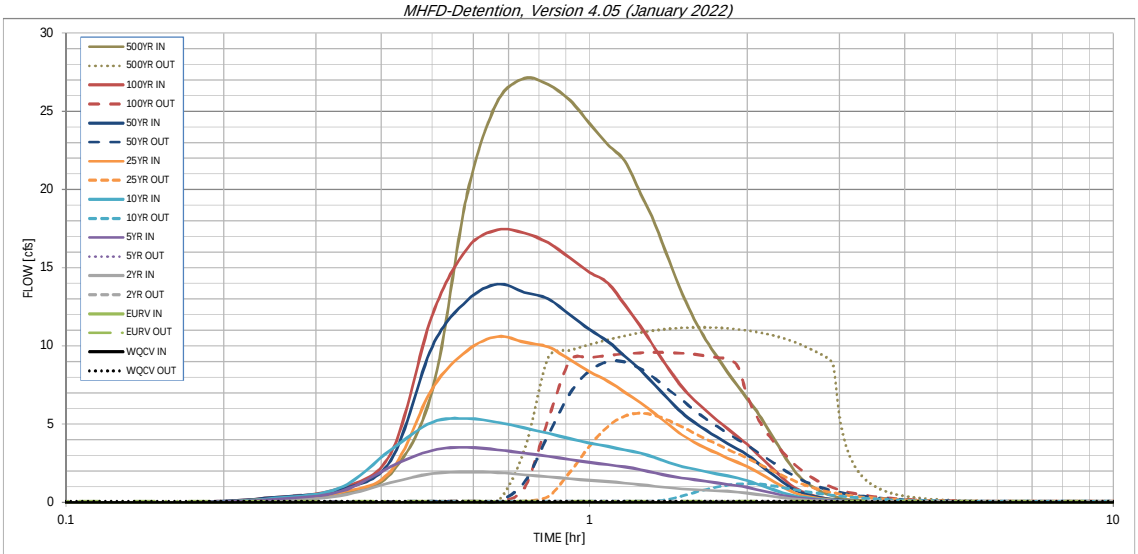
**Routed Hydrograph Results**

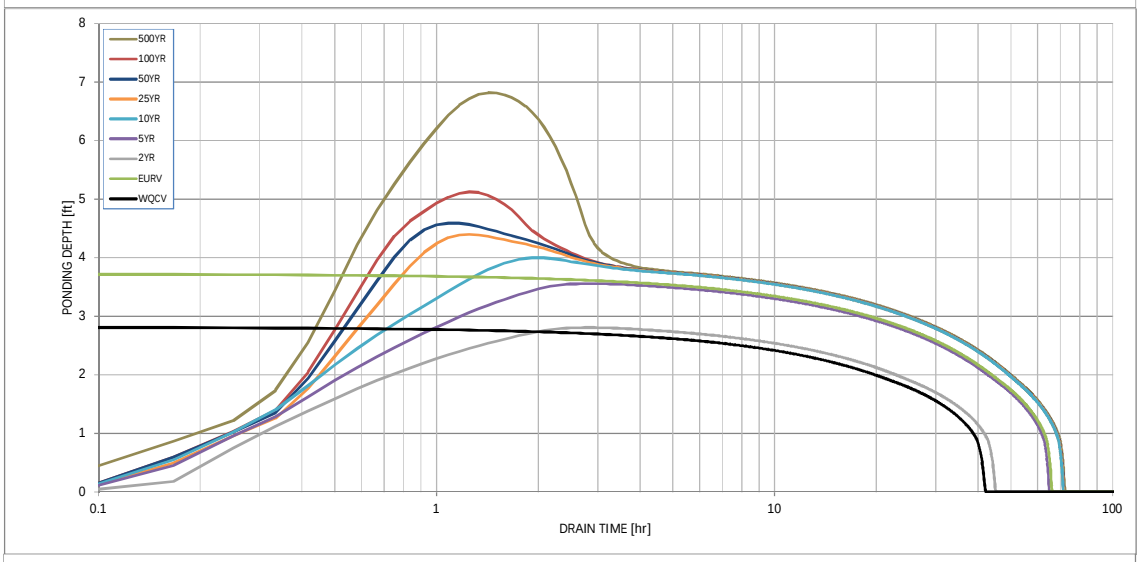
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

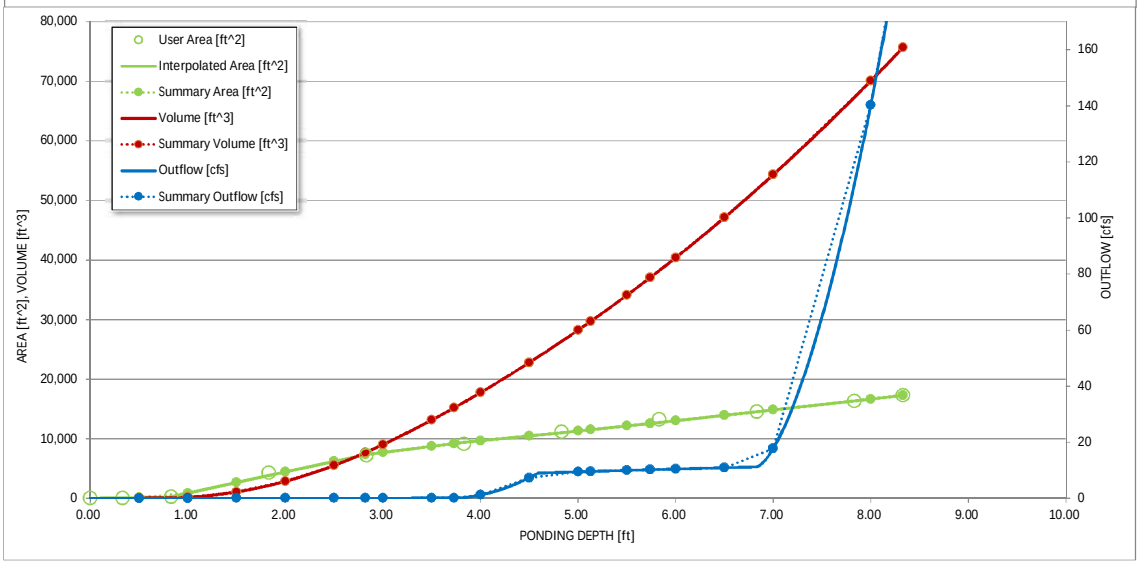
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.83 | 1.14 | 1.37 | 1.76 | 2.08 | 2.38 | 3.30 |
| CUHP Runoff Volume (acre-ft) = | 0.175 | 0.347 | 0.190 | 0.333 | 0.494 | 0.905 | 1.198 | 1.528 | 2.417 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 0.190 | 0.333 | 0.494 | 0.905 | 1.198 | 1.528 | 2.417 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.1 | 0.7 | 2.1 | 6.4 | 9.0 | 12.1 | 19.8 |
| 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 | 0.18 | 0.57 | 0.80 | 1.07 | 1.76 |
| Peak Inflow Q (cfs) = | N/A | N/A | 1.9 | 3.5 | 5.4 | 10.6 | 14.0 | 17.4 | 27.1 |
| Peak Outflow Q (cfs) = | 0.1 | 0.1 | 0.1 | 0.1 | 1.2 | 5.7 | 9.0 | 9.59 | 11.2 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 0.1 | 0.6 | 0.9 | 1.0 | 0.8 | 0.6 |
| Structure Controlling Flow = | Plate | Plate | Plate | Plate | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 | Outlet Plate 1 | Outlet Plate 1 |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | 0.1 | 0.7 | 1.0 | 1.1 | 1.3 |
| 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) = | 38 | 60 | 41 | 59 | 64 | 60 | 57 | 55 | 49 |
| Time to Drain 99% of Inflow Volume (hours) = | 40 | 63 | 43 | 62 | 68 | 66 | 65 | 64 | 61 |
| Maximum Ponding Depth (ft) = | 2.82 | 3.73 | 2.81 | 3.56 | 4.00 | 4.40 | 4.59 | 5.13 | 6.82 |
| Area at Maximum Ponding Depth (acres) = | 0.17 | 0.21 | 0.17 | 0.20 | 0.22 | 0.24 | 0.24 | 0.26 | 0.33 |
| Maximum Volume Stored (acre-ft) = | 0.176 | 0.349 | 0.173 | 0.312 | 0.407 | 0.497 | 0.545 | 0.679 | 1.183 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 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 | 0.10 |
| | 0:15:00 | 0.00 | 0.00 | 0.05 | 0.19 | 0.27 | 0.22 | 0.32 | 0.32 | 0.57 |
| | 0:20:00 | 0.00 | 0.00 | 0.43 | 0.70 | 0.93 | 0.64 | 0.82 | 0.92 | 1.85 |
| | 0:25:00 | 0.00 | 0.00 | 1.27 | 2.29 | 3.36 | 2.00 | 2.69 | 3.13 | 7.15 |
| | 0:30:00 | 0.00 | 0.00 | 1.84 | 3.33 | 5.13 | 7.27 | 9.96 | 11.98 | 19.74 |
| | 0:35:00 | 0.00 | 0.00 | 1.94 | 3.52 | 5.36 | 9.71 | 12.93 | 16.24 | 25.65 |
| | 0:40:00 | 0.00 | 0.00 | 1.91 | 3.37 | 5.12 | 10.61 | 13.95 | 17.42 | 27.11 |
| | 0:45:00 | 0.00 | 0.00 | 1.77 | 3.15 | 4.78 | 10.25 | 13.44 | 17.22 | 26.70 |
| | 0:50:00 | 0.00 | 0.00 | 1.64 | 2.96 | 4.41 | 9.93 | 13.01 | 16.61 | 25.71 |
| | 0:55:00 | 0.00 | 0.00 | 1.52 | 2.74 | 4.07 | 9.12 | 11.99 | 15.63 | 24.21 |
| | 1:00:00 | 0.00 | 0.00 | 1.42 | 2.56 | 3.80 | 8.37 | 11.04 | 14.71 | 22.87 |
| | 1:05:00 | 0.00 | 0.00 | 1.34 | 2.41 | 3.58 | 7.75 | 10.28 | 14.02 | 21.82 |
| | 1:10:00 | 0.00 | 0.00 | 1.24 | 2.27 | 3.37 | 7.05 | 9.36 | 12.63 | 19.78 |
| | 1:15:00 | 0.00 | 0.00 | 1.14 | 2.09 | 3.15 | 6.37 | 8.46 | 11.27 | 17.76 |
| | 1:20:00 | 0.00 | 0.00 | 1.04 | 1.89 | 2.86 | 5.65 | 7.48 | 9.83 | 15.47 |
| | 1:25:00 | 0.00 | 0.00 | 0.95 | 1.70 | 2.54 | 4.97 | 6.57 | 8.50 | 13.39 |
| | 1:30:00 | 0.00 | 0.00 | 0.87 | 1.57 | 2.30 | 4.33 | 5.74 | 7.38 | 11.70 |
| | 1:35:00 | 0.00 | 0.00 | 0.82 | 1.47 | 2.13 | 3.85 | 5.12 | 6.55 | 10.40 |
| | 1:40:00 | 0.00 | 0.00 | 0.78 | 1.36 | 1.97 | 3.47 | 4.62 | 5.86 | 9.31 |
| | 1:45:00 | 0.00 | 0.00 | 0.75 | 1.25 | 1.83 | 3.14 | 4.18 | 5.26 | 8.34 |
| | 1:50:00 | 0.00 | 0.00 | 0.71 | 1.16 | 1.70 | 2.84 | 3.78 | 4.70 | 7.45 |
| | 1:55:00 | 0.00 | 0.00 | 0.66 | 1.06 | 1.55 | 2.56 | 3.40 | 4.19 | 6.62 |
| | 2:00:00 | 0.00 | 0.00 | 0.60 | 0.97 | 1.40 | 2.29 | 3.04 | 3.70 | 5.84 |
| | 2:05:00 | 0.00 | 0.00 | 0.52 | 0.83 | 1.19 | 1.96 | 2.59 | 3.14 | 4.92 |
| | 2:10:00 | 0.00 | 0.00 | 0.45 | 0.70 | 0.99 | 1.63 | 2.15 | 2.60 | 4.03 |
| | 2:15:00 | 0.00 | 0.00 | 0.38 | 0.57 | 0.80 | 1.32 | 1.72 | 2.08 | 3.18 |
| | 2:20:00 | 0.00 | 0.00 | 0.31 | 0.46 | 0.63 | 1.02 | 1.32 | 1.58 | 2.39 |
| | 2:25:00 | 0.00 | 0.00 | 0.25 | 0.36 | 0.49 | 0.75 | 0.96 | 1.13 | 1.73 |
| | 2:30:00 | 0.00 | 0.00 | 0.19 | 0.28 | 0.38 | 0.54 | 0.70 | 0.82 | 1.30 |
| | 2:35:00 | 0.00 | 0.00 | 0.15 | 0.23 | 0.32 | 0.40 | 0.54 | 0.61 | 0.98 |
| | 2:40:00 | 0.00 | 0.00 | 0.13 | 0.19 | 0.26 | 0.31 | 0.41 | 0.46 | 0.74 |
| | 2:45:00 | 0.00 | 0.00 | 0.10 | 0.16 | 0.21 | 0.24 | 0.32 | 0.34 | 0.55 |
| | 2:50:00 | 0.00 | 0.00 | 0.09 | 0.13 | 0.17 | 0.18 | 0.25 | 0.25 | 0.41 |
| | 2:55:00 | 0.00 | 0.00 | 0.07 | 0.10 | 0.14 | 0.14 | 0.19 | 0.18 | 0.30 |
| | 3:00:00 | 0.00 | 0.00 | 0.06 | 0.08 | 0.11 | 0.11 | 0.15 | 0.13 | 0.22 |
| | 3:05:00 | 0.00 | 0.00 | 0.05 | 0.07 | 0.09 | 0.09 | 0.12 | 0.11 | 0.18 |
| | 3:10:00 | 0.00 | 0.00 | 0.04 | 0.05 | 0.07 | 0.07 | 0.09 | 0.08 | 0.14 |
| | 3:15:00 | 0.00 | 0.00 | 0.03 | 0.04 | 0.06 | 0.05 | 0.07 | 0.07 | 0.11 |
| | 3:20:00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.04 | 0.04 | 0.06 | 0.05 | 0.09 |
| | 3:25:00 | 0.00 | 0.00 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.06 |
| | 3:30:00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.05 |
| | 3:35:00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 |
| | 3:40:00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| | 3:45:00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| | 3:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Summary Stage-Area-Volume-Discharge Relationships

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

| Stage - Storage Description | Stage [ft] | Area [ft²] | Area [acres] | Volume [ft³] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|
| | 0.50 | 128 | 0.003 | 31 | 0.001 | 0.01 |
| | 1.00 | 870 | 0.020 | 192 | 0.004 | 0.02 |
| | 1.50 | 2,660 | 0.061 | 1,074 | 0.025 | 0.04 |
| | 2.00 | 4,439 | 0.102 | 2,851 | 0.065 | 0.05 |
| | 2.50 | 6,196 | 0.142 | 5,510 | 0.126 | 0.07 |
| WQCV | 2.82 | 7,320 | 0.168 | 7,672 | 0.176 | 0.08 |
| | 3.00 | 7,703 | 0.177 | 9,025 | 0.207 | 0.08 |
| | 3.50 | 8,727 | 0.200 | 13,133 | 0.301 | 0.09 |
| EURV | 3.73 | 9,198 | 0.211 | 15,194 | 0.349 | 0.10 |
| | 4.00 | 9,676 | 0.222 | 17,746 | 0.407 | 1.20 |
| | 4.50 | 10,479 | 0.241 | 22,785 | 0.523 | 7.32 |
| | 5.00 | 11,300 | 0.259 | 28,227 | 0.648 | 9.47 |
| 100-YEAR | 5.13 | 11,523 | 0.265 | 29,710 | 0.682 | 9.60 |
| | 5.50 | 12,156 | 0.279 | 34,091 | 0.783 | 9.97 |
| 100-YEAR + 1/2 EURV | 5.75 | 12,567 | 0.288 | 37,057 | 0.851 | 10.20 |
| | 6.00 | 13,031 | 0.299 | 40,384 | 0.927 | 10.45 |
| | 6.50 | 13,942 | 0.320 | 47,127 | 1.082 | 10.91 |
| | 7.00 | 14,848 | 0.341 | 54,326 | 1.247 | 17.78 |
| | 8.00 | 16,665 | 0.383 | 70,074 | 1.609 | 140.30 |
| | 8.33 | 17,298 | 0.397 | 75,678 | 1.737 | 204.25 |

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).

# POND A FOREBAY VOLUME REQUIREMENTS

Equation 3-1 $WQCV = a(0.91I^3 - 1.19I^2 + 0.781I)$
a=1 (40 hour drain time)

Basin A *I=.312* *WQCV=* 0.15516

Equation 3-3 $V=(WQCV/12)A$
Basin A A= 11.28 Acres V= 0.14585
20% WQCV Increase = 0.17502

3% OF WQCV
FOREBAY TOTAL VOLUME= .03(V)

| | | | |
|---|---|---|---|
| VOLUME REQUIRED FOR POND A FOREBAY = | 0.0053 | AC-FT | 229 CF |
| VOLUME PROVIDED FOR POND A FOREBAY = | 0.0058 | AC-FT | 251 CF |

$Q_{100}$ Discharges 2% OF $Q_{100}$

$Q_{100}$ BASIN A= .02*17.4 CFS= 0.35 CFS

# Weir Report



## Pond A Forebay Notch

**Rectangular Weir**

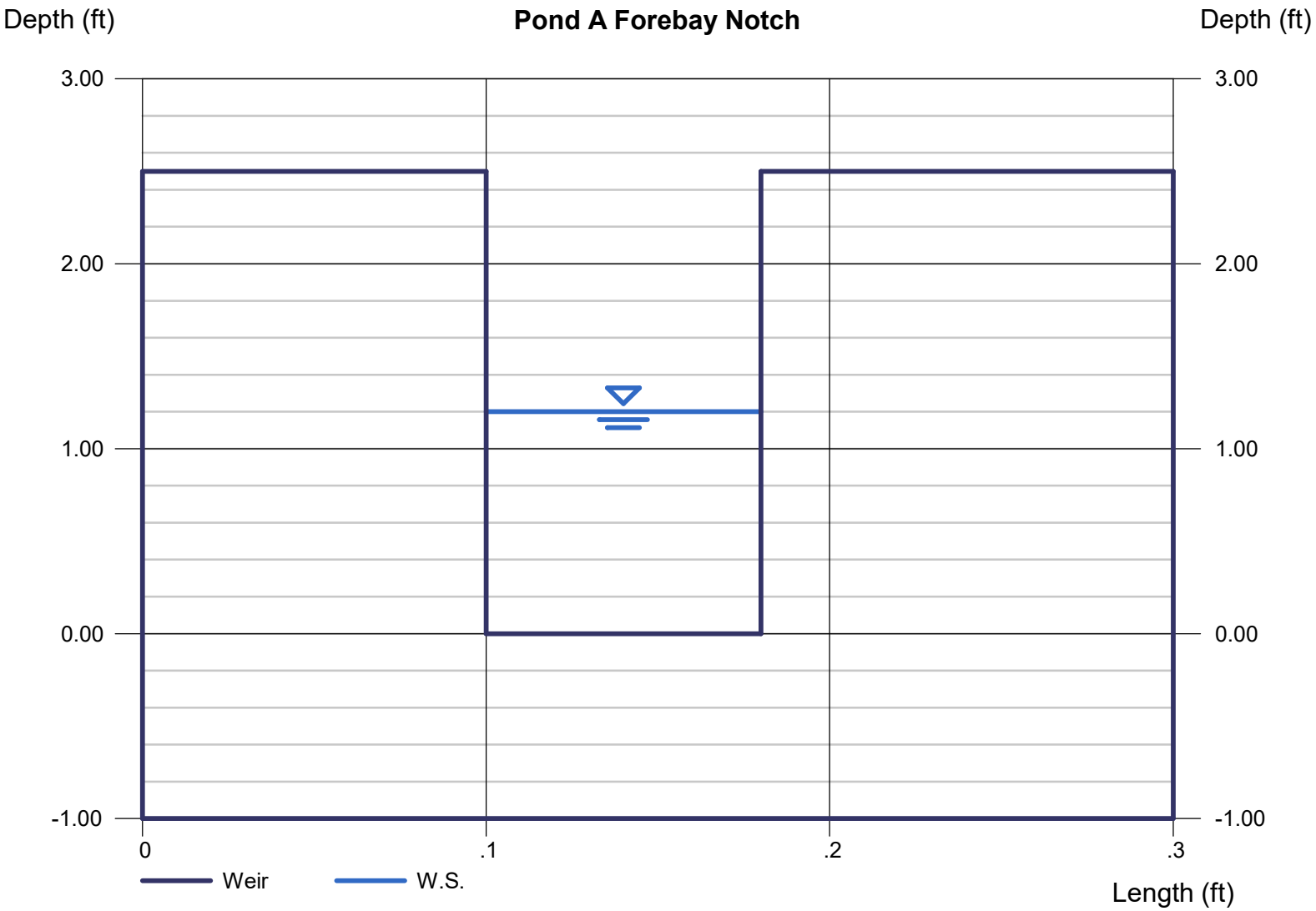
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.08 |
| Total Depth (ft) | = 2.50 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.35 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.20 |
| Q (cfs) | = 0.350 |
| Area (sqft) | = 0.10 |
| Velocity (ft/s) | = 3.65 |
| Top Width (ft) | = 0.08 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond A Trickle Channel

**Rectangular**

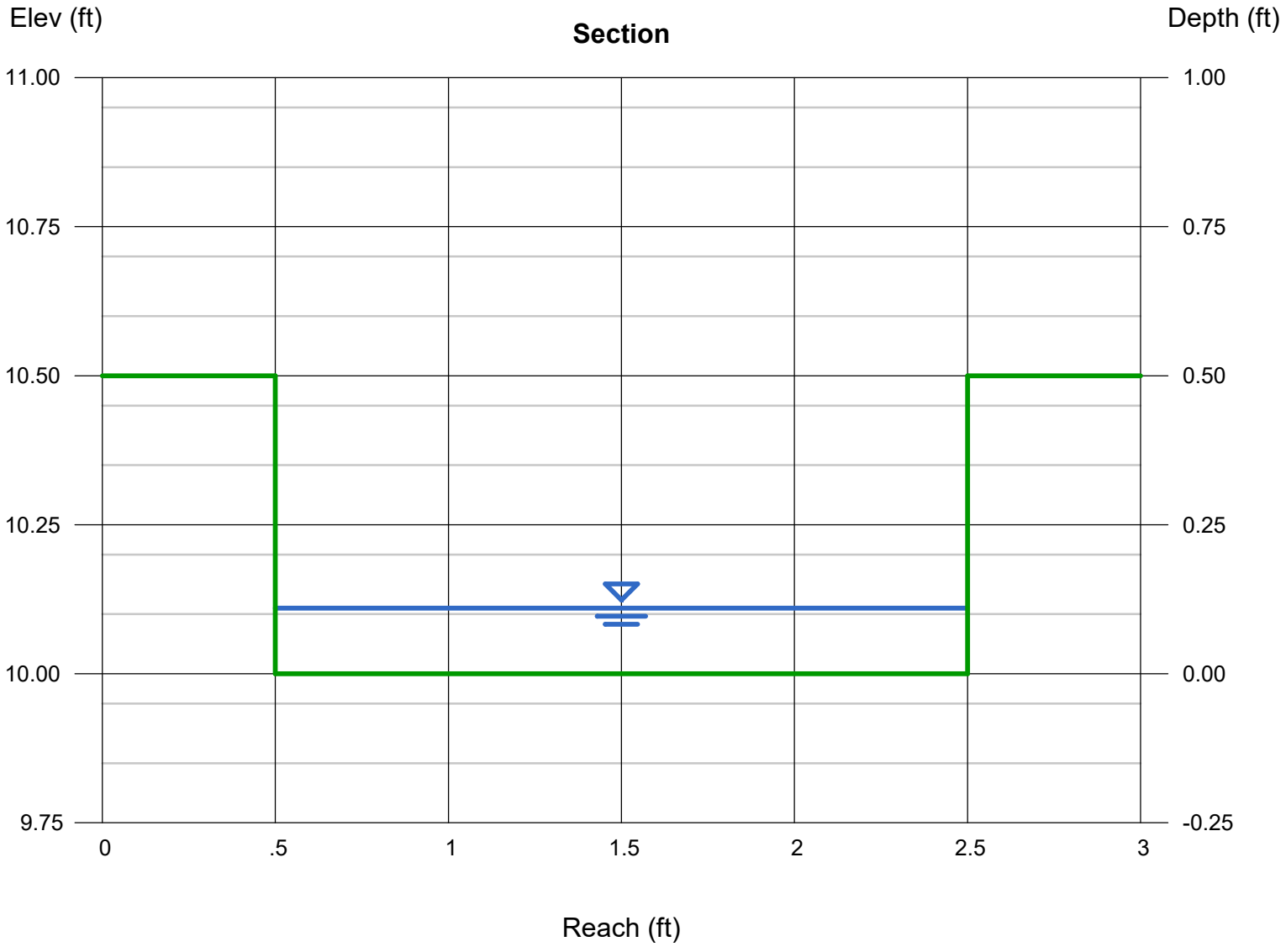
| | |
|---|---|
| Bottom Width (ft) | = 2.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.35 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.11 |
| Q (cfs) | = 0.350 |
| Area (sqft) | = 0.22 |
| Velocity (ft/s) | = 1.59 |
| Wetted Perim (ft) | = 2.22 |
| Crit Depth, Yc (ft) | = 0.10 |
| Top Width (ft) | = 2.00 |
| EGL (ft) | = 0.15 |



# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond A Spillway

**Trapezoidal Weir**

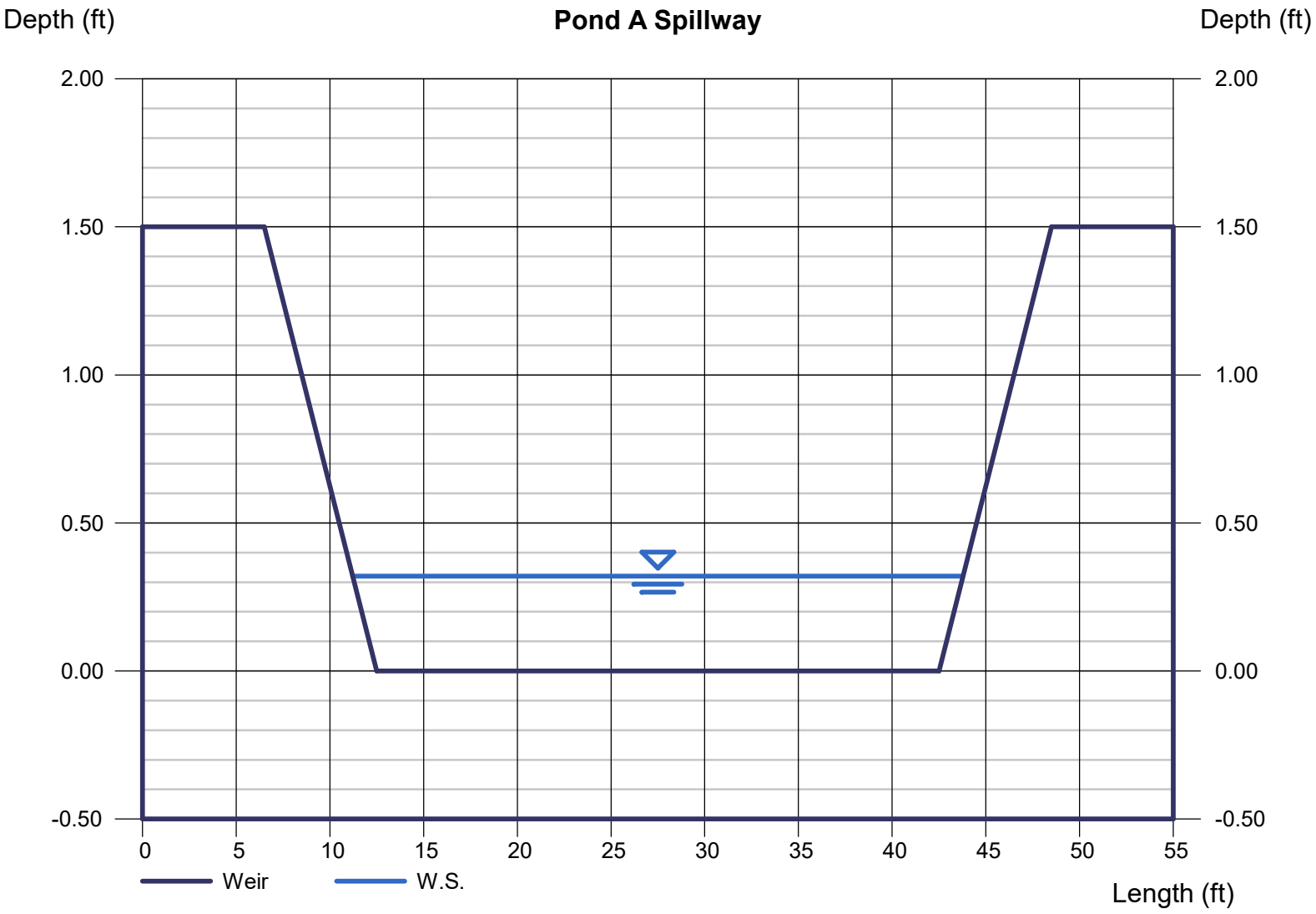
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 30.00 |
| Total Depth (ft) | = 1.50 |
| Side Slope (z:1) | = 4.00 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.10 |
| Compute by: | Known Q |
| Known Q (cfs) | = 17.40 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.32 |
| Q (cfs) | = 17.40 |
| Area (sqft) | = 10.01 |
| Velocity (ft/s) | = 1.74 |
| Top Width (ft) | = 32.56 |

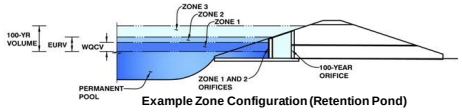


# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Pond B




**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 143.92 | acres |
| Watershed Length = | 3,029 | ft |
| Watershed Length to Centroid = | 1,490 | ft |
| Watershed Slope = | 0.045 | ft/ft |
| Watershed Imperviousness = | 43.00% | percent |
| Percentage Hydrologic Soil Group A = | 0.0% | percent |
| Percentage Hydrologic Soil Group B = | 80.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 20.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | Aurora - Municipal Center | |

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

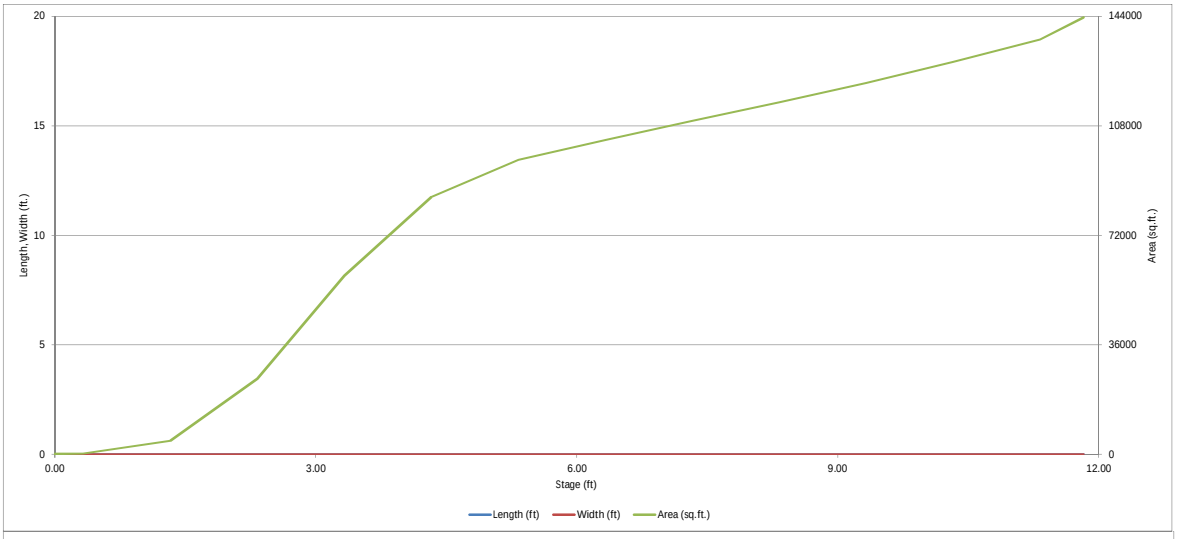
| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 3.126 | acre-feet | 3.126 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 6.386 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.83 in.) = | 3.693 | acre-feet | 0.83 | inches |
| 5-yr Runoff Volume (P1 = 1.14 in.) = | 5.807 | acre-feet | | inches |
| 10-yr Runoff Volume (P1 = 1.37 in.) = | 8.018 | acre-feet | 1.37 | inches |
| 25-yr Runoff Volume (P1 = 1.76 in.) = | 13.235 | acre-feet | | inches |
| 50-yr Runoff Volume (P1 = 2.08 in.) = | 17.006 | acre-feet | | inches |
| 100-yr Runoff Volume (P1 = 2.38 in.) = | 21.211 | acre-feet | 2.38 | inches |
| 500-yr Runoff Volume (P1 = 3.3 in.) = | 32.716 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 3.403 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 5.282 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 7.127 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 8.863 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 9.743 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 11.362 | acre-feet | | |

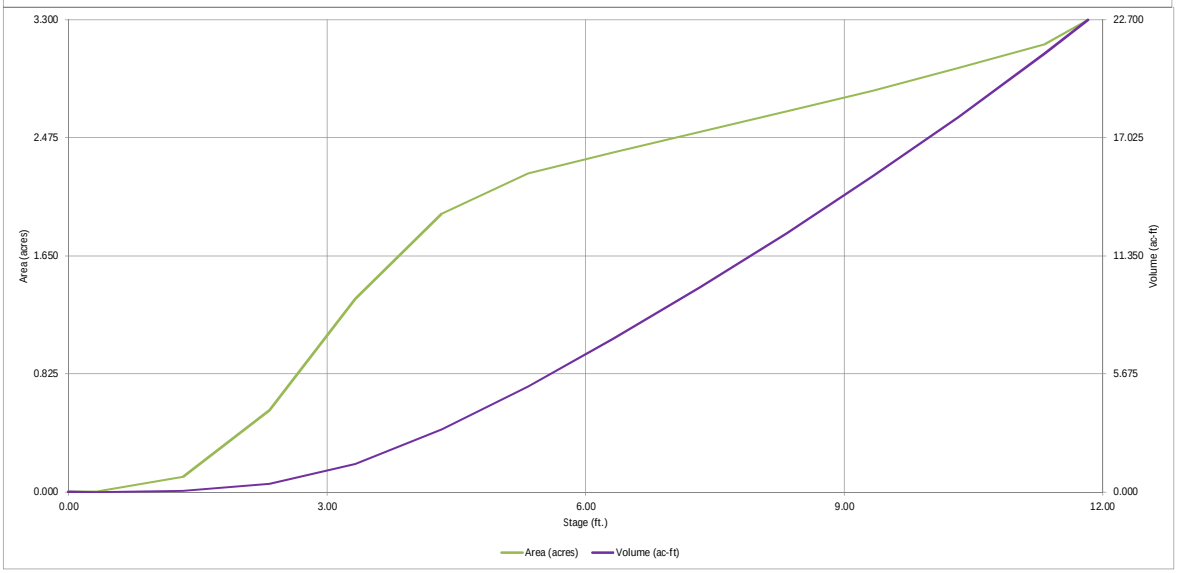
## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 3.126 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 3.260 | acre-feet |
| Zone 3 Volume (User Defined - Zones 1 & 2) = | 9.492 | acre-feet |
| Total Detention Basin Volume = | 15.878 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | $ft^3$ |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | user | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | -- | 0.00 | -- | -- | -- | 100 | 0.002 | | |
| 6040 | -- | 0.33 | -- | -- | -- | 200 | 0.005 | 49 | 0.001 |
| 6041 | -- | 1.33 | -- | -- | -- | 4,553 | 0.105 | 2,426 | 0.056 |
| 6042 | -- | 2.33 | -- | -- | -- | 24,854 | 0.571 | 17,129 | 0.393 |
| 6043 | -- | 3.33 | -- | -- | -- | 58,812 | 1.350 | 58,962 | 1.354 |
| 6044 | -- | 4.33 | -- | -- | -- | 84,656 | 1.943 | 130,696 | 3.000 |
| 6045 | -- | 5.33 | -- | -- | -- | 96,914 | 2.225 | 221,481 | 5.085 |
| 6046 | -- | 6.33 | -- | -- | -- | 103,463 | 2.375 | 321,670 | 7.385 |
| 6047 | -- | 7.33 | -- | -- | -- | 109,614 | 2.516 | 428,208 | 9.830 |
| 6048 | -- | 8.33 | -- | -- | -- | 115,825 | 2.659 | 540,928 | 12.418 |
| 6049 | -- | 9.33 | -- | -- | -- | 122,096 | 2.803 | 659,888 | 15.149 |
| 6050 | -- | 10.33 | -- | -- | -- | 129,138 | 2.965 | 785,505 | 18.033 |
| 6051 | -- | 11.33 | -- | -- | -- | 136,316 | 3.129 | 918,232 | 21.080 |
| 6051.5 | -- | 11.83 | -- | -- | -- | 143,627 | 3.297 | 988,218 | 22.686 |


20
15
10
5
0
Length, Width (ft.)
144000
108000
72000
36000
0
Area (sq.ft.)
0.00
3.00
6.00
9.00
12.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

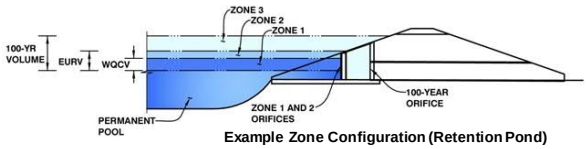

3.300
2.475
1.650
0.825
0.000
Area (acres)
22.700
17.025
11.350
5.675
0.000
Volume (ac-ft)
0.00
3.00
6.00
9.00
12.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Pond B




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 4.40 | 3.126 | Orifice Plate |
| Zone 2 (EURV) | 5.91 | 3.260 | Orifice Plate |
| Zone 3 (User) | 9.59 | 9.492 | Weir&Pipe (Restrict) |
| Total (all zones) | | 15.878 | |

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

| | | | | | |
|---|---|---|---|---|---|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) | Underdrain Orifice Area = | N/A | ft² |
| Underdrain Orifice Diameter = | N/A | inches | Underdrain Orifice Centroid = | N/A | feet |

Calculated Parameters for Underdrain

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

| | | | | | |
|---|---|---|---|---|---|
| Centroid of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | 5.688E-02 | ft² |
| Depth at top of Zone using Orifice Plate = | 5.91 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | N/A | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | 8.19 | sq. inches (use rectangular openings) | Elliptical Slot Area = | N/A | ft² |

Calculated Parameters for Plate

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 1.47 | 2.93 | | | | | |
| Orifice Area (sq. inches) | 8.19 | 8.19 | 8.19 | | | | | |

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

User Input: Vertical Orifice (Circular or Rectangular)

| | Not Selected | Not Selected | | | Not Selected | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | N/A | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | N/A | N/A | ft² |
| Depth at top of Zone using Vertical Orifice = | N/A | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | N/A | N/A | feet |
| Vertical Orifice Diameter = | N/A | N/A | inches | | | | |

Calculated Parameters for Vertical Orifice

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

| | Zone 3 Weir | Not Selected | | | Zone 3 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 5.92 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 5.92 | N/A | feet |
| Overflow Weir Front Edge Length = | 16.00 | N/A | feet | Overflow Weir Slope Length = | 7.00 | N/A | feet |
| Overflow Weir Grate Slope = | 0.00 | N/A | H:V | Grate Open Area / 100-yr Orifice Area = | 6.09 | N/A | |
| Horiz. Length of Weir Sides = | 7.00 | N/A | feet | Overflow Grate Open Area w/o Debris = | 77.95 | N/A | ft² |
| Overflow Grate Type = | Type C Grate | N/A | | Overflow Grate Open Area w/ Debris = | 77.95 | N/A | ft² |
| Debris Clogging % = | 0% | N/A | % | | | | |

Calculated Parameters for Overflow Weir

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

| | Zone 3 Restrictor | Not Selected | | | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 0.00 | N/A | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 12.80 | N/A | ft² |
| Outlet Pipe Diameter = | 54.00 | N/A | inches | Outlet Orifice Centroid = | 1.86 | N/A | feet |
| Restrictor Plate Height Above Pipe Invert = | 40.50 | | inches | Half-Central Angle of Restrictor Plate on Pipe = | 2.09 | N/A | radians |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

| | | | | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | 9.67 | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | 1.21 | feet |
| Spillway Crest Length = | 90.00 | feet | Stage at Top of Freeboard = | 11.88 | feet |
| Spillway End Slopes = | 4.00 | H:V | Basin Area at Top of Freeboard = | 3.30 | acres |
| Freeboard above Max Water Surface = | 1.00 | feet | Basin Volume at Top of Freeboard = | 22.69 | acre-ft |

Calculated Parameters for Spillway

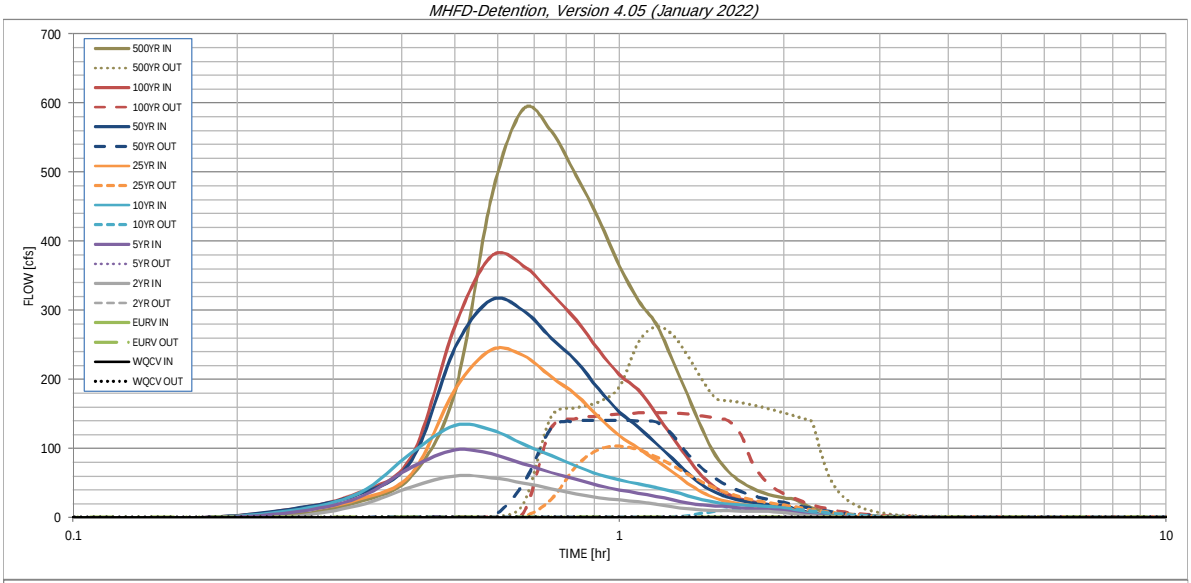
Routed Hydrograph Results

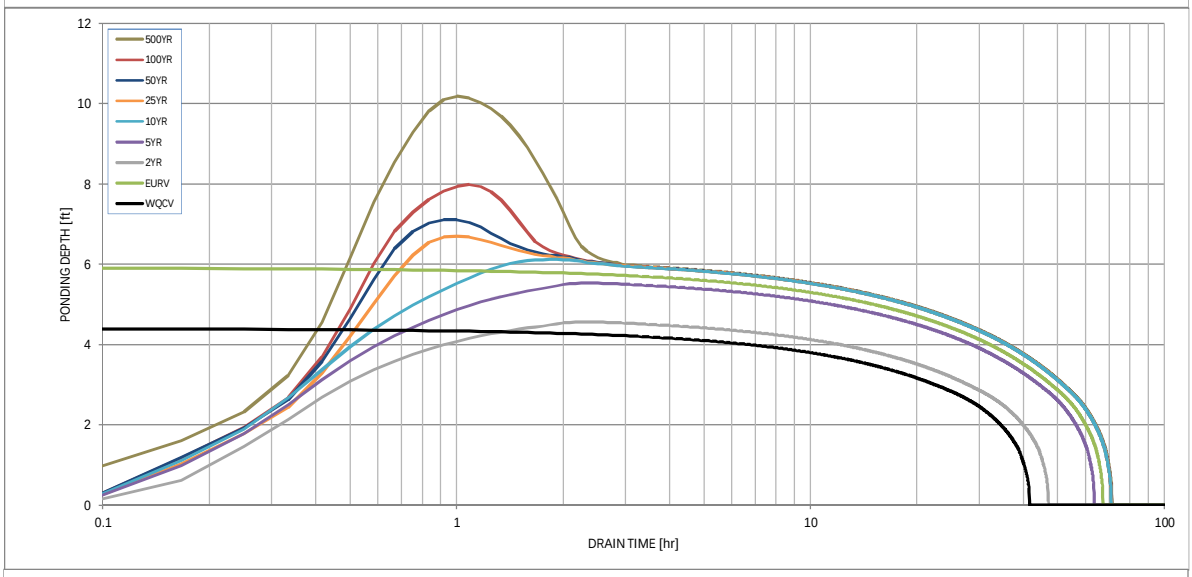
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

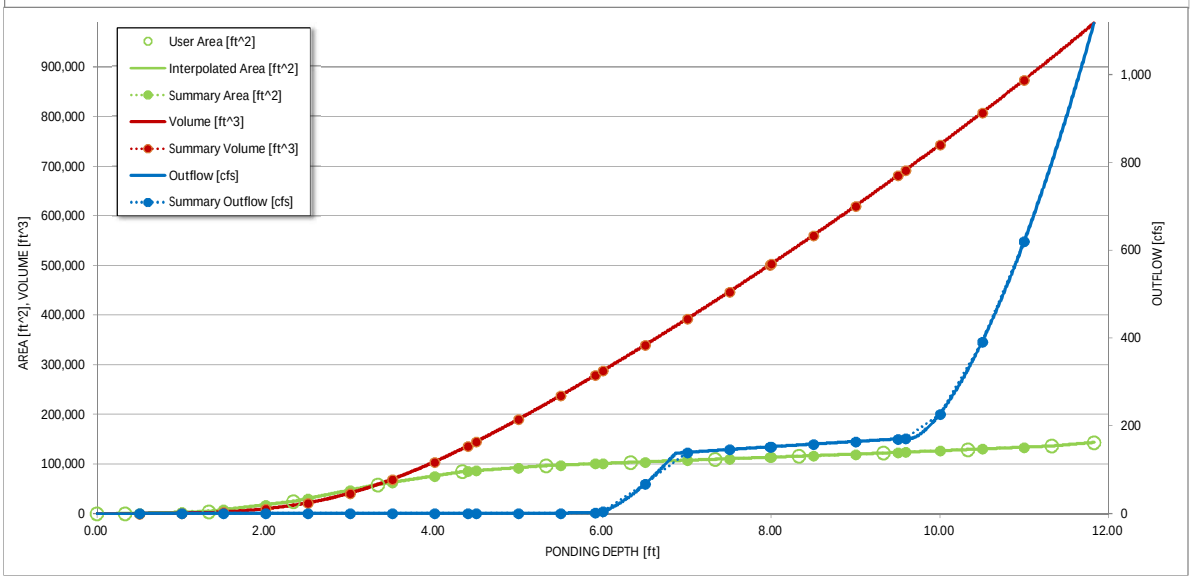
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.83 | 1.14 | 1.37 | 1.76 | 2.08 | 2.38 | 3.30 |
| CUHP Runoff Volume (acre-ft) = | 3.126 | 6.386 | 3.693 | 5.807 | 8.018 | 13.235 | 17.006 | 21.211 | 32.716 |
| User Override Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 3.693 | 5.807 | 7.867 | 13.235 | 17.006 | 21.000 | 32.716 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 1.6 | 9.8 | 36.1 | 113.1 | 160.0 | 213.5 | 348.1 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | | | | | | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.01 | 0.07 | 0.25 | 0.79 | 1.11 | 1.48 | 2.42 |
| Peak Inflow Q (cfs) = | N/A | N/A | 60.9 | 98.5 | 134.0 | 243.2 | 315.6 | 378.9 | 591.6 |
| Peak Outflow Q (cfs) = | 1.4 | 1.7 | 1.4 | 1.6 | 14.9 | 103.8 | 141.1 | 152.4 | 276.6 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 0.2 | 0.4 | 0.9 | 0.9 | 0.7 | 0.8 |
| Structure Controlling Flow = | Plate | Plate | Plate | Plate | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | 0.2 | 1.3 | 1.8 | 1.9 | 2.2 |
| 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) = | 38 | 61 | 43 | 58 | 64 | 61 | 59 | 57 | 52 |
| Time to Drain 99% of Inflow Volume (hours) = | 40 | 64 | 45 | 61 | 67 | 66 | 65 | 64 | 62 |
| Maximum Ponding Depth (ft) = | 4.40 | 5.91 | 4.56 | 5.53 | 6.12 | 6.70 | 7.11 | 7.98 | 10.18 |
| Area at Maximum Ponding Depth (acres) = | 1.96 | 2.31 | 2.01 | 2.25 | 2.34 | 2.43 | 2.49 | 2.61 | 2.94 |
| Maximum Volume Stored (acre-ft) = | 3.137 | 6.400 | 3.455 | 5.510 | 6.866 | 8.249 | 9.280 | 11.496 | 17.560 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 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 | USER | CUHP | CUHP | USER | CUHP |
|---|---|---|---|---|---|---|---|---|---|---|
| Time Interval | TIME | WQCV [cfs] | EURV [cfs] | 2 Year [cfs] | 5 Year [cfs] | 10 Year [cfs] | 25 Year [cfs] | 50 Year [cfs] | 100 Year [cfs] | 500 Year [cfs] |
| 5.00 min | 0:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.98 |
| | 0:15:00 | 0.00 | 0.00 | 2.26 | 7.74 | 10.52 | 8.88 | 12.79 | 12.39 | 23.20 |
| | 0:20:00 | 0.00 | 0.00 | 18.16 | 29.52 | 35.70 | 26.93 | 34.39 | 36.35 | 60.92 |
| | 0:25:00 | 0.00 | 0.00 | 44.90 | 73.70 | 94.25 | 64.21 | 83.58 | 89.62 | 182.82 |
| | 0:30:00 | 0.00 | 0.00 | 60.93 | 98.50 | 134.03 | 185.70 | 246.05 | 277.98 | 464.21 |
| | 0:35:00 | 0.00 | 0.00 | 58.16 | 92.62 | 127.39 | 243.21 | 315.61 | 378.93 | 591.57 |
| | 0:40:00 | 0.00 | 0.00 | 50.48 | 78.37 | 106.92 | 234.98 | 300.24 | 365.15 | 559.21 |
| | 0:45:00 | 0.00 | 0.00 | 42.16 | 65.75 | 89.96 | 204.18 | 260.33 | 325.33 | 495.58 |
| | 0:50:00 | 0.00 | 0.00 | 34.85 | 55.57 | 75.03 | 177.82 | 226.66 | 286.16 | 431.87 |
| | 0:55:00 | 0.00 | 0.00 | 29.47 | 46.84 | 62.82 | 145.74 | 186.26 | 242.75 | 364.58 |
| | 1:00:00 | 0.00 | 0.00 | 25.89 | 40.57 | 54.85 | 118.94 | 153.27 | 207.40 | 314.49 |
| | 1:05:00 | 0.00 | 0.00 | 23.16 | 35.77 | 49.09 | 101.05 | 131.24 | 184.92 | 280.81 |
| | 1:10:00 | 0.00 | 0.00 | 19.65 | 31.32 | 43.64 | 83.09 | 107.80 | 151.18 | 228.94 |
| | 1:15:00 | 0.00 | 0.00 | 16.12 | 26.17 | 38.45 | 66.39 | 85.77 | 117.28 | 177.42 |
| | 1:20:00 | 0.00 | 0.00 | 13.31 | 21.30 | 32.15 | 50.36 | 64.75 | 86.44 | 128.47 |
| | 1:25:00 | 0.00 | 0.00 | 11.58 | 18.47 | 26.21 | 37.16 | 47.80 | 60.21 | 90.09 |
| | 1:30:00 | 0.00 | 0.00 | 10.71 | 17.05 | 22.46 | 28.74 | 36.83 | 43.70 | 66.79 |
| | 1:35:00 | 0.00 | 0.00 | 10.25 | 16.16 | 20.22 | 23.34 | 29.58 | 33.88 | 52.56 |
| | 1:40:00 | 0.00 | 0.00 | 10.01 | 14.62 | 18.64 | 20.01 | 25.01 | 27.61 | 42.97 |
| | 1:45:00 | 0.00 | 0.00 | 9.84 | 13.17 | 17.52 | 17.80 | 21.94 | 23.29 | 36.45 |
| | 1:50:00 | 0.00 | 0.00 | 9.71 | 12.18 | 16.74 | 16.46 | 20.00 | 20.36 | 31.95 |
| | 1:55:00 | 0.00 | 0.00 | 8.64 | 11.44 | 15.84 | 15.51 | 18.64 | 18.31 | 28.85 |
| | 2:00:00 | 0.00 | 0.00 | 7.51 | 10.61 | 14.38 | 14.90 | 17.78 | 17.08 | 27.16 |
| | 2:05:00 | 0.00 | 0.00 | 5.76 | 8.16 | 11.00 | 11.55 | 13.72 | 13.30 | 20.89 |
| | 2:10:00 | 0.00 | 0.00 | 4.13 | 5.76 | 7.78 | 8.06 | 9.54 | 9.37 | 14.52 |
| | 2:15:00 | 0.00 | 0.00 | 2.94 | 4.08 | 5.55 | 5.70 | 6.72 | 6.72 | 10.30 |
| | 2:20:00 | 0.00 | 0.00 | 2.08 | 2.84 | 3.95 | 4.00 | 4.70 | 4.81 | 7.24 |
| | 2:25:00 | 0.00 | 0.00 | 1.43 | 1.91 | 2.74 | 2.74 | 3.21 | 3.32 | 4.92 |
| | 2:30:00 | 0.00 | 0.00 | 0.95 | 1.27 | 1.88 | 1.86 | 2.18 | 2.27 | 3.33 |
| | 2:35:00 | 0.00 | 0.00 | 0.61 | 0.84 | 1.25 | 1.23 | 1.43 | 1.53 | 2.17 |
| | 2:40:00 | 0.00 | 0.00 | 0.34 | 0.50 | 0.76 | 0.72 | 0.84 | 0.94 | 1.26 |
| | 2:45:00 | 0.00 | 0.00 | 0.16 | 0.25 | 0.39 | 0.35 | 0.41 | 0.49 | 0.59 |
| | 2:50:00 | 0.00 | 0.00 | 0.06 | 0.08 | 0.15 | 0.11 | 0.13 | 0.18 | 0.17 |
| | 2:55:00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 |
| | 3:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Summary Stage-Area-Volume-Discharge Relationships

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

| Stage - Storage Description | Stage [ft] | Area [ft²] | Area [acres] | Volume [ft³] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|
| | 0.50 | 940 | 0.022 | 146 | 0.003 | 0.19 |
| | 1.00 | 3,117 | 0.072 | 1,160 | 0.027 | 0.27 |
| | 1.50 | 8,004 | 0.184 | 3,493 | 0.080 | 0.38 |
| | 2.00 | 18,155 | 0.417 | 10,033 | 0.230 | 0.59 |
| | 2.50 | 30,627 | 0.703 | 21,845 | 0.501 | 0.71 |
| | 3.00 | 47,606 | 1.093 | 41,403 | 0.950 | 0.89 |
| | 3.50 | 63,205 | 1.451 | 69,334 | 1.592 | 1.11 |
| | 4.00 | 76,127 | 1.748 | 104,167 | 2.391 | 1.27 |
| WQCV | 4.40 | 85,514 | 1.963 | 136,652 | 3.137 | 1.38 |
| | 4.50 | 86,740 | 1.991 | 145,265 | 3.335 | 1.40 |
| | 5.00 | 92,869 | 2.132 | 190,167 | 4.366 | 1.52 |
| | 5.50 | 98,027 | 2.250 | 238,051 | 5.465 | 1.63 |
| EURV | 5.91 | 100,712 | 2.312 | 278,793 | 6.400 | 1.72 |
| | 6.00 | 101,302 | 2.326 | 287,883 | 6.609 | 5.09 |
| | 6.50 | 104,509 | 2.399 | 339,347 | 7.790 | 67.29 |
| | 7.00 | 107,584 | 2.470 | 392,370 | 9.008 | 139.61 |
| | 7.50 | 110,670 | 2.541 | 446,932 | 10.260 | 146.25 |
| 100-Year | 7.98 | 113,651 | 2.609 | 500,769 | 11.496 | 152.35 |
| | 8.00 | 113,775 | 2.612 | 503,044 | 11.548 | 152.60 |
| | 8.50 | 116,891 | 2.683 | 560,708 | 12.872 | 158.70 |
| | 9.00 | 120,027 | 2.755 | 619,938 | 14.232 | 164.57 |
| | 9.50 | 123,293 | 2.830 | 680,746 | 15.628 | 170.24 |
| 100-Year + 1/2 EURV | 9.59 | 123,927 | 2.845 | 691,871 | 15.883 | 171.24 |
| | 10.00 | 126,814 | 2.911 | 743,273 | 17.063 | 227.51 |
| | 10.50 | 130,358 | 2.993 | 807,562 | 18.539 | 391.23 |
| | 11.00 | 133,947 | 3.075 | 873,639 | 20.056 | 619.93 |

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).

# POND B FOREBAY VOLUME REQUIREMENTS

EQUATION 3-1 $WQCV = a(0.91i^3 - 1.19i^2 + 0.781i)$
a=1 (40 hour drain time)

| | | | |
|---|---|---|---|
| FOREBAY 1 | *I=.550* | *WQCV=* | 0.22043 |
| FOREBAY 2 | *I=.369* | *WQCV=* | 0.17151 |
| FOREBAY 3 | *I=.534* | *WQCV=* | 0.21575 |

EQUATION 3-3 V=(WQCV/12)A

FOREBAY 1 A= 2.98 Acres V= 0.05474 AC-FT
20% WQCV Increase = 0.06569 AC-FT

FOREBAY 2 A= 168.49 Acres V= 2.40814 AC-FT
20% WQCV Increase = 2.88977 AC-FT

FOREBAY 3 A= 7.89 Acres V= 0.14186 AC-FT
20% WQCV Increase = 0.17023 AC-FT
TOTAL WQCV REQUIRED = 3.12569 AC-FT
3% OF WQCV
FOREBAY TOTAL VOLUME= .03(V)

VOLUME REQUIRED FOR FOREBAY 1= 0.0020 AC-FT 86 CF
VOLUME PROVIDED FOR FOREBAY 1= 0.0120 AC-FT 524 CF
$Q_{100}$ DISCHARGES 2% OF $Q_{100}$
$Q_{100}$ FOREBAY 1= .02*11.89 CFS= 0.24 CFS

VOLUME REQUIRED FOR FOREBAY 2= 0.0867 AC-FT 3776 CF
VOLUME PROVIDED FOR FOREBAY 2= 0.3635 AC-FT 15835 CF
$Q_{100}$ DISCHARGES 2% OF $Q_{100}$
$Q_{100}$ FOREBAY 2= .02*361.87 CFS= 7.24 CFS

VOLUME REQUIRED FOR FOREBAY 3= 0.0051 AC-FT 222 CF
VOLUME PROVIDED FOR FOREBAY 3= 0.0146 AC-FT 636 CF
$Q_{100}$ DISCHARGES 2% OF $Q_{100}$
$Q_{100}$ FOREBAY 3= .02*26.25 CFS= 0.53 CFS

# Weir Report



## Pond B Forebay 1 Notch

**Rectangular Weir**

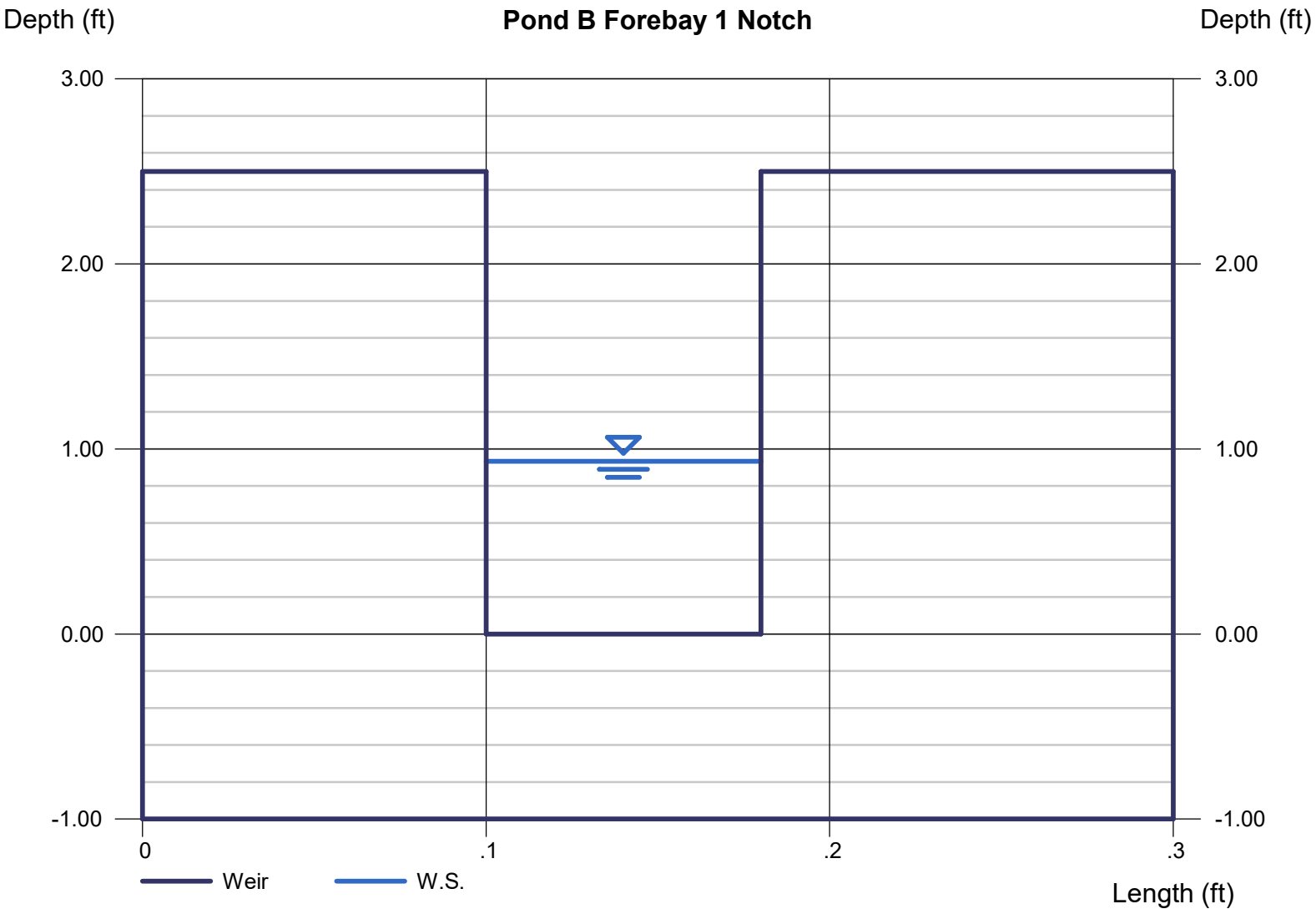
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.08 |
| Total Depth (ft) | = 2.50 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.24 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.93 |
| Q (cfs) | = 0.240 |
| Area (sqft) | = 0.07 |
| Velocity (ft/s) | = 3.22 |
| Top Width (ft) | = 0.08 |



# Weir Report



## Pond B Forebay 2 Notch

**Rectangular Weir**

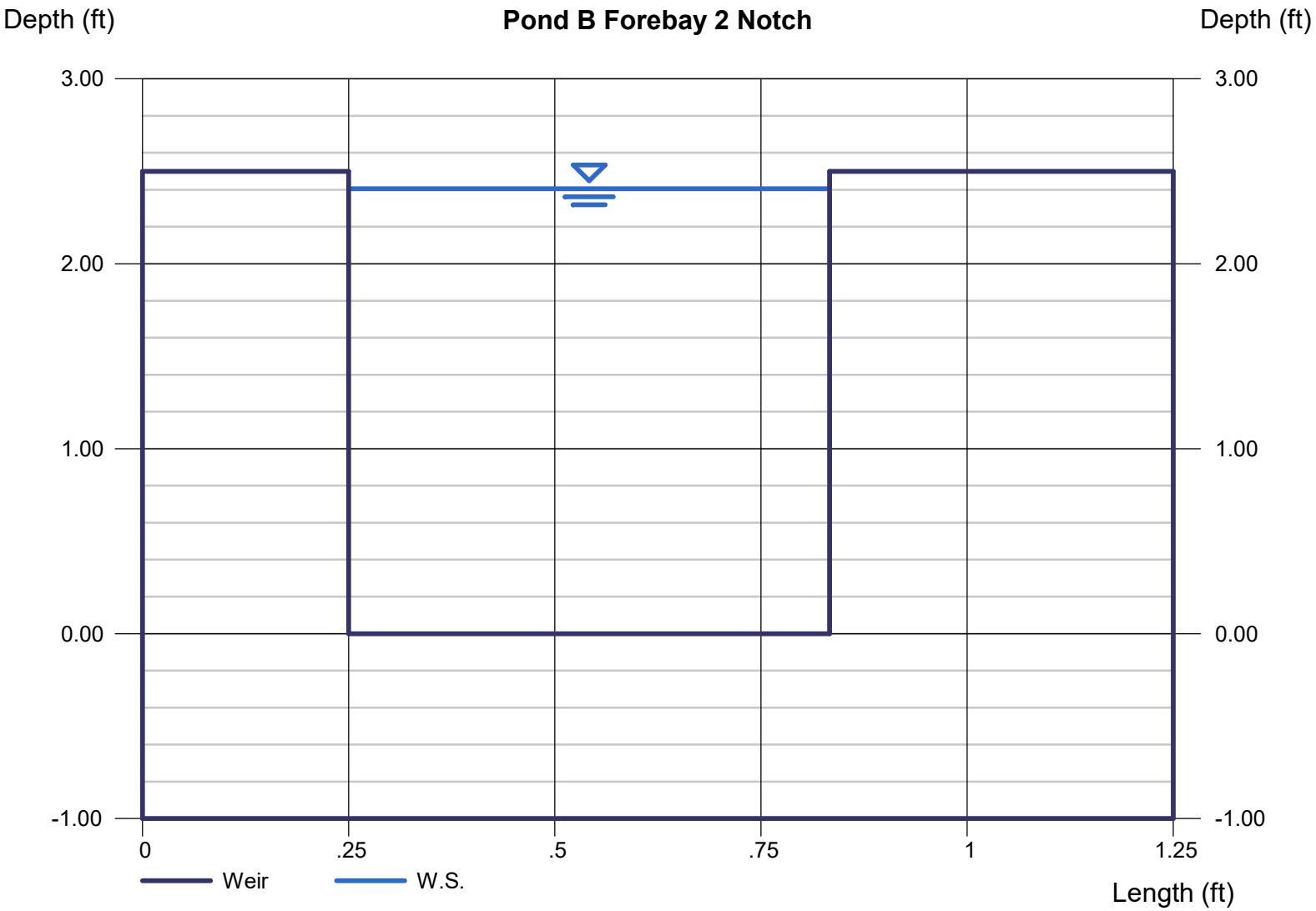
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.58 |
| Total Depth (ft) | = 2.50 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 7.24 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.40 |
| Q (cfs) | = 7.240 |
| Area (sqft) | = 1.40 |
| Velocity (ft/s) | = 5.16 |
| Top Width (ft) | = 0.58 |



# Weir Report



## Pond B Forebay 3 Notch

**Rectangular Weir**

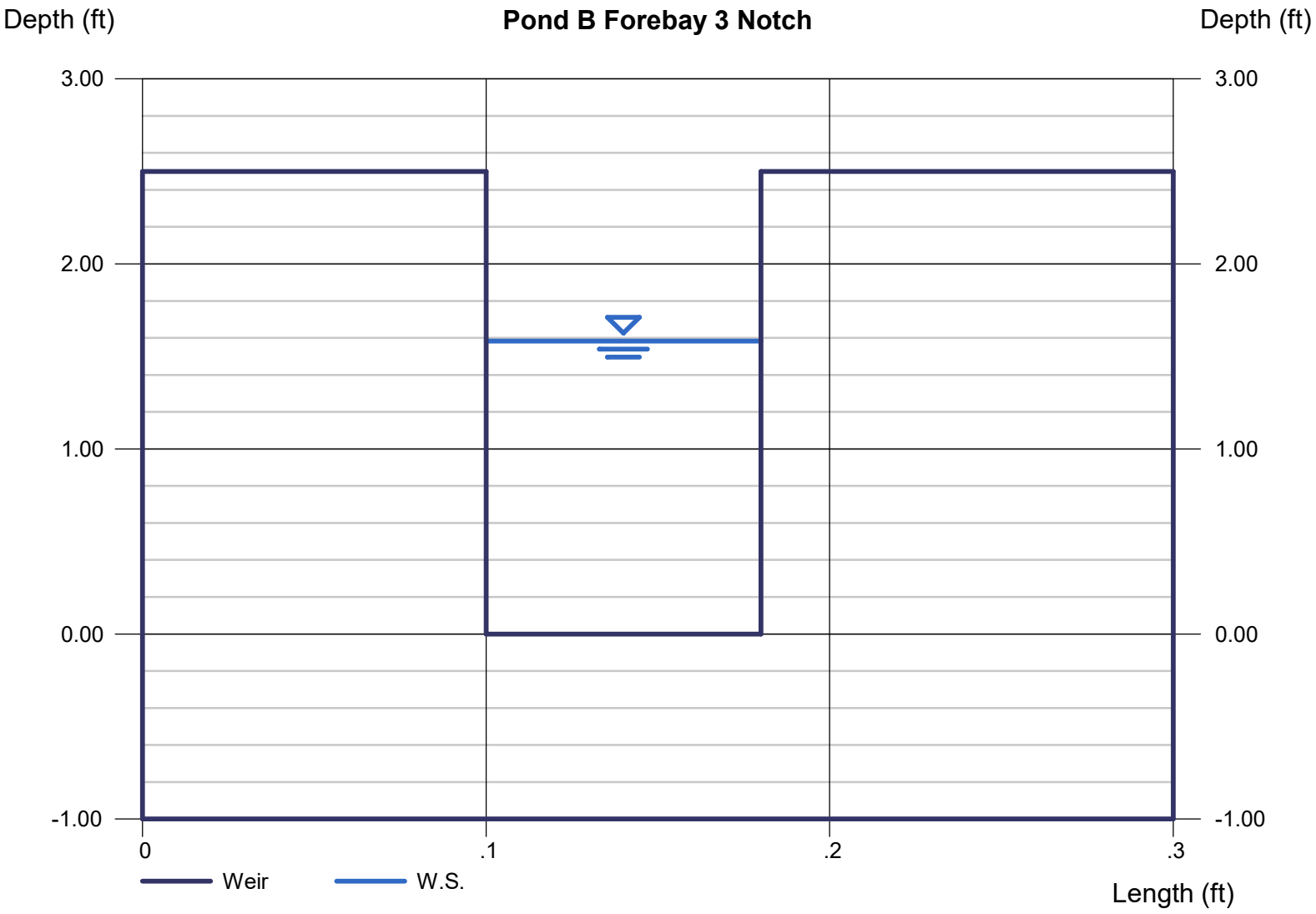
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.08 |
| Total Depth (ft) | = 2.50 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.53 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.58 |
| Q (cfs) | = 0.530 |
| Area (sqft) | = 0.13 |
| Velocity (ft/s) | = 4.19 |
| Top Width (ft) | = 0.08 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond B Trickle Channel 1

**Rectangular**

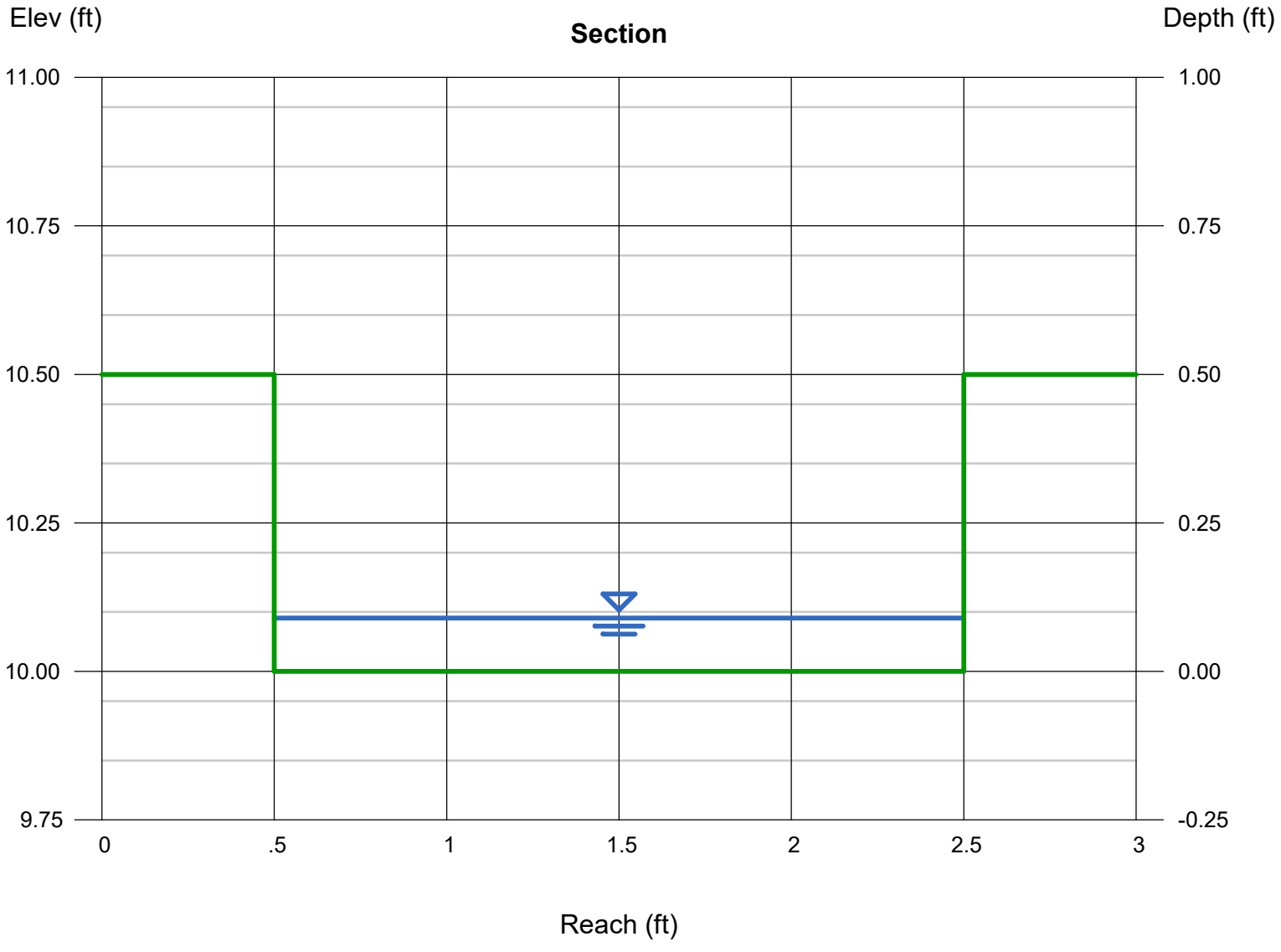
| | |
|---|---|
| Bottom Width (ft) | = 2.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.24 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.09 |
| Q (cfs) | = 0.240 |
| Area (sqft) | = 0.18 |
| Velocity (ft/s) | = 1.33 |
| Wetted Perim (ft) | = 2.18 |
| Crit Depth, Yc (ft) | = 0.08 |
| Top Width (ft) | = 2.00 |
| EGL (ft) | = 0.12 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond B Trickle Channel 2

**Rectangular**

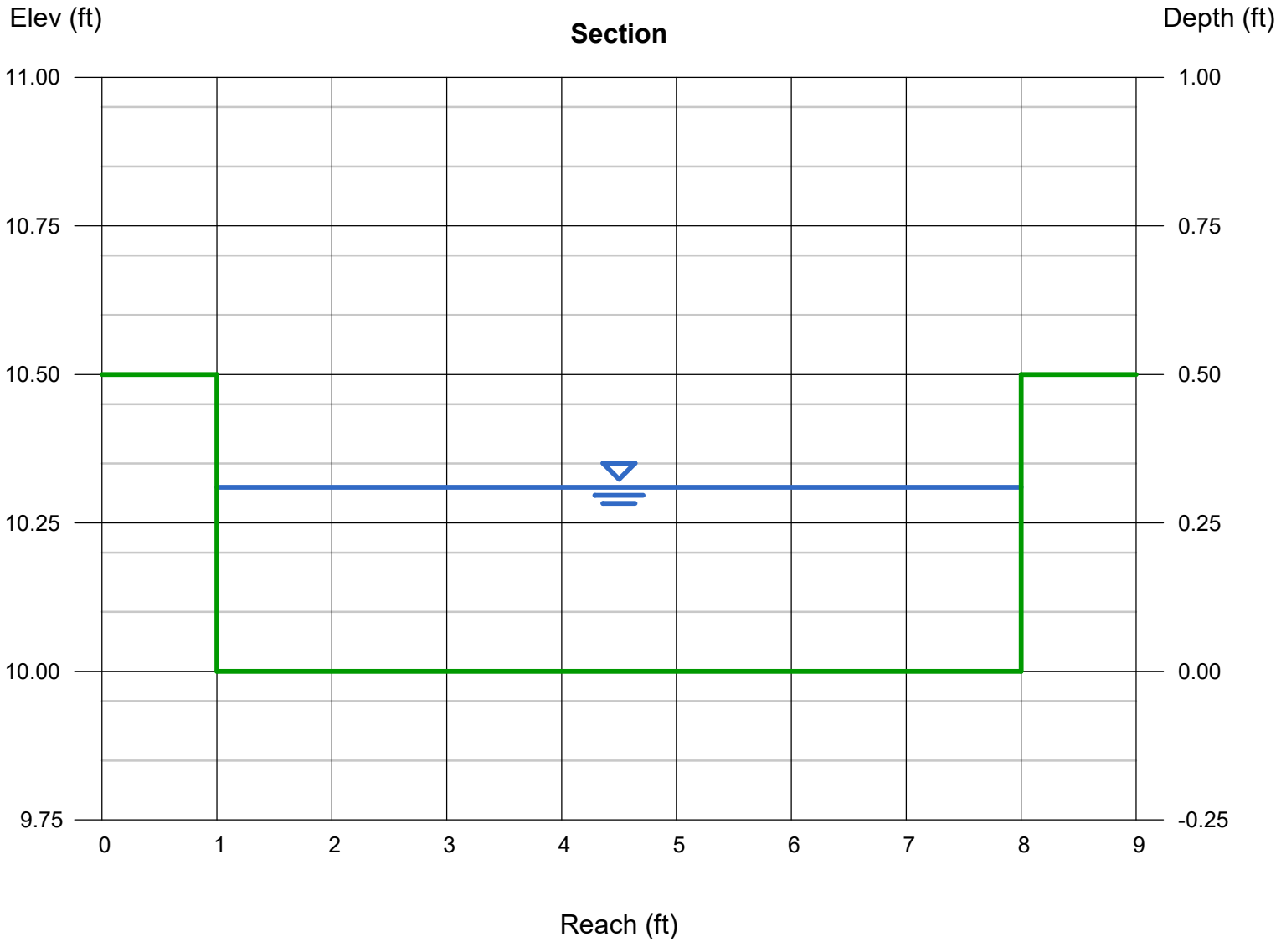
| | |
|---|---|
| Bottom Width (ft) | = 7.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 7.24 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.31 |
| Q (cfs) | = 7.240 |
| Area (sqft) | = 2.17 |
| Velocity (ft/s) | = 3.34 |
| Wetted Perim (ft) | = 7.62 |
| Crit Depth, Yc (ft) | = 0.33 |
| Top Width (ft) | = 7.00 |
| EGL (ft) | = 0.48 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond B Trickle Channel 3

**Rectangular**

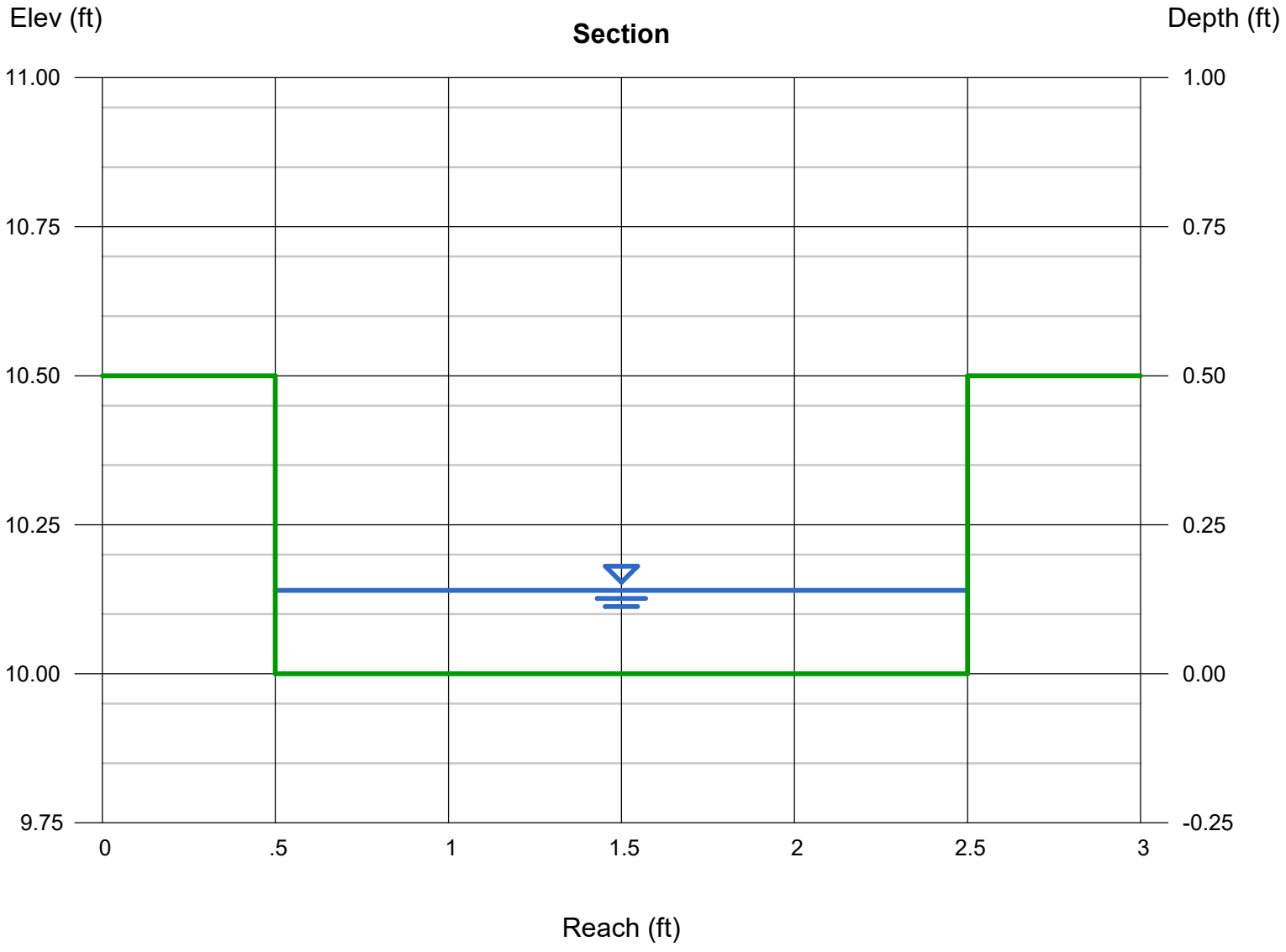
| | |
|---|---|
| Bottom Width (ft) | = 2.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.53 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.14 |
| Q (cfs) | = 0.530 |
| Area (sqft) | = 0.28 |
| Velocity (ft/s) | = 1.89 |
| Wetted Perim (ft) | = 2.28 |
| Crit Depth, Yc (ft) | = 0.13 |
| Top Width (ft) | = 2.00 |
| EGL (ft) | = 0.20 |



# Weir Report



## Pond B Spillway

**Trapezoidal Weir**

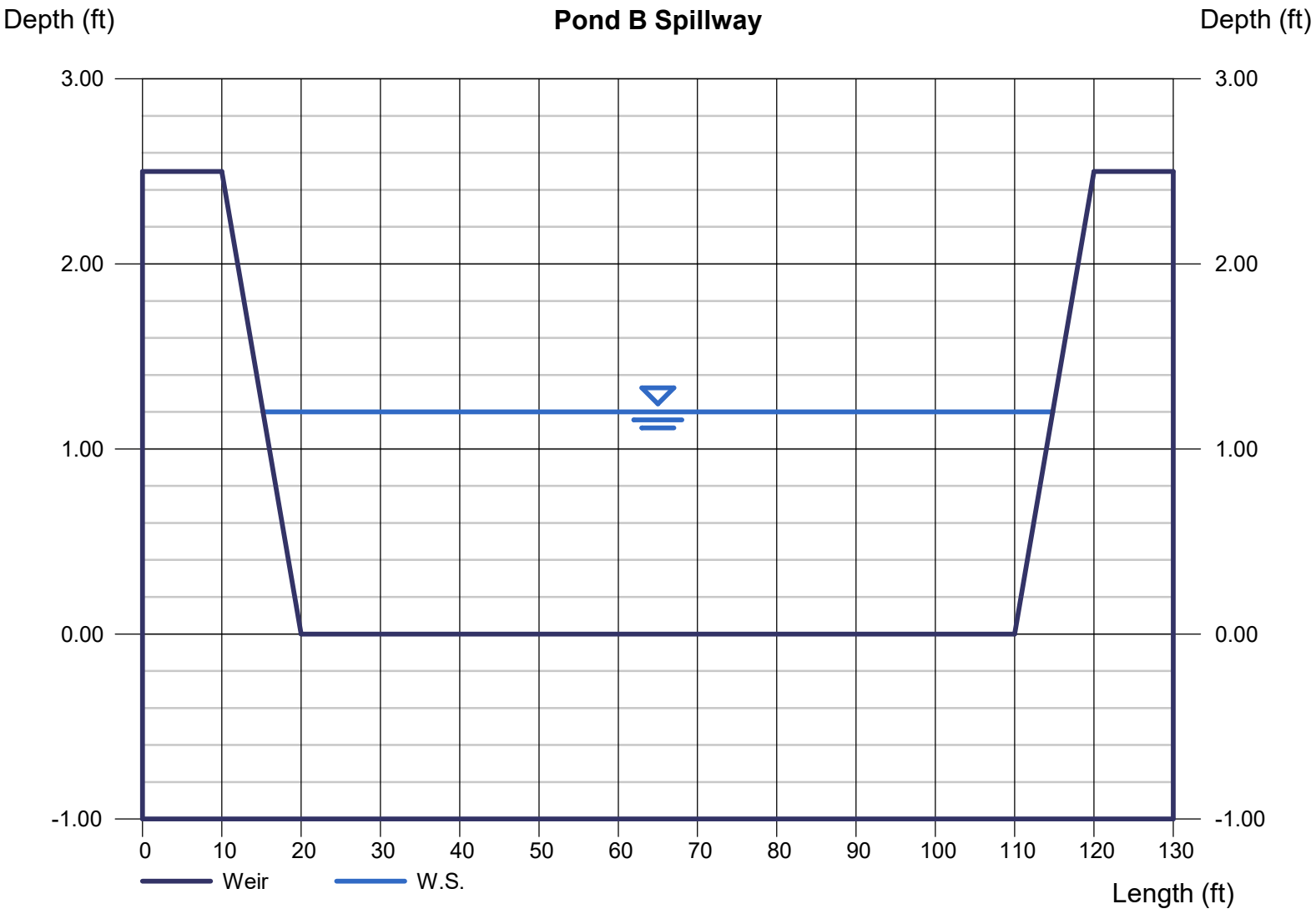
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 90.00 |
| Total Depth (ft) | = 2.50 |
| Side Slope (z:1) | = 4.00 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.10 |
| Compute by: | Known Q |
| Known Q (cfs) | = 378.90 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.20 |
| Q (cfs) | = 378.90 |
| Area (sqft) | = 113.76 |
| Velocity (ft/s) | = 3.33 |
| Top Width (ft) | = 99.60 |

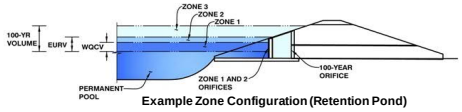


# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Pond C




**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 28.53 | acres |
| Watershed Length = | 1,720 | ft |
| Watershed Length to Centroid = | 828 | ft |
| Watershed Slope = | 0.041 | ft/ft |
| Watershed Imperviousness = | 52.40% | percent |
| Percentage Hydrologic Soil Group A = | 0.0% | percent |
| Percentage Hydrologic Soil Group B = | 59.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 41.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | Aurora - Municipal Center | |

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

| | | Optional User Overrides | |
|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.611 acre-feet | 0.611 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 1.529 acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.83 in.) = | 0.916 acre-feet | 0.83 | inches |
| 5-yr Runoff Volume (P1 = 1.14 in.) = | 1.415 acre-feet | | inches |
| 10-yr Runoff Volume (P1 = 1.37 in.) = | 1.880 acre-feet | 1.37 | inches |
| 25-yr Runoff Volume (P1 = 1.76 in.) = | 2.905 acre-feet | | inches |
| 50-yr Runoff Volume (P1 = 2.08 in.) = | 3.660 acre-feet | | inches |
| 100-yr Runoff Volume (P1 = 2.38 in.) = | 4.473 acre-feet | 2.38 | inches |
| 500-yr Runoff Volume (P1 = 3.3 in.) = | 6.756 acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.857 acre-feet | | |
| Approximate 5-yr Detention Volume = | 1.322 acre-feet | | |
| Approximate 10-yr Detention Volume = | 1.687 acre-feet | | |
| Approximate 25-yr Detention Volume = | 2.059 acre-feet | | |
| Approximate 50-yr Detention Volume = | 2.251 acre-feet | | |
| Approximate 100-yr Detention Volume = | 2.571 acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.611 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.918 | acre-feet |
| Zone 3 Volume (User Defined - Zones 1 & 2) = | 2.225 | acre-feet |
| Total Detention Basin Volume = | 3.753 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | $ft^3$ |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | user | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

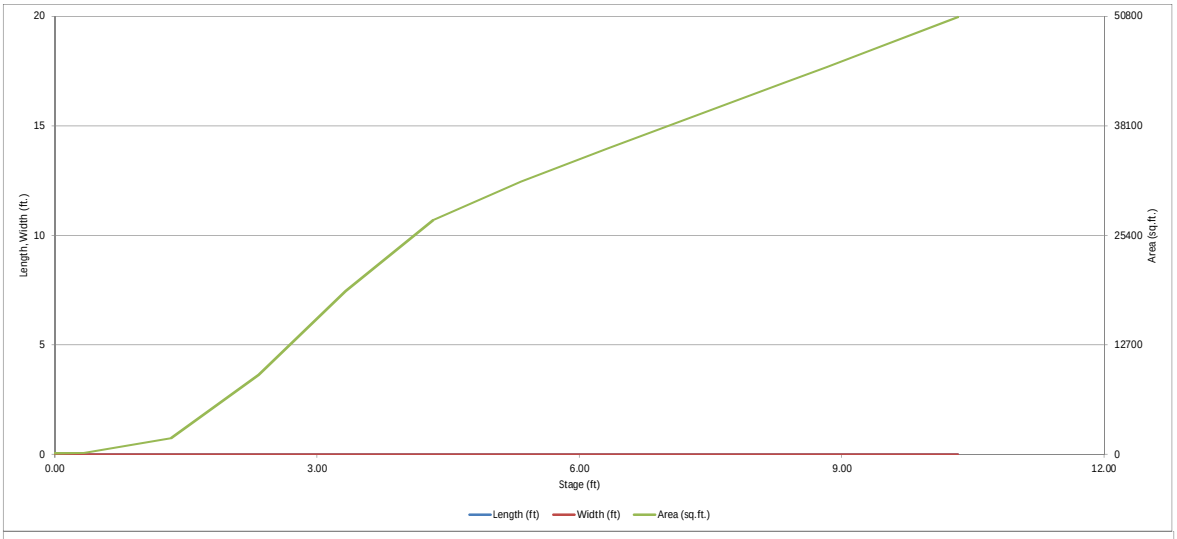
6077.67

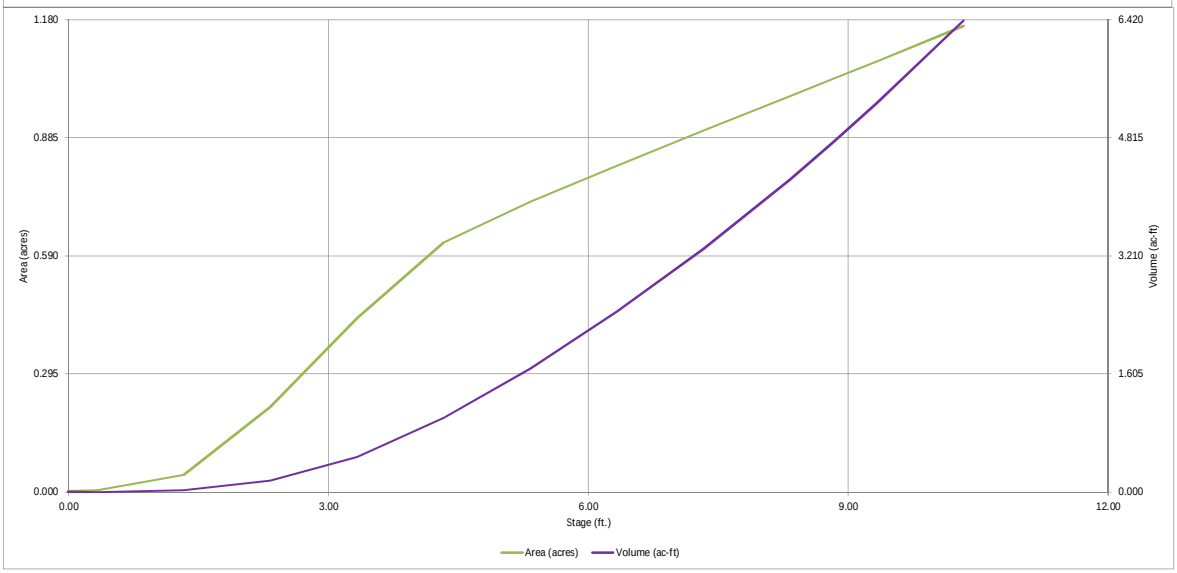
Depth Increment = ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | -- | 0.00 | -- | -- | -- | 100 | 0.002 | | |
| 6078 | -- | 0.33 | -- | -- | -- | 200 | 0.005 | 49 | 0.001 |
| 6079 | -- | 1.33 | -- | -- | -- | 1,860 | 0.043 | 1,079 | 0.025 |
| 6080 | -- | 2.33 | -- | -- | -- | 9,222 | 0.212 | 6,620 | 0.152 |
| 6081 | -- | 3.33 | -- | -- | -- | 18,940 | 0.435 | 20,701 | 0.475 |
| 6082 | -- | 4.33 | -- | -- | -- | 27,157 | 0.623 | 43,750 | 1.004 |
| 6083 | -- | 5.33 | -- | -- | -- | 31,608 | 0.726 | 73,132 | 1.679 |
| 6084 | -- | 6.33 | -- | -- | -- | 35,503 | 0.815 | 106,688 | 2.449 |
| 6085 | -- | 7.33 | -- | -- | -- | 39,311 | 0.902 | 144,095 | 3.308 |
| 6086 | -- | 8.33 | -- | -- | -- | 43,092 | 0.989 | 185,296 | 4.254 |
| 6086.5 | -- | 8.83 | -- | -- | -- | 44,951 | 1.032 | 207,307 | 4.759 |
| 6087 | -- | 9.33 | -- | -- | -- | 46,840 | 1.075 | 230,255 | 5.286 |
| 6088 | -- | 10.33 | -- | -- | -- | 50,708 | 1.164 | 279,029 | 6.406 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.05 (January 2022)*



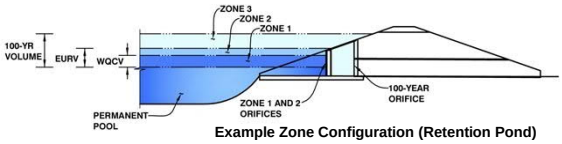



# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Pond C




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 3.63 | 0.611 | Orifice Plate |
| Zone 2 (EURV) | 5.12 | 0.918 | Circular Orifice |
| Zone 3 (User) | 7.82 | 2.225 | Weir&Pipe (Restrict) |
| Total (all zones) | | 3.753 | |

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

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

Calculated Parameters for Underdrain

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

| | | | | | |
|---|---|---|---|---|---|
| Centroid of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | 1.250E-02 | $ft^2$ |
| Depth at top of Zone using Orifice Plate = | 3.63 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | 14.90 | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | 1.80 | sq. inches (diameter = 1-1/2 inches) | Elliptical Slot Area = | N/A | $ft^2$ |

Calculated Parameters for Plate

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 1.21 | 2.42 | | | | | |
| Orifice Area (sq. inches) | 1.80 | 1.80 | 1.80 | | | | | |

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

User Input: Vertical Orifice (Circular or Rectangular)

| | Zone 2 Circular | Not Selected | | | Zone 2 Circular | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | 3.63 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | 0.00 | N/A | $ft^2$ |
| Depth at top of Zone using Vertical Orifice = | 5.13 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | 0.02 | N/A | feet |
| Vertical Orifice Diameter = | 0.50 | N/A | inches | | | | |

Calculated Parameters for Vertical Orifice

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

| | Zone 3 Weir | Not Selected | | | Zone 3 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 5.26 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 6.26 | N/A | feet |
| Overflow Weir Front Edge Length = | 4.00 | N/A | feet | Overflow Weir Slope Length = | 4.12 | N/A | feet |
| Overflow Weir Grate Slope = | 4.00 | N/A | H:V | Grate Open Area / 100-yr Orifice Area = | 6.55 | N/A | |
| Horiz. Length of Weir Sides = | 4.00 | N/A | feet | Overflow Grate Open Area w/o Debris = | 11.48 | N/A | $ft^2$ |
| Overflow Grate Type = | Type C Grate | N/A | | Overflow Grate Open Area w/ Debris = | 11.48 | N/A | $ft^2$ |
| Debris Clogging % = | 0% | N/A | % | | | | |

Calculated Parameters for Overflow Weir

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

| | Zone 3 Restrictor | Not Selected | | | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 2.00 | N/A | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 1.75 | N/A | $ft^2$ |
| Outlet Pipe Diameter = | 18.00 | N/A | inches | Outlet Orifice Centroid = | 0.74 | N/A | feet |
| Restrictor Plate Height Above Pipe Invert = | 17.50 | | inches | Half-Central Angle of Restrictor Plate on Pipe = | 2.81 | N/A | radians |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

| | | | | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | 7.83 | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | 0.90 | feet |
| Spillway Crest Length = | 28.00 | feet | Stage at Top of Freeboard = | 9.73 | feet |
| Spillway End Slopes = | 4.00 | H:V | Basin Area at Top of Freeboard = | 1.11 | acres |
| Freeboard above Max Water Surface = | 1.00 | feet | Basin Volume at Top of Freeboard = | 5.72 | acre-ft |

Calculated Parameters for Spillway

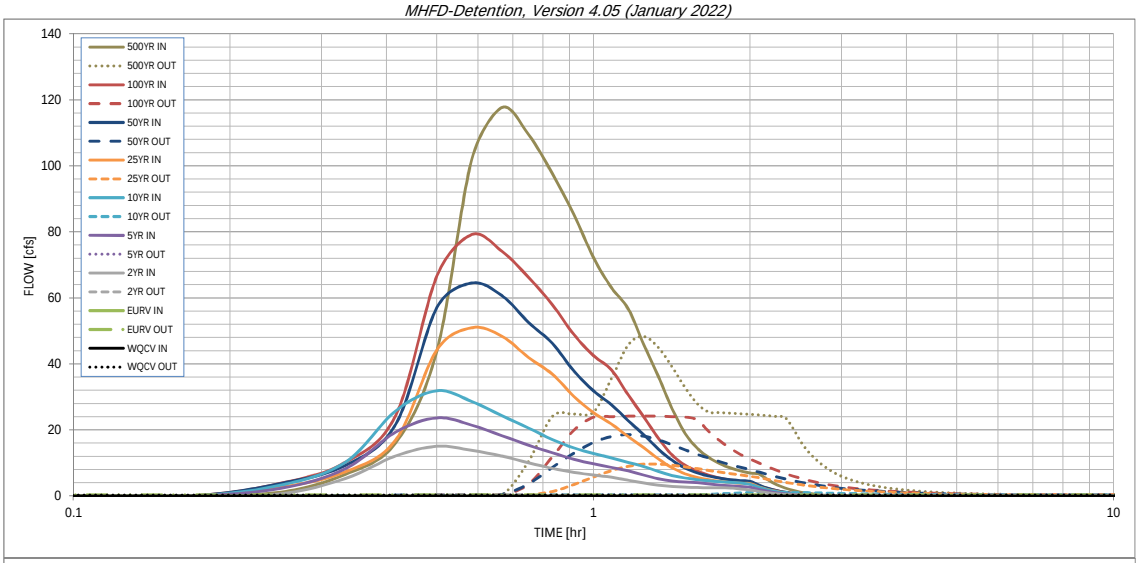
Routed Hydrograph Results

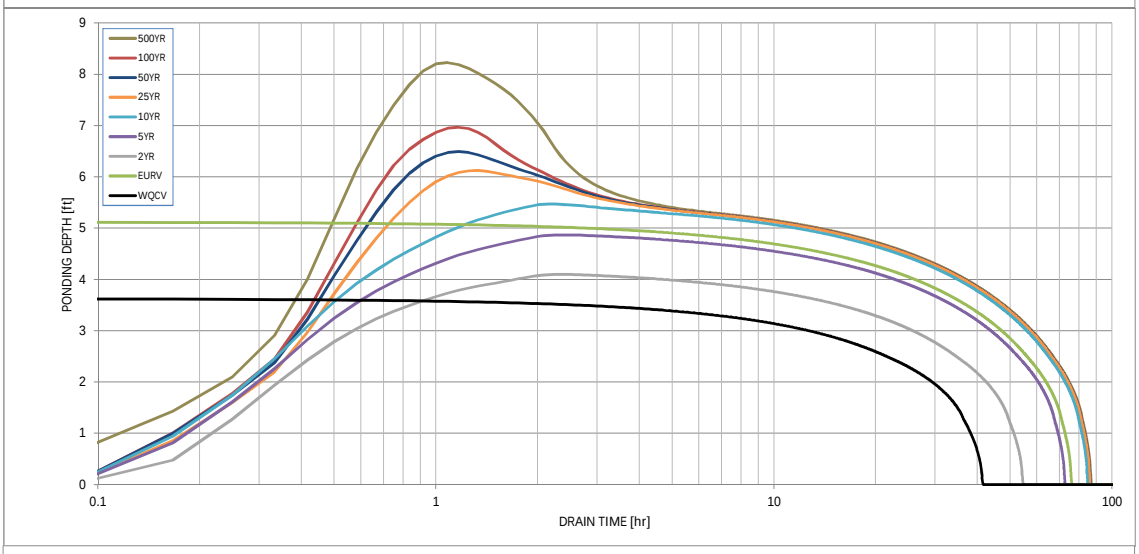
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

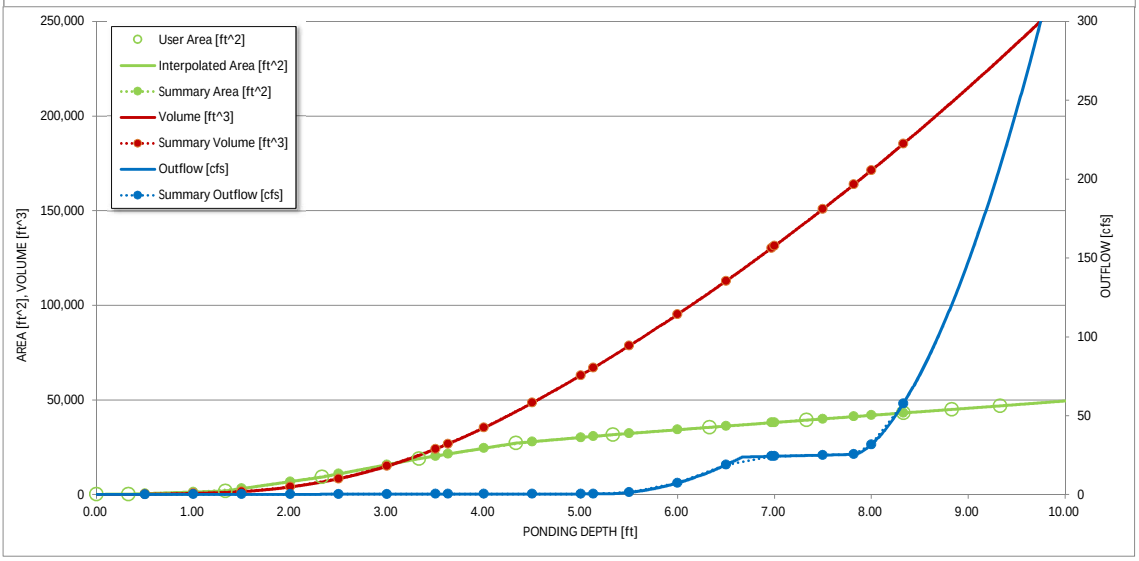
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.83 | 1.14 | 1.37 | 1.76 | 2.08 | 2.38 | 3.30 |
| CUHP Runoff Volume (acre-ft) = | 0.611 | 1.529 | 0.916 | 1.415 | 1.880 | 2.905 | 3.660 | 4.473 | 6.756 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 0.916 | 1.415 | 1.880 | 2.905 | 3.660 | 4.473 | 6.756 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.3 | 2.3 | 6.8 | 20.1 | 28.4 | 37.6 | 61.3 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | | | | | | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.01 | 0.08 | 0.24 | 0.71 | 0.99 | 1.32 | 2.15 |
| Peak Inflow Q (cfs) = | N/A | N/A | 15.1 | 23.7 | 31.9 | 51.0 | 64.5 | 79.2 | 117.7 |
| Peak Outflow Q (cfs) = | 0.3 | 0.4 | 0.3 | 0.3 | 1.1 | 9.7 | 18.6 | 24.22 | 48.3 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 0.2 | 0.2 | 0.5 | 0.7 | 0.6 | 0.8 |
| Structure Controlling Flow = | Plate | Vertical Orifice 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 | 0.8 | 1.6 | 2.1 | 2.2 |
| 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) = | 37 | 68 | 49 | 65 | 76 | 75 | 73 | 71 | 66 |
| Time to Drain 99% of Inflow Volume (hours) = | 40 | 72 | 52 | 69 | 80 | 80 | 80 | 79 | 77 |
| Maximum Ponding Depth (ft) = | 3.63 | 5.13 | 4.10 | 4.87 | 5.47 | 6.12 | 6.49 | 6.97 | 8.23 |
| Area at Maximum Ponding Depth (acres) = | 0.49 | 0.71 | 0.58 | 0.68 | 0.74 | 0.80 | 0.83 | 0.87 | 0.98 |
| Maximum Volume Stored (acre-ft) = | 0.614 | 1.536 | 0.860 | 1.349 | 1.781 | 2.280 | 2.581 | 2.989 | 4.155 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 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 | 1.18 |
| | 0:15:00 | 0.00 | 0.00 | 0.68 | 2.32 | 3.29 | 2.65 | 3.80 | 3.84 | 6.58 |
| | 0:20:00 | 0.00 | 0.00 | 5.32 | 8.27 | 10.24 | 7.37 | 9.29 | 10.21 | 16.14 |
| | 0:25:00 | 0.00 | 0.00 | 12.15 | 19.38 | 25.83 | 17.00 | 21.76 | 24.46 | 44.08 |
| | 0:30:00 | 0.00 | 0.00 | 15.10 | 23.69 | 31.90 | 44.31 | 57.14 | 66.66 | 101.94 |
| | 0:35:00 | 0.00 | 0.00 | 13.83 | 21.47 | 28.65 | 51.00 | 64.53 | 79.22 | 117.70 |
| | 0:40:00 | 0.00 | 0.00 | 12.11 | 18.29 | 24.33 | 48.41 | 60.72 | 74.15 | 109.52 |
| | 0:45:00 | 0.00 | 0.00 | 10.06 | 15.42 | 20.63 | 41.97 | 52.60 | 66.27 | 97.73 |
| | 0:50:00 | 0.00 | 0.00 | 8.38 | 13.12 | 17.12 | 36.95 | 46.27 | 57.99 | 85.31 |
| | 0:55:00 | 0.00 | 0.00 | 7.17 | 11.14 | 14.58 | 30.21 | 37.91 | 48.94 | 72.23 |
| | 1:00:00 | 0.00 | 0.00 | 6.36 | 9.77 | 12.89 | 25.26 | 31.87 | 42.56 | 63.10 |
| | 1:05:00 | 0.00 | 0.00 | 5.71 | 8.66 | 11.51 | 21.81 | 27.65 | 38.20 | 56.71 |
| | 1:10:00 | 0.00 | 0.00 | 4.79 | 7.61 | 10.17 | 17.99 | 22.81 | 30.58 | 45.79 |
| | 1:15:00 | 0.00 | 0.00 | 3.94 | 6.35 | 8.94 | 14.63 | 18.55 | 23.93 | 36.23 |
| | 1:20:00 | 0.00 | 0.00 | 3.27 | 5.22 | 7.45 | 11.25 | 14.22 | 17.48 | 26.46 |
| | 1:25:00 | 0.00 | 0.00 | 2.88 | 4.59 | 6.21 | 8.56 | 10.82 | 12.42 | 19.01 |
| | 1:30:00 | 0.00 | 0.00 | 2.69 | 4.26 | 5.46 | 6.76 | 8.49 | 9.38 | 14.47 |
| | 1:35:00 | 0.00 | 0.00 | 2.59 | 4.06 | 4.96 | 5.62 | 7.00 | 7.54 | 11.69 |
| | 1:40:00 | 0.00 | 0.00 | 2.53 | 3.63 | 4.60 | 4.90 | 6.04 | 6.31 | 9.79 |
| | 1:45:00 | 0.00 | 0.00 | 2.49 | 3.30 | 4.35 | 4.42 | 5.39 | 5.47 | 8.50 |
| | 1:50:00 | 0.00 | 0.00 | 2.45 | 3.06 | 4.17 | 4.11 | 4.97 | 4.89 | 7.60 |
| | 1:55:00 | 0.00 | 0.00 | 2.13 | 2.88 | 3.94 | 3.90 | 4.67 | 4.49 | 6.97 |
| | 2:00:00 | 0.00 | 0.00 | 1.87 | 2.66 | 3.55 | 3.75 | 4.48 | 4.27 | 6.62 |
| | 2:05:00 | 0.00 | 0.00 | 1.39 | 1.97 | 2.60 | 2.78 | 3.30 | 3.15 | 4.87 |
| | 2:10:00 | 0.00 | 0.00 | 1.00 | 1.41 | 1.84 | 1.97 | 2.33 | 2.24 | 3.45 |
| | 2:15:00 | 0.00 | 0.00 | 0.72 | 1.00 | 1.31 | 1.41 | 1.66 | 1.61 | 2.48 |
| | 2:20:00 | 0.00 | 0.00 | 0.51 | 0.70 | 0.93 | 0.99 | 1.17 | 1.14 | 1.75 |
| | 2:25:00 | 0.00 | 0.00 | 0.35 | 0.47 | 0.64 | 0.68 | 0.80 | 0.78 | 1.19 |
| | 2:30:00 | 0.00 | 0.00 | 0.23 | 0.32 | 0.43 | 0.47 | 0.55 | 0.54 | 0.82 |
| | 2:35:00 | 0.00 | 0.00 | 0.15 | 0.21 | 0.28 | 0.31 | 0.36 | 0.35 | 0.54 |
| | 2:40:00 | 0.00 | 0.00 | 0.08 | 0.12 | 0.16 | 0.18 | 0.21 | 0.21 | 0.31 |
| | 2:45:00 | 0.00 | 0.00 | 0.04 | 0.06 | 0.07 | 0.09 | 0.10 | 0.10 | 0.15 |
| | 2:50:00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.05 |
| | 2:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Summary Stage-Area-Volume-Discharge Relationships

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

| Stage - Storage Description | Stage [ft] | Area [ft$^2$] | Area [acres] | Volume [ft$^3$] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|
| | 0.50 | 482 | 0.011 | 107 | 0.002 | 0.04 |
| | 1.00 | 1,312 | 0.030 | 556 | 0.013 | 0.06 |
| | 1.50 | 3,112 | 0.071 | 1,502 | 0.034 | 0.11 |
| | 2.00 | 6,793 | 0.156 | 3,978 | 0.091 | 0.14 |
| | 2.50 | 10,874 | 0.250 | 8,329 | 0.191 | 0.18 |
| | 3.00 | 15,733 | 0.361 | 14,980 | 0.344 | 0.23 |
| | 3.50 | 20,337 | 0.467 | 24,040 | 0.552 | 0.27 |
| WQCV | 3.63 | 21,405 | 0.491 | 26,753 | 0.614 | 0.27 |
| | 4.00 | 24,445 | 0.561 | 35,236 | 0.809 | 0.30 |
| | 4.50 | 27,914 | 0.641 | 48,431 | 1.112 | 0.33 |
| | 5.00 | 30,139 | 0.692 | 62,944 | 1.445 | 0.36 |
| EURV | 5.13 | 30,718 | 0.705 | 66,900 | 1.536 | 0.36 |
| | 5.50 | 32,270 | 0.741 | 78,562 | 1.804 | 1.34 |
| | 6.00 | 34,218 | 0.786 | 95,184 | 2.185 | 7.34 |
| | 6.50 | 36,150 | 0.830 | 112,778 | 2.589 | 18.82 |
| 100-YR | 6.97 | 37,940 | 0.871 | 130,190 | 2.989 | 24.22 |
| | 7.00 | 38,054 | 0.874 | 131,330 | 3.015 | 24.26 |
| | 7.50 | 39,954 | 0.917 | 150,832 | 3.463 | 24.98 |
| 100-YR + 1/2 EURV | 7.82 | 41,164 | 0.945 | 163,811 | 3.761 | 25.44 |
| | 8.00 | 41,844 | 0.961 | 171,282 | 3.932 | 31.69 |
| | 8.33 | 43,092 | 0.989 | 185,296 | 4.254 | 57.54 |

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).

# POND C FOREBAY VOLUME REQUIREMENTS

EQUATION 3-1 $WQCV = a(0.91I^3 - 1.19I^2 + 0.781I)$
a=1 (40 hour drain time)

| | | | |
|---|---|---|---|
| FOREBAY 1 | *I=.471* | *WQCV=* | 0.19847 |
| FUTURE FOREBAY 2 | *I=.597* | *WQCV=* | 0.23516 |
| FUTURE FOREBAY 3 | *I=.593* | *WQCV=* | 0.23384 |

EQUATION 3-3 V=(WQCV/12)A

FOREBAY 1 A= 16.33 Acres V= 0.27009 AC-FT
20% WQCV Increase = 0.32411 AC-FT

FUTURE FOREBAY 2 A= 9.17 Acres V= 0.17970 AC-FT
20% WQCV Increase = 0.21564 AC-FT

FUTURE FOREBAY 3 A= 3.03 Acres V= 0.05904 AC-FT
20% WQCV Increase = 0.07085 AC-FT
TOTAL WQCV REQUIRED = 0.6106 AC-FT
3% OF WQCV
FOREBAY TOTAL VOLUME= .03(V)

VOLUME REQUIRED FOR FOREBAY 1= 0.0097 AC-FT 424 CF
VOLUME PROVIDED FOR FOREBAY 1= 0.0147 AC-FT 640 CF

$Q_{100}$ DISCHARGES 2% OF $Q_{100}$

$Q_{100}$ FOREBAY 1 = .02*38.5 CFS= 0.77 CFS

VOLUME REQUIRED FOR FUTURE FOREBAY 2= 0.0065 AC-FT 282 CF

$Q_{100}$ DISCHARGES 2% OF $Q_{100}$

$Q_{100}$ FOREBAY 2 = .02*33.5 CFS= 0.67 CFS

VOLUME REQUIRED FOR FUTURE FOREBAY 3= 0.0021 AC-FT 93 CF

$Q_{100}$ DISCHARGES 2% OF $Q_{100}$

$Q_{100}$ FOREBAY 3 = .02*13.0 CFS=0.26 CFS

# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond C Forebay 1 Notch

**Rectangular Weir**

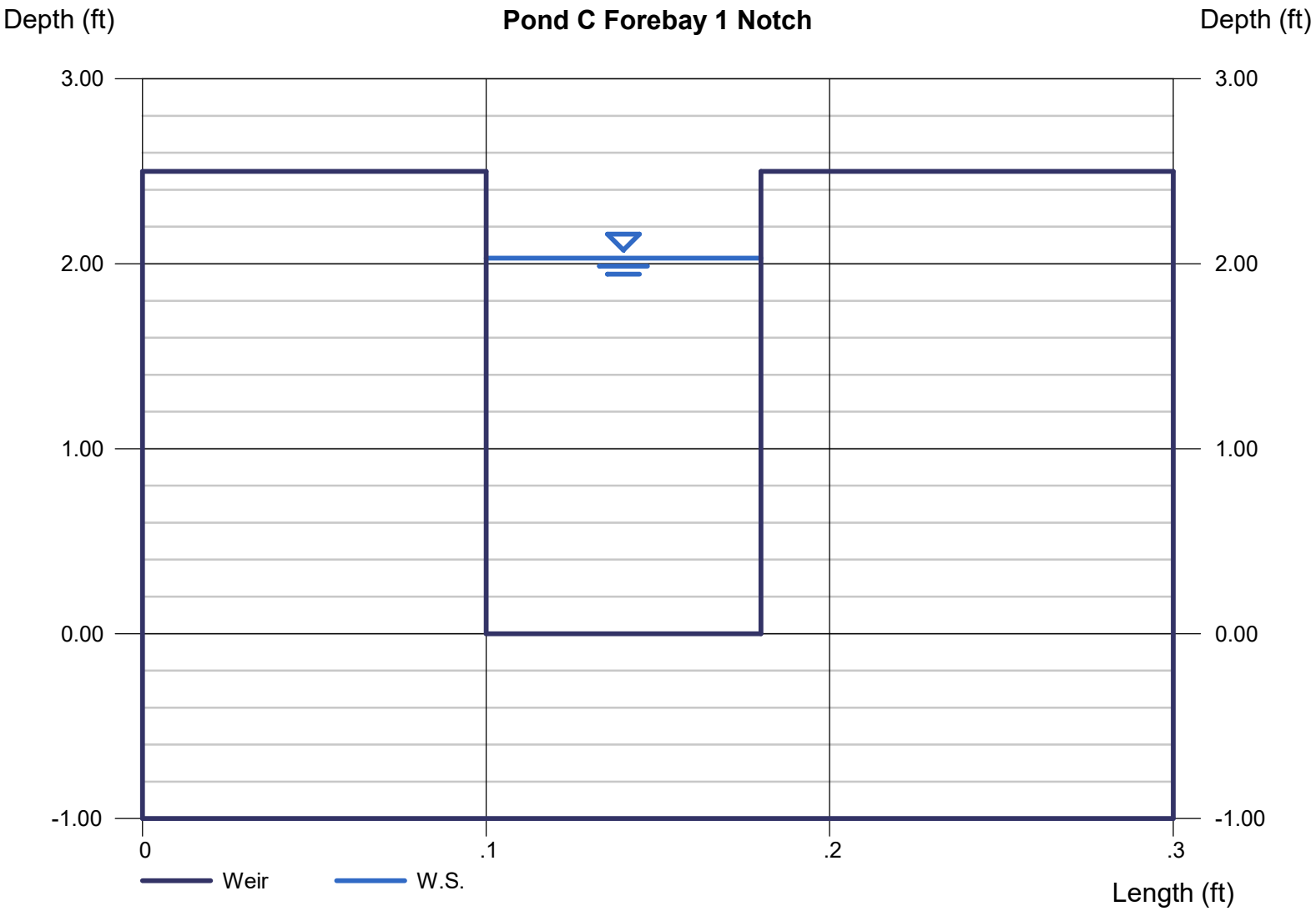
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.08 |
| Total Depth (ft) | = 2.50 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.77 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.03 |
| Q (cfs) | = 0.770 |
| Area (sqft) | = 0.16 |
| Velocity (ft/s) | = 4.74 |
| Top Width (ft) | = 0.08 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond C Trickle Channel 1

**Rectangular**

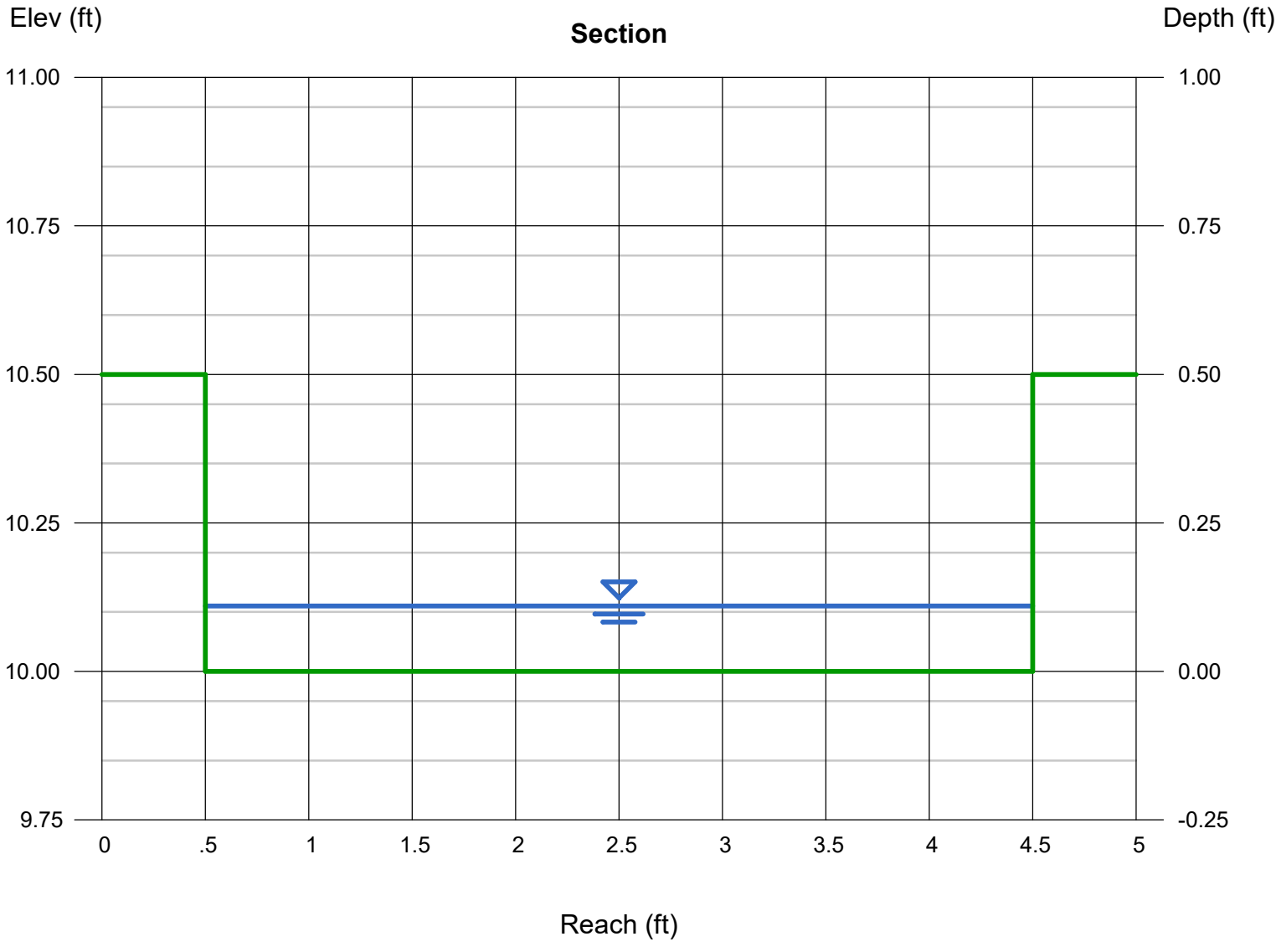
| | |
|---|---|
| Bottom Width (ft) | = 4.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.77 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.11 |
| Q (cfs) | = 0.770 |
| Area (sqft) | = 0.44 |
| Velocity (ft/s) | = 1.75 |
| Wetted Perim (ft) | = 4.22 |
| Crit Depth, Yc (ft) | = 0.11 |
| Top Width (ft) | = 4.00 |
| EGL (ft) | = 0.16 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond C Trickle Channel 2

**Rectangular**

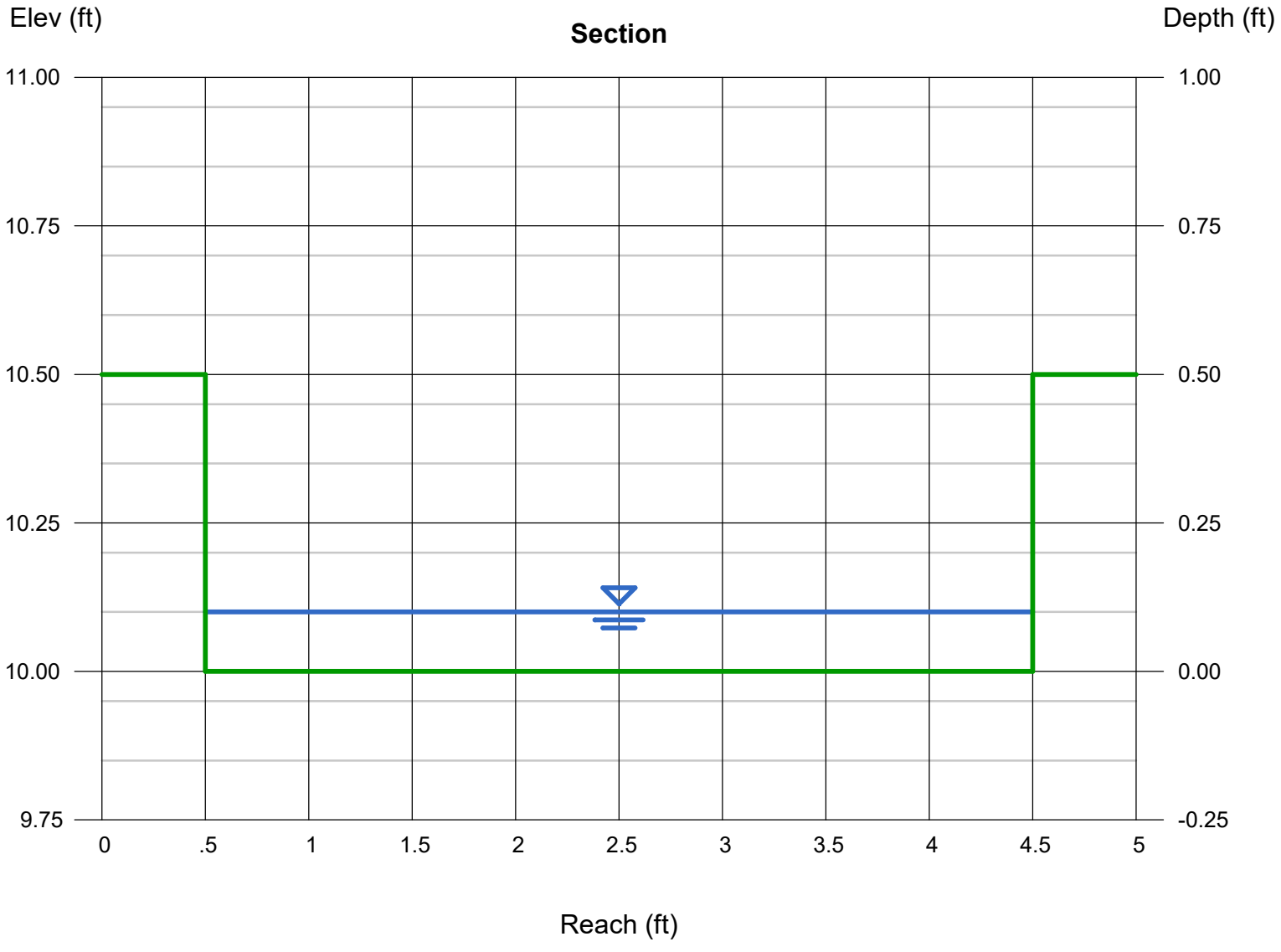
| | |
|---|---|
| Bottom Width (ft) | = 4.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.67 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.10 |
| Q (cfs) | = 0.670 |
| Area (sqft) | = 0.40 |
| Velocity (ft/s) | = 1.68 |
| Wetted Perim (ft) | = 4.20 |
| Crit Depth, Yc (ft) | = 0.10 |
| Top Width (ft) | = 4.00 |
| EGL (ft) | = 0.14 |



# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond C Spillway

**Trapezoidal Weir**

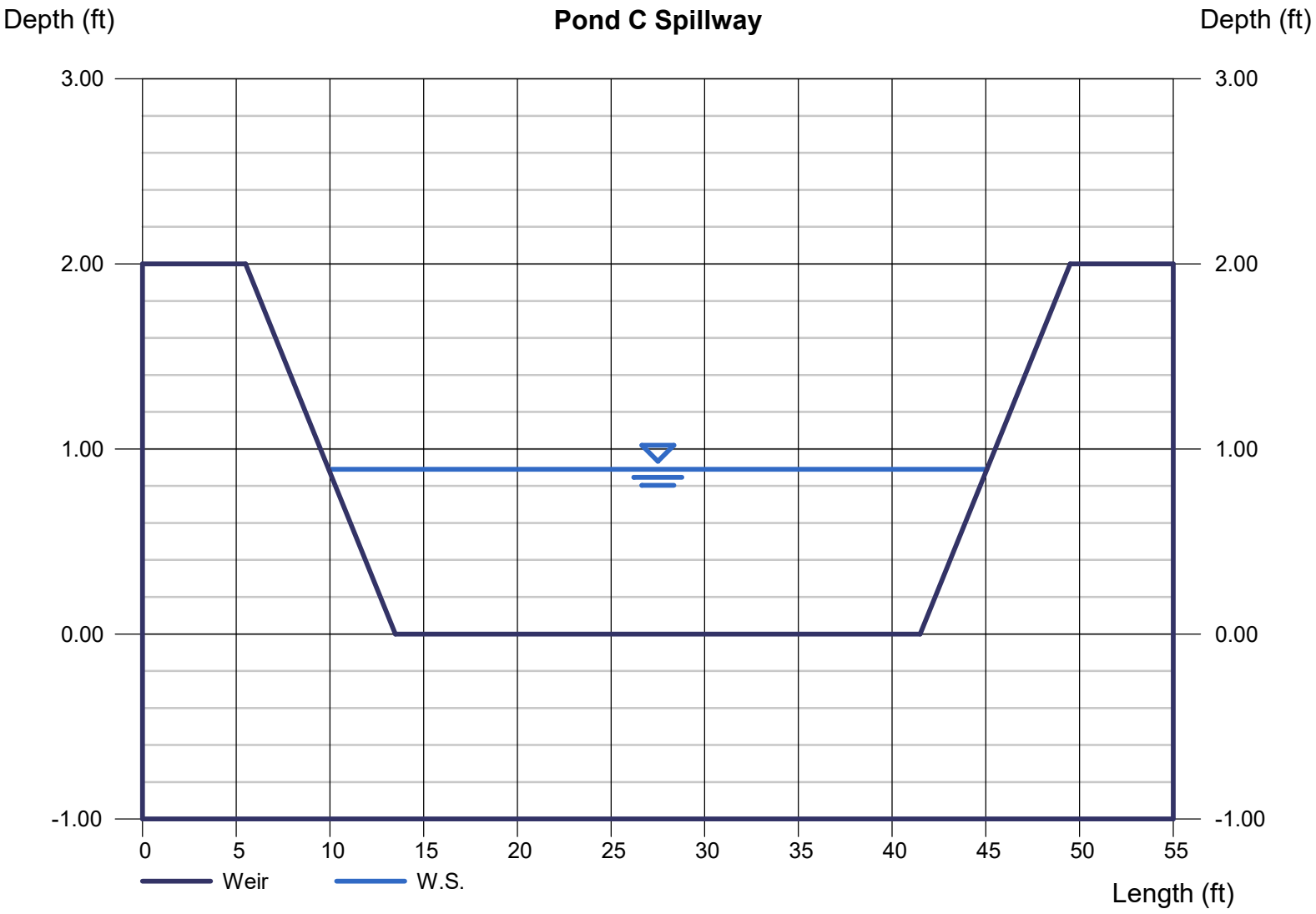
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 28.00 |
| Total Depth (ft) | = 2.00 |
| Side Slope (z:1) | = 4.00 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.10 |
| Compute by: | Known Q |
| Known Q (cfs) | = 79.20 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.89 |
| Q (cfs) | = 79.20 |
| Area (sqft) | = 28.09 |
| Velocity (ft/s) | = 2.82 |
| Top Width (ft) | = 35.12 |

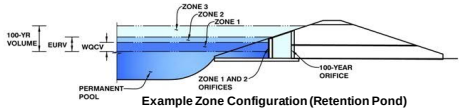


# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Temp Pond D




**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 20.91 | acres |
| Watershed Length = | 1,380 | ft |
| Watershed Length to Centroid = | 674 | ft |
| Watershed Slope = | 0.060 | ft/ft |
| Watershed Imperviousness = | 28.80% | percent |
| Percentage Hydrologic Soil Group A = | 0.0% | percent |
| Percentage Hydrologic Soil Group B = | 48.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 52.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | Aurora - Municipal Center | |

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

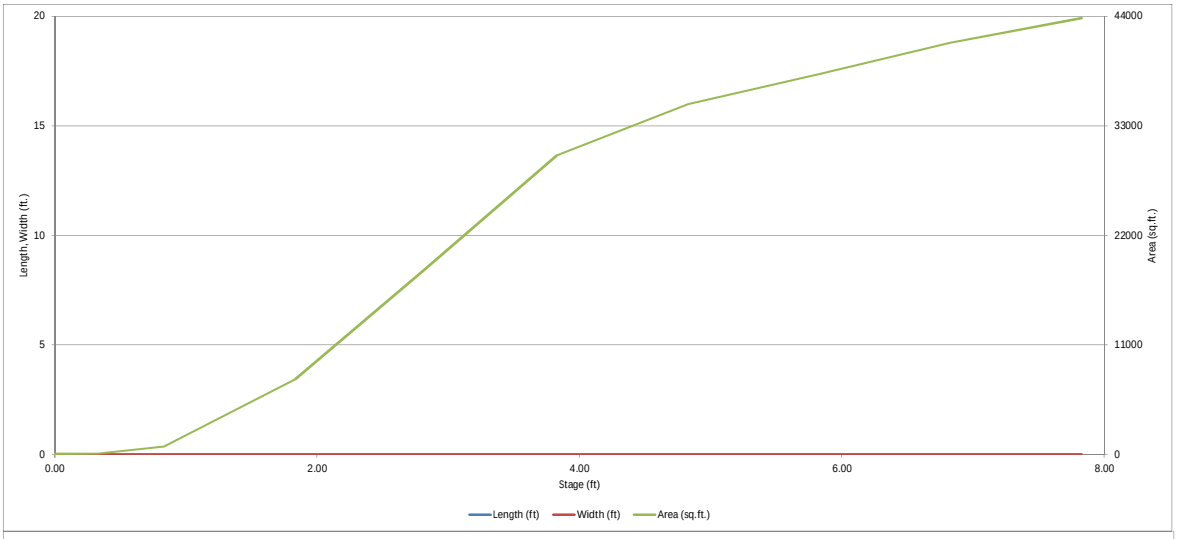
| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.309 | acre-feet | 0.309 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.579 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 0.83 in.) = | 0.319 | acre-feet | 0.83 | inches |
| 5-yr Runoff Volume (P1 = 1.14 in.) = | 0.584 | acre-feet | | inches |
| 10-yr Runoff Volume (P1 = 1.37 in.) = | 0.878 | acre-feet | 1.37 | inches |
| 25-yr Runoff Volume (P1 = 1.76 in.) = | 1.639 | acre-feet | | inches |
| 50-yr Runoff Volume (P1 = 2.08 in.) = | 2.177 | acre-feet | | inches |
| 100-yr Runoff Volume (P1 = 2.38 in.) = | 2.785 | acre-feet | 2.38 | inches |
| 500-yr Runoff Volume (P1 = 3.3 in.) = | 4.423 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.315 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.542 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.722 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.931 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 1.027 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 1.269 | acre-feet | | |

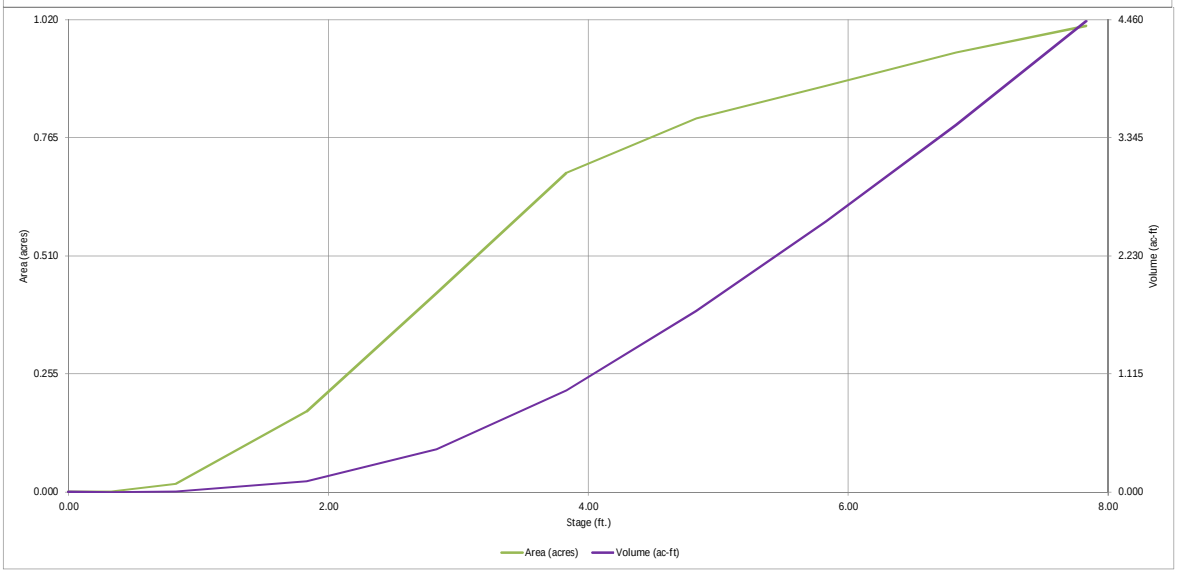
## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.309 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.270 | acre-feet |
| Zone 3 Volume (User Defined - Zones 1 & 2) = | 1.277 | acre-feet |
| Total Detention Basin Volume = | 1.857 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | $ft^3$ |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | user | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| 6099.17 Top of Micropool | -- | 0.00 | -- | -- | -- | 33 | 0.001 | | |
| 6099.5 | -- | 0.33 | -- | -- | -- | 52 | 0.001 | 14 | 0.000 |
| 6100 | -- | 0.83 | -- | -- | -- | 803 | 0.018 | 228 | 0.005 |
| 6101 | -- | 1.83 | -- | -- | -- | 7,571 | 0.174 | 4,415 | 0.101 |
| 6102 | -- | 2.83 | -- | -- | -- | 18,687 | 0.429 | 17,544 | 0.403 |
| 6103 | -- | 3.83 | -- | -- | -- | 30,050 | 0.690 | 41,912 | 0.962 |
| 6104 | -- | 4.83 | -- | -- | -- | 35,173 | 0.807 | 74,524 | 1.711 |
| 6105 | -- | 5.83 | -- | -- | -- | 38,211 | 0.877 | 111,216 | 2.553 |
| 6106 | -- | 6.83 | -- | -- | -- | 41,372 | 0.950 | 151,007 | 3.467 |
| 6107 | -- | 7.83 | -- | -- | -- | 43,852 | 1.007 | 193,619 | 4.445 |


20
15
10
5
0
Length, Width (ft.)
44000
33000
22000
11000
0
Area (sq.ft.)
0.00
2.00
4.00
6.00
8.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

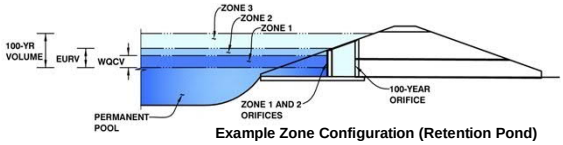

1.020
0.765
0.510
0.255
0.000
Area (acres)
4.460
3.345
2.230
1.115
0.000
Volume (ac-ft)
0.00
2.00
4.00
6.00
8.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Project: Trails at Overland Ranch

Basin ID: Temp Pond D




**Example Zone Configuration (Retention Pond)**

| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|---|---|---|---|
| Zone 1 (WQCV) | 2.60 | 0.309 | Orifice Plate |
| Zone 2 (EURV) | 3.20 | 0.270 | Orifice Plate |
| Zone 3 (User) | 5.01 | 1.277 | Weir&Pipe (Restrict) |
| Total (all zones) | | 1.857 | |

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

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

Calculated Parameters for Underdrain

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

| | | | | | |
|---|---|---|---|---|---|
| Centroid of Lowest Orifice = | 0.00 | ft (relative to basin bottom at Stage = 0 ft) | WQ Orifice Area per Row = | 7.153E-03 | $ft^2$ |
| Depth at top of Zone using Orifice Plate = | 3.20 | ft (relative to basin bottom at Stage = 0 ft) | Elliptical Half-Width = | N/A | feet |
| Orifice Plate: Orifice Vertical Spacing = | N/A | inches | Elliptical Slot Centroid = | N/A | feet |
| Orifice Plate: Orifice Area per Row = | 1.03 | sq. inches (diameter = 1-1/8 inches) | Elliptical Slot Area = | N/A | $ft^2$ |

Calculated Parameters for Plate

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

| | Row 1 (required) | Row 2 (optional) | Row 3 (optional) | Row 4 (optional) | Row 5 (optional) | Row 6 (optional) | Row 7 (optional) | Row 8 (optional) |
|---|---|---|---|---|---|---|---|---|
| Stage of Orifice Centroid (ft) | 0.00 | 0.87 | 1.73 | | | | | |
| Orifice Area (sq. inches) | 1.03 | 1.03 | 1.03 | | | | | |

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

User Input: Vertical Orifice (Circular or Rectangular)

| | Not Selected | Not Selected | | | Not Selected | Not Selected | |
|---|---|---|---|---|---|---|---|
| Invert of Vertical Orifice = | N/A | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Area = | N/A | N/A | $ft^2$ |
| Depth at top of Zone using Vertical Orifice = | N/A | N/A | ft (relative to basin bottom at Stage = 0 ft) | Vertical Orifice Centroid = | N/A | N/A | feet |
| Vertical Orifice Diameter = | N/A | N/A | inches | | | | |

Calculated Parameters for Vertical Orifice

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

| | Zone 3 Weir | Not Selected | | | Zone 3 Weir | Not Selected | |
|---|---|---|---|---|---|---|---|
| Overflow Weir Front Edge Height, Ho = | 3.21 | N/A | ft (relative to basin bottom at Stage = 0 ft) | Height of Grate Upper Edge, $H_t$ = | 4.21 | N/A | feet |
| Overflow Weir Front Edge Length = | 4.00 | N/A | feet | Overflow Weir Slope Length = | 4.12 | N/A | feet |
| Overflow Weir Grate Slope = | 4.00 | N/A | H:V | Grate Open Area / 100-yr Orifice Area = | 6.50 | N/A | |
| Horiz. Length of Weir Sides = | 4.00 | N/A | feet | Overflow Grate Open Area w/o Debris = | 11.48 | N/A | $ft^2$ |
| Overflow Grate Type = | Type C Grate | N/A | | Overflow Grate Open Area w/ Debris = | 11.48 | N/A | $ft^2$ |
| Debris Clogging % = | 0% | N/A | % | | | | |

Calculated Parameters for Overflow Weir

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

| | Zone 3 Restrictor | Not Selected | | | Zone 3 Restrictor | Not Selected | |
|---|---|---|---|---|---|---|---|
| Depth to Invert of Outlet Pipe = | 0.00 | N/A | ft (distance below basin bottom at Stage = 0 ft) | Outlet Orifice Area = | 1.77 | N/A | $ft^2$ |
| Outlet Pipe Diameter = | 18.00 | N/A | inches | Outlet Orifice Centroid = | 0.75 | N/A | feet |
| Restrictor Plate Height Above Pipe Invert = | 18.00 | | inches | Half-Central Angle of Restrictor Plate on Pipe = | 3.14 | N/A | radians |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

| | | | | | |
|---|---|---|---|---|---|
| Spillway Invert Stage= | 5.33 | ft (relative to basin bottom at Stage = 0 ft) | Spillway Design Flow Depth= | 0.44 | feet |
| Spillway Crest Length = | 45.00 | feet | Stage at Top of Freeboard = | 6.77 | feet |
| Spillway End Slopes = | 4.00 | H:V | Basin Area at Top of Freeboard = | 0.95 | acres |
| Freeboard above Max Water Surface = | 1.00 | feet | Basin Volume at Top of Freeboard = | 3.41 | acre-ft |

Calculated Parameters for Spillway

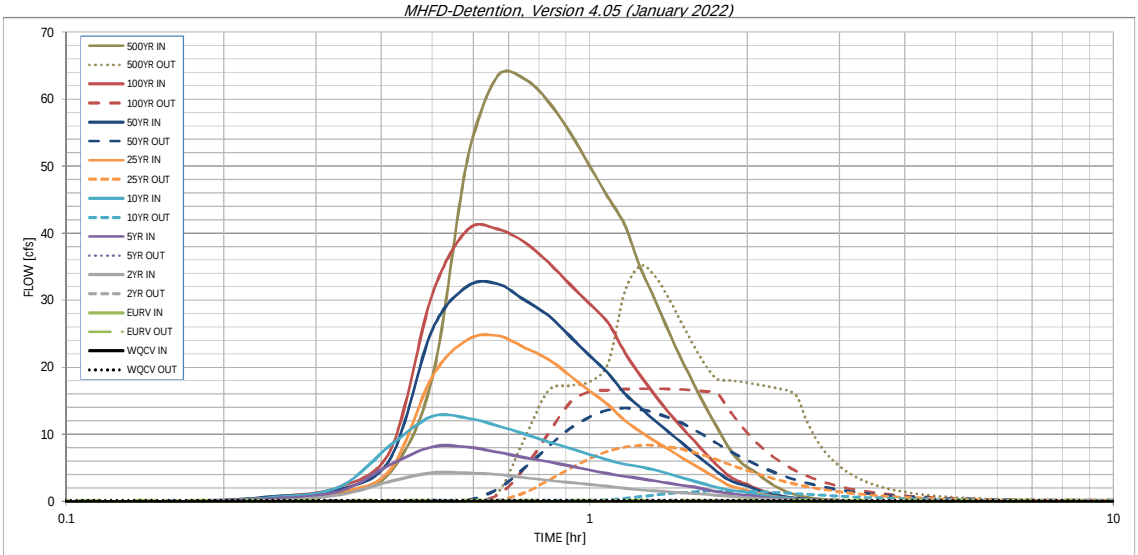
Routed Hydrograph Results

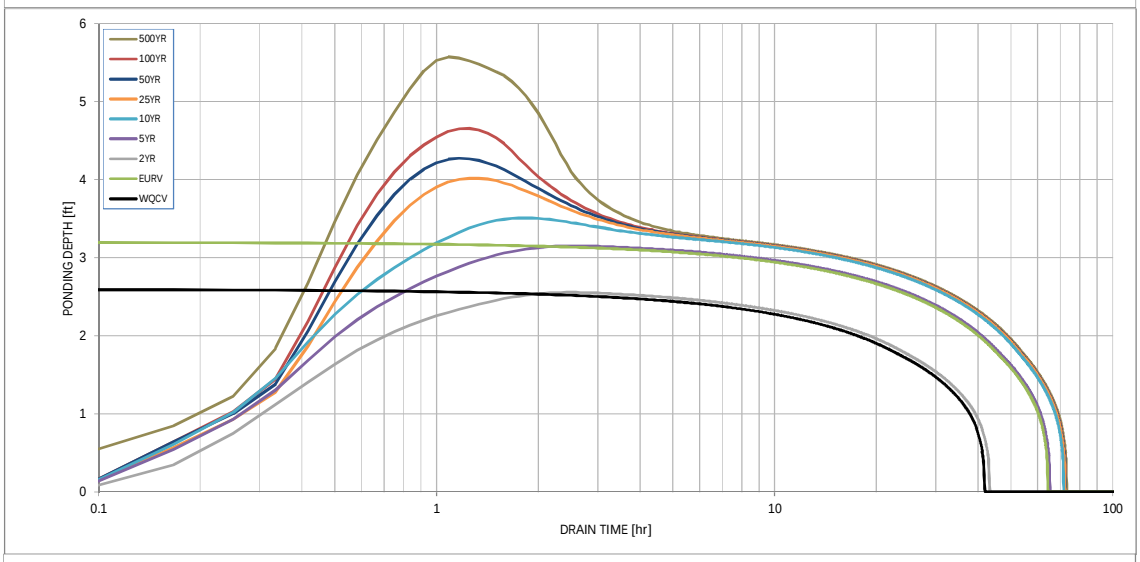
*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

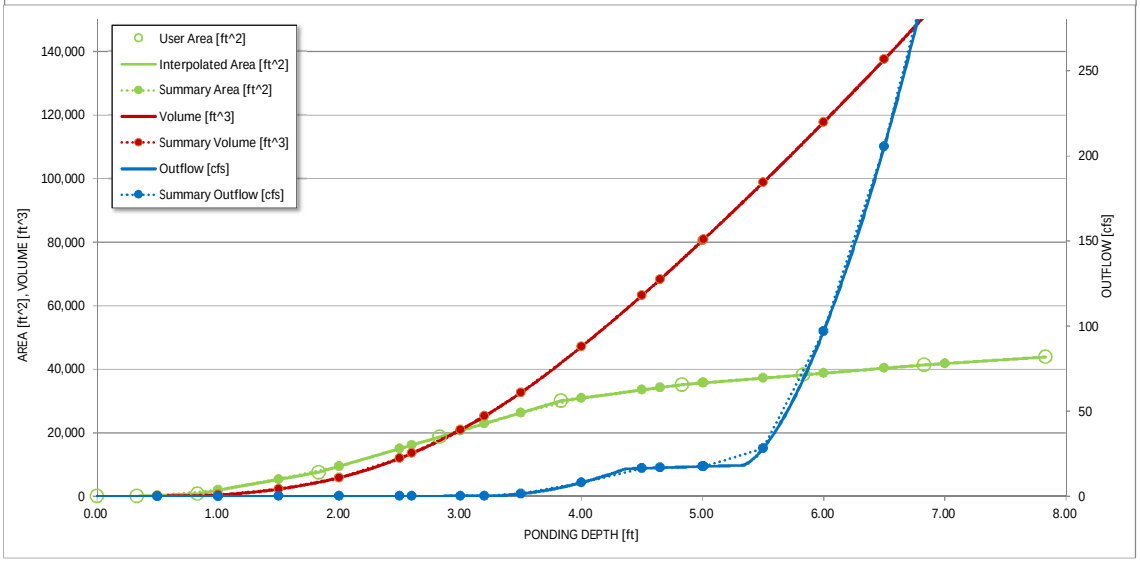
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | N/A | N/A | 0.83 | 1.14 | 1.37 | 1.76 | 2.08 | 2.38 | 3.30 |
| CUHP Runoff Volume (acre-ft) = | 0.309 | 0.579 | 0.319 | 0.584 | 0.878 | 1.639 | 2.177 | 2.785 | 4.423 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 0.319 | 0.584 | 0.878 | 1.639 | 2.177 | 2.785 | 4.423 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.2 | 2.2 | 6.0 | 17.1 | 23.9 | 31.1 | 50.7 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | | | | | | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.01 | 0.11 | 0.29 | 0.82 | 1.14 | 1.49 | 2.43 |
| Peak Inflow Q (cfs) = | N/A | N/A | 4.3 | 8.1 | 12.7 | 24.7 | 32.4 | 40.6 | 63.5 |
| Peak Outflow Q (cfs) = | 0.1 | 0.2 | 0.1 | 0.2 | 1.5 | 8.4 | 13.9 | 16.82 | 35.2 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 0.1 | 0.3 | 0.5 | 0.6 | 0.5 | 0.7 |
| Structure Controlling Flow = | Plate | Plate | Plate | Plate | 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 | 1.2 | 1.4 | 1.6 |
| 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) = | 38 | 59 | 40 | 60 | 64 | 61 | 58 | 55 | 49 |
| Time to Drain 99% of Inflow Volume (hours) = | 40 | 62 | 42 | 63 | 68 | 67 | 66 | 65 | 62 |
| Maximum Ponding Depth (ft) = | 2.60 | 3.20 | 2.56 | 3.15 | 3.51 | 4.02 | 4.27 | 4.66 | 5.57 |
| Area at Maximum Ponding Depth (acres) = | 0.37 | 0.53 | 0.36 | 0.51 | 0.60 | 0.71 | 0.74 | 0.79 | 0.86 |
| Maximum Volume Stored (acre-ft) = | 0.311 | 0.579 | 0.293 | 0.553 | 0.749 | 1.088 | 1.277 | 1.567 | 2.327 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 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 | 0.22 |
| | 0:15:00 | 0.00 | 0.00 | 0.12 | 0.42 | 0.61 | 0.49 | 0.72 | 0.73 | 1.27 |
| | 0:20:00 | 0.00 | 0.00 | 0.96 | 1.55 | 2.23 | 1.42 | 1.81 | 2.19 | 4.43 |
| | 0:25:00 | 0.00 | 0.00 | 3.00 | 5.51 | 8.40 | 4.79 | 6.48 | 7.75 | 18.38 |
| | 0:30:00 | 0.00 | 0.00 | 4.27 | 8.14 | 12.67 | 18.61 | 25.62 | 30.87 | 50.86 |
| | 0:35:00 | 0.00 | 0.00 | 4.26 | 8.11 | 12.43 | 24.11 | 32.11 | 40.49 | 63.48 |
| | 0:40:00 | 0.00 | 0.00 | 4.00 | 7.35 | 11.28 | 24.72 | 32.45 | 40.65 | 63.05 |
| | 0:45:00 | 0.00 | 0.00 | 3.53 | 6.54 | 10.06 | 22.95 | 30.06 | 38.68 | 59.66 |
| | 0:50:00 | 0.00 | 0.00 | 3.13 | 5.91 | 8.89 | 21.23 | 27.76 | 35.65 | 55.03 |
| | 0:55:00 | 0.00 | 0.00 | 2.81 | 5.29 | 7.92 | 18.75 | 24.64 | 32.36 | 49.99 |
| | 1:00:00 | 0.00 | 0.00 | 2.51 | 4.70 | 7.00 | 16.47 | 21.74 | 29.43 | 45.40 |
| | 1:05:00 | 0.00 | 0.00 | 2.24 | 4.15 | 6.15 | 14.43 | 19.13 | 26.68 | 41.17 |
| | 1:10:00 | 0.00 | 0.00 | 1.95 | 3.74 | 5.55 | 12.06 | 16.07 | 22.18 | 34.84 |
| | 1:15:00 | 0.00 | 0.00 | 1.73 | 3.39 | 5.16 | 10.40 | 13.97 | 18.79 | 29.99 |
| | 1:20:00 | 0.00 | 0.00 | 1.57 | 3.03 | 4.68 | 8.95 | 12.01 | 15.81 | 25.22 |
| | 1:25:00 | 0.00 | 0.00 | 1.43 | 2.71 | 4.09 | 7.72 | 10.32 | 13.24 | 21.03 |
| | 1:30:00 | 0.00 | 0.00 | 1.30 | 2.41 | 3.53 | 6.51 | 8.68 | 11.03 | 17.40 |
| | 1:35:00 | 0.00 | 0.00 | 1.17 | 2.13 | 3.01 | 5.41 | 7.18 | 8.99 | 14.08 |
| | 1:40:00 | 0.00 | 0.00 | 1.04 | 1.78 | 2.53 | 4.37 | 5.77 | 7.10 | 11.03 |
| | 1:45:00 | 0.00 | 0.00 | 0.92 | 1.45 | 2.08 | 3.39 | 4.45 | 5.37 | 8.33 |
| | 1:50:00 | 0.00 | 0.00 | 0.81 | 1.19 | 1.75 | 2.53 | 3.31 | 3.94 | 6.31 |
| | 1:55:00 | 0.00 | 0.00 | 0.68 | 1.03 | 1.52 | 1.98 | 2.67 | 3.08 | 5.07 |
| | 2:00:00 | 0.00 | 0.00 | 0.59 | 0.93 | 1.33 | 1.65 | 2.27 | 2.53 | 4.25 |
| | 2:05:00 | 0.00 | 0.00 | 0.48 | 0.75 | 1.08 | 1.26 | 1.74 | 1.89 | 3.20 |
| | 2:10:00 | 0.00 | 0.00 | 0.39 | 0.59 | 0.86 | 0.95 | 1.31 | 1.38 | 2.35 |
| | 2:15:00 | 0.00 | 0.00 | 0.31 | 0.47 | 0.68 | 0.72 | 1.00 | 1.00 | 1.71 |
| | 2:20:00 | 0.00 | 0.00 | 0.25 | 0.37 | 0.53 | 0.55 | 0.75 | 0.71 | 1.22 |
| | 2:25:00 | 0.00 | 0.00 | 0.20 | 0.29 | 0.41 | 0.41 | 0.57 | 0.51 | 0.89 |
| | 2:30:00 | 0.00 | 0.00 | 0.16 | 0.22 | 0.31 | 0.31 | 0.43 | 0.39 | 0.66 |
| | 2:35:00 | 0.00 | 0.00 | 0.12 | 0.17 | 0.23 | 0.23 | 0.32 | 0.29 | 0.50 |
| | 2:40:00 | 0.00 | 0.00 | 0.10 | 0.13 | 0.17 | 0.17 | 0.24 | 0.22 | 0.38 |
| | 2:45:00 | 0.00 | 0.00 | 0.08 | 0.10 | 0.13 | 0.13 | 0.18 | 0.17 | 0.29 |
| | 2:50:00 | 0.00 | 0.00 | 0.06 | 0.07 | 0.10 | 0.10 | 0.14 | 0.13 | 0.22 |
| | 2:55:00 | 0.00 | 0.00 | 0.04 | 0.05 | 0.07 | 0.07 | 0.10 | 0.09 | 0.15 |
| | 3:00:00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.05 | 0.05 | 0.07 | 0.06 | 0.10 |
| | 3:05:00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.06 |
| | 3:10:00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 |
| | 3:15:00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| | 3:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*

Summary Stage-Area-Volume-Discharge Relationships

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

| Stage - Storage Description | Stage [ft] | Area [ft²] | Area [acres] | Volume [ft³] | Volume [ac-ft] | Total Outflow [cfs] |
|---|---|---|---|---|---|---|
| | 0.50 | 307 | 0.007 | 45 | 0.001 | 0.02 |
| | 1.00 | 1,954 | 0.045 | 462 | 0.011 | 0.05 |
| | 1.50 | 5,338 | 0.123 | 2,285 | 0.052 | 0.07 |
| | 2.00 | 9,461 | 0.217 | 5,862 | 0.135 | 0.10 |
| | 2.50 | 15,019 | 0.345 | 11,982 | 0.275 | 0.13 |
| WQCV | 2.60 | 16,130 | 0.370 | 13,540 | 0.311 | 0.13 |
| | 3.00 | 20,619 | 0.473 | 20,885 | 0.479 | 0.15 |
| EURV | 3.20 | 22,891 | 0.526 | 25,236 | 0.579 | 0.16 |
| | 3.50 | 26,300 | 0.604 | 32,614 | 0.749 | 1.48 |
| | 4.00 | 30,921 | 0.710 | 47,095 | 1.081 | 8.03 |
| | 4.50 | 33,482 | 0.769 | 63,195 | 1.451 | 16.48 |
| 100-YR | 4.66 | 34,302 | 0.787 | 68,618 | 1.575 | 16.82 |
| | 5.00 | 35,689 | 0.819 | 80,547 | 1.849 | 17.54 |
| 100-YR + 1/2 EURV | 5.01 | 35,720 | 0.820 | 80,904 | 1.857 | 17.56 |
| | 5.50 | 37,208 | 0.854 | 98,771 | 2.267 | 28.12 |
| | 6.00 | 38,748 | 0.890 | 117,757 | 2.703 | 97.06 |
| | 6.50 | 40,329 | 0.926 | 137,526 | 3.157 | 205.47 |
| | 7.00 | 41,794 | 0.959 | 158,076 | 3.629 | 347.22 |

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).

# POND D FOREBAY VOLUME REQUIREMENTS

EQUATION 3-1 $WQCV = a(0.91I^3 - 1.19I^2 + 0.781I)$
a=1 (40 hour drain time)

FOREBAY 1 *I=.288* *WQCV=* 0.14767

EQUATION 3-3 V=(WQCV/12)A
FOREBAY 1 A= 20.91 Acres V= 0.25732
20% WQCV Increase = 0.30879

3% OF WQCV
FOREBAY TOTAL VOLUME = .03(V)

| | | | |
|---|---|---|---|
| VOLUME REQUIRED FOR POND D FOREBAY = | 0.0093 | AC-FT | 404 CF |
| VOLUME PROVIDED FOR POND D FOREBAY = | 0.0489 | AC-FT | 2132 CF |

$Q_{100}$ DISCHARGES 2% OF $Q_{100}$

$Q_{100}$ FOREBAY 1 = .02*40.6 CFS= 0.81 CFS

# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond D Forebay Notch

**Rectangular Weir**

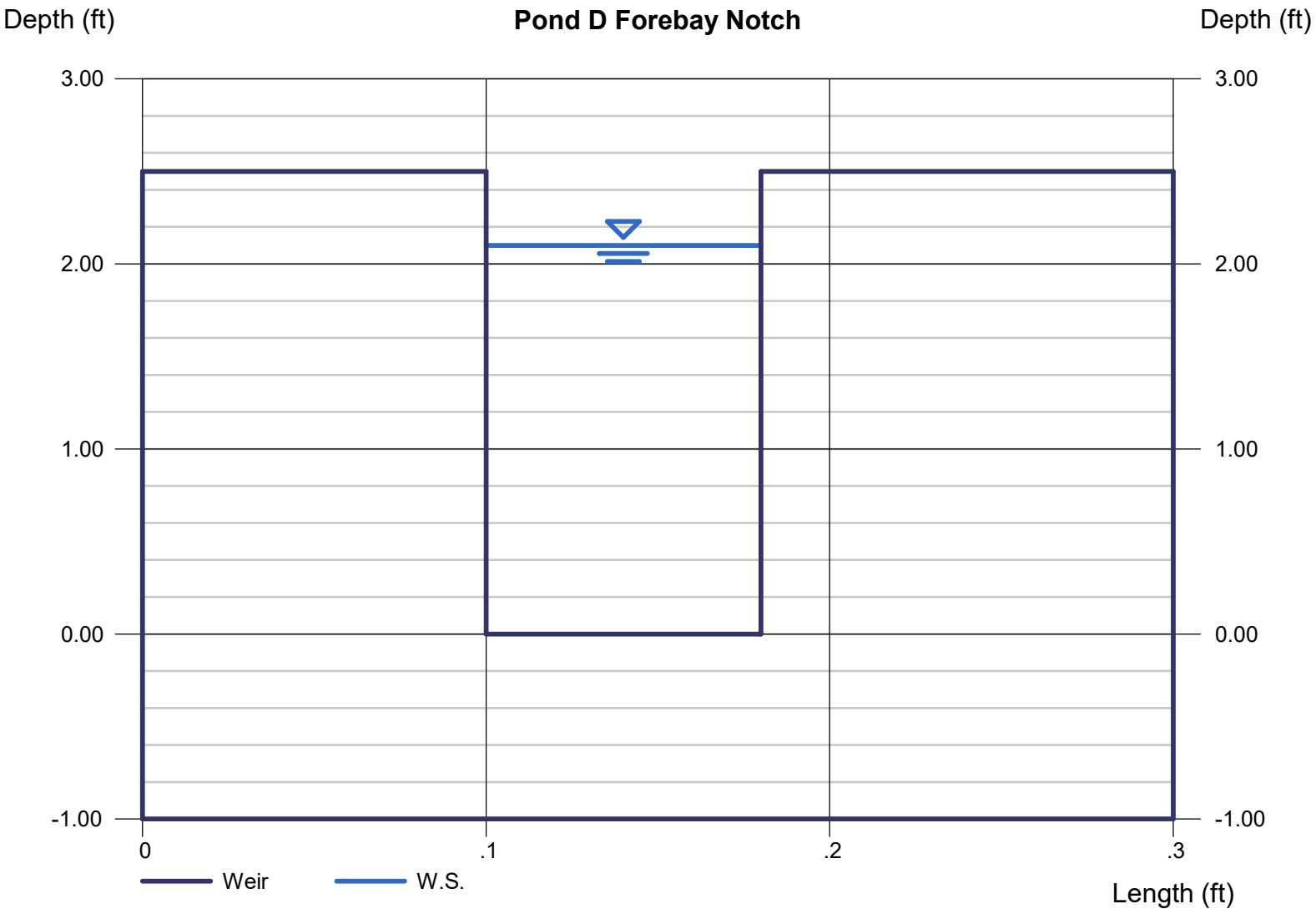
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 0.08 |
| Total Depth (ft) | = 2.50 |

**Calculations**

| | |
|---|---|
| Weir Coeff. Cw | = 3.33 |
| Compute by: | Known Q |
| Known Q (cfs) | = 0.81 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.10 |
| Q (cfs) | = 0.810 |
| Area (sqft) | = 0.17 |
| Velocity (ft/s) | = 4.82 |
| Top Width (ft) | = 0.08 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond D Trickle Channel

**Rectangular**

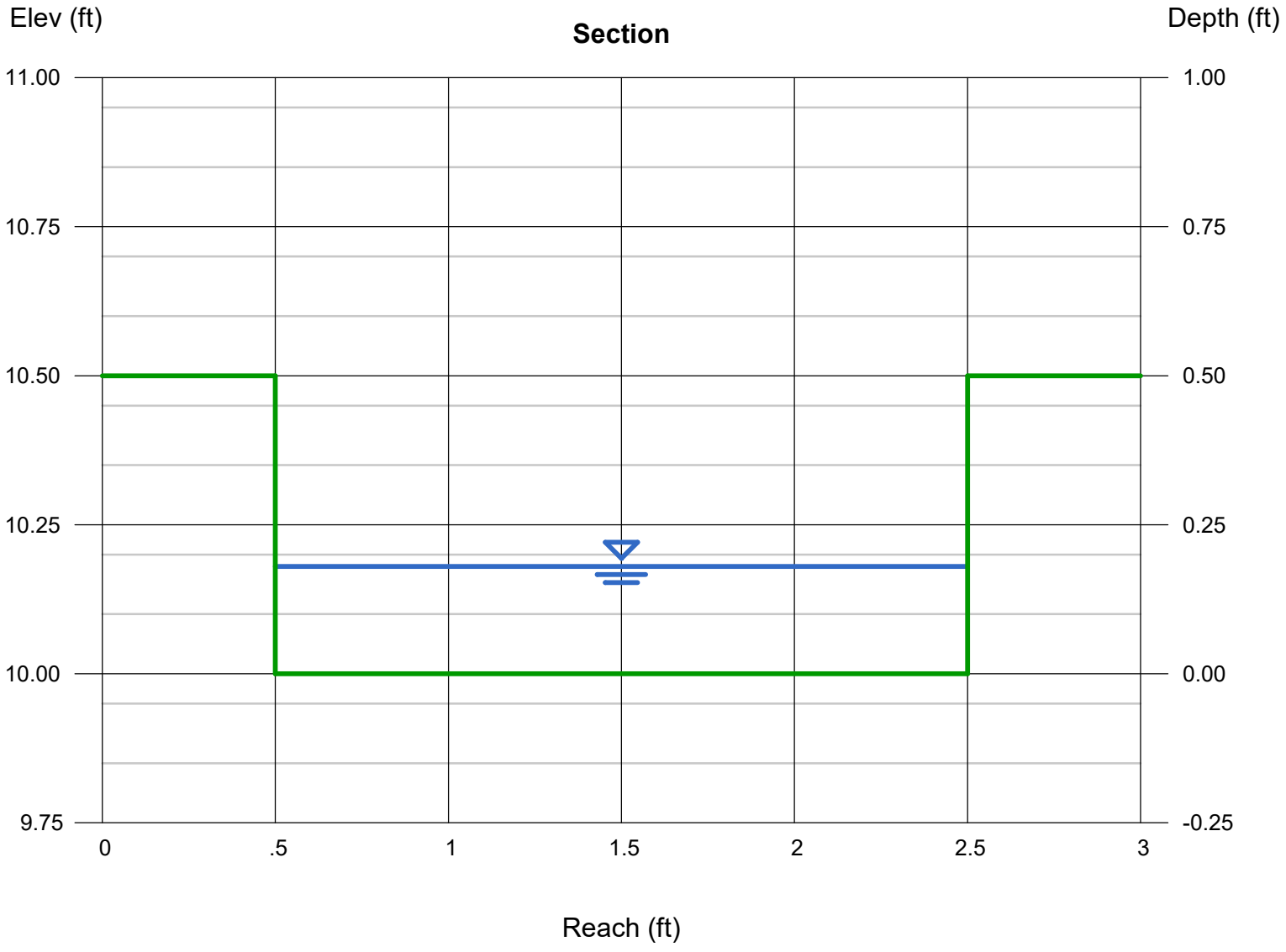
| | |
|---|---|
| Bottom Width (ft) | = 2.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 10.00 |
| Slope (%) | = 0.50 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 0.81 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.18 |
| Q (cfs) | = 0.810 |
| Area (sqft) | = 0.36 |
| Velocity (ft/s) | = 2.25 |
| Wetted Perim (ft) | = 2.36 |
| Crit Depth, Yc (ft) | = 0.18 |
| Top Width (ft) | = 2.00 |
| EGL (ft) | = 0.26 |



# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 21 2022

## Pond D Spillway

**Trapezoidal Weir**

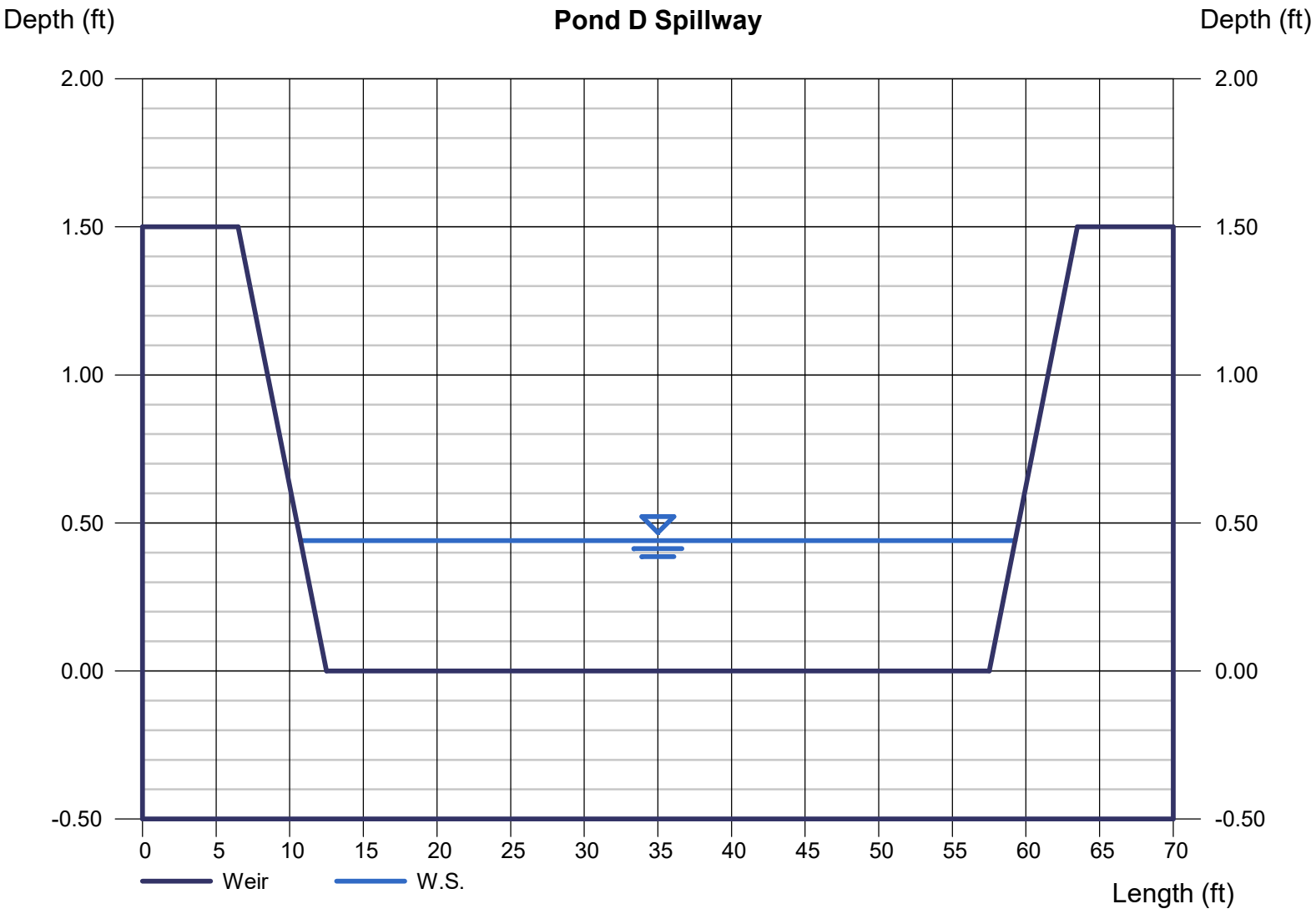
| | |
|---|---|
| Crest | = Sharp |
| Bottom Length (ft) | = 45.00 |
| Total Depth (ft) | = 1.50 |
| Side Slope (z:1) | = 4.00 |

**Calculations**

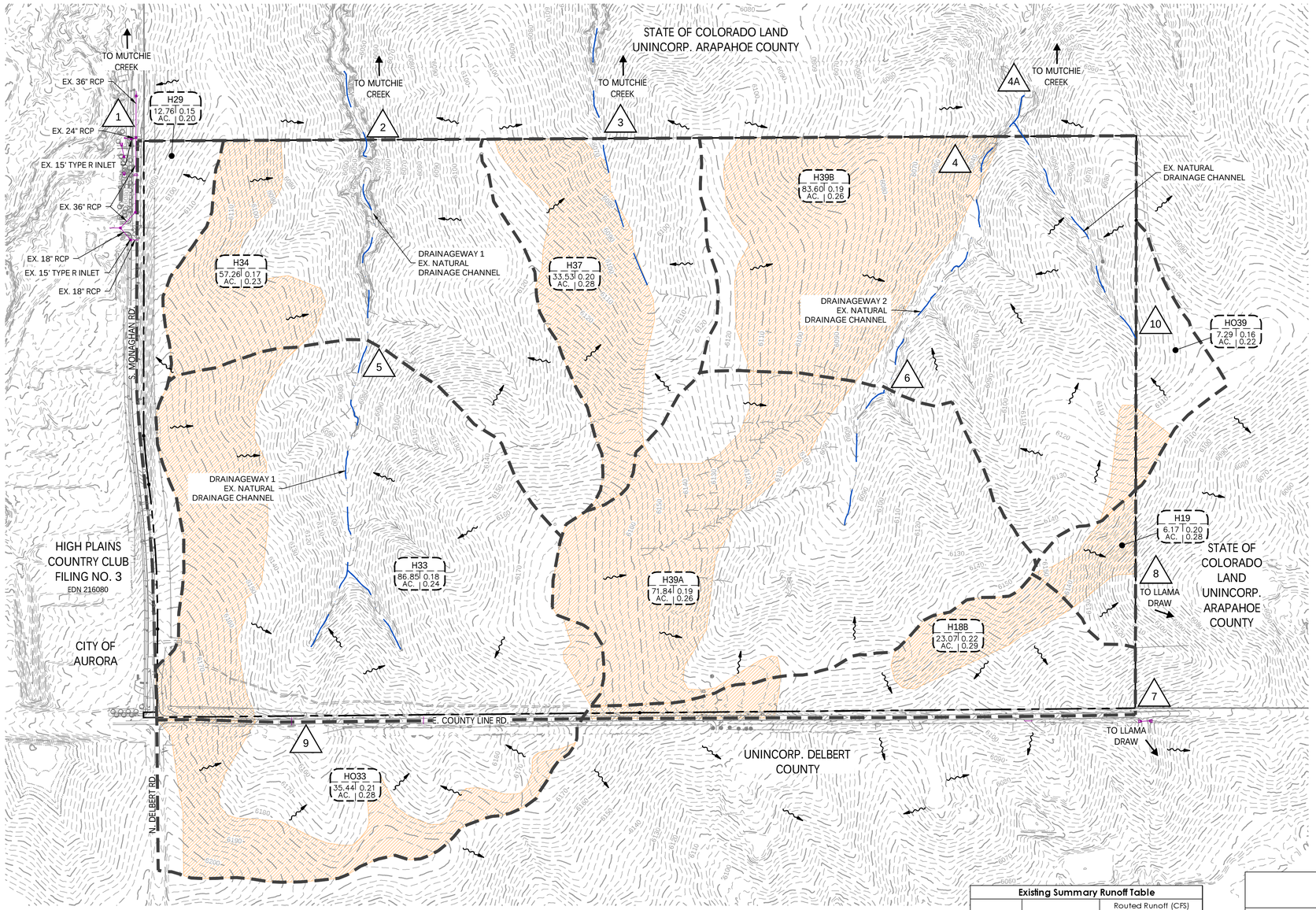
| | |
|---|---|
| Weir Coeff. Cw | = 3.10 |
| Compute by: | Known Q |
| Known Q (cfs) | = 40.60 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.44 |
| Q (cfs) | = 40.60 |
| Area (sqft) | = 20.57 |
| Velocity (ft/s) | = 1.97 |
| Top Width (ft) | = 48.52 |



# APPENDIX E
# REFERENCE MATERIAL





VICINITY MAP
NOT TO SCALE

## LEGEND

- Property Line
- Basin Boundary
- Ex. Major Contour (10')
- Ex. Minor Contour (2')
- Ex. Drainageway FL
- Ex. Storm Manhole
- Ex. Storm Sewer Line
- Flow Arrow
- Ex. Basin Designation (Name / Area AC. / C2 / C100)
- Design Point
- Type C Soils

**MASTER DRAINAGE NOTES:**

1. CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
2. STORM SEWER SYSTEMS, IN COMBINATION WITH THE STREETS, WILL BE SIZED FOR THE 100-YR STORM EVENT.
3. STORM SEWER SHALL BE PUBLIC UNLESS LABELED AS PRIVATE.
4. THE STORM SEWER SHOWN MAY NOT BE IN ITS FINAL LOCATION. ADDITIONAL STORM SEWER MAY BE REQUIRED AND WILL BE REFINED WITH THE PRELIMINARY DRAINAGE REPORT.
5. DETENTION PONDS SHALL BE PRIVATE. PONDS SHOWN ARE CONCEPTUAL ONLY. ACTUAL SIZE, SHAPE, AND LOCATION MAY VARY.
6. CULVERTS SHALL BE PROVIDED WITH AN EMERGENCY OVERFLOW PATH THAT DOES NOT ENCROACH INTO ANY RESIDENTIAL LOTS.
7. AT ALL CULVERTS THE ADJACENT FINISHED FLOOR ELEVATIONS WILL BE 1' ABOVE THE EMERGENCY WATER SURFACE ELEVATION OVER THE ROAD.
8. SOIL TYPE IS MIXED, CONSISTING OF HYDROLOGIC TYPE B AND C SOILS. ANY AREA NOT SHOWN AS TYPE C SOIL IS TYPE B SOIL.

**Existing Summary Runoff Table**

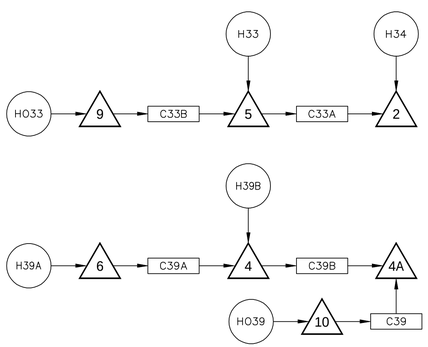
| Design Point | Contributing Area | Routed Runoff (CFS) $Q_2$ | Routed Runoff (CFS) $Q_{100}$ |
|---|---|---|---|
| 1 | H29 | 0.0 | 10.0 |
| 2 | H33, H34, HO33 | 4.9 | 312.5 |
| 3 | H37 | 1.0 | 52.0 |
| 4 | H39A, H39B | 2.8 | 269.3 |
| 4A | H39A, H39B, HO39 | 2.9 | 284.8 |
| 5 | H33, HO33 | 3.9 | 225.4 |
| 6 | H39A | 2.0 | 121.0 |
| 7 | H18B | 1.0 | 23.0 |
| 8 | H19 | 0.0 | 15.0 |
| 9 | HO33 | 2.0 | 81.0 |
| 10 | HO39 | 0.0 | 17.0 |

**Basin Runoff Calculations - Direct Runoff**

Project No.: 1002-98
16-Dec-21

| Basin ID | Design Point | Total Area (Ac.) | Imp (%) | Tp (min) 2-yr | Tp (min) 100-yr | Runoff Coeff. $C_2$ | Runoff Coeff. $C_5$ | Runoff Coeff. $C_{100}$ | Peak Flow (cfs) $Q_2$ | Peak Flow (cfs) $Q_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Existing | | | | | | | | | | |
| H18B | 7 | 23.07 | 7% | 44.0 | 54.0 | 0.22 | 0.23 | 0.29 | 1.0 | 23.0 |
| H19 | 8 | 6.17 | 4% | 31.0 | 36.0 | 0.20 | 0.22 | 0.28 | 0.0 | 15.0 |
| H29 | 1 | 12.76 | 2% | 45.0 | 63.0 | 0.15 | 0.16 | 0.20 | 0.0 | 10.0 |
| H33 | 5 | 86.85 | 4% | 38.0 | 43.0 | 0.18 | 0.19 | 0.24 | 3.0 | 149.0 |
| H34 | 2 | 57.26 | 3% | 39.0 | 45.0 | 0.17 | 0.18 | 0.23 | 1.0 | 88.0 |
| H37 | 3 | 33.53 | 4% | 39.0 | 44.0 | 0.20 | 0.22 | 0.28 | 1.0 | 52.0 |
| H39A | 6 | 71.84 | 3% | 38.0 | 43.0 | 0.19 | 0.20 | 0.26 | 2.0 | 121.0 |
| H39B | 4 | 83.60 | 3% | 36.0 | 42.0 | 0.19 | 0.20 | 0.26 | 2.0 | 156.0 |
| HO33 | 9 | 35.44 | 6% | 32.0 | 37.0 | 0.21 | 0.23 | 0.28 | 2.0 | 81.0 |
| HO39 | 10 | 7.29 | 2% | 31.0 | 36.0 | 0.16 | 0.18 | 0.22 | 0.0 | 17.0 |
| | | | | | | | | 2 Year $P_1$ = | 0.99 | |
| | | | | | | | | 5 Year $P_1$ = | 1.39 | |
| | | | | | | | | 100 Year $P_1$ = | 2.65 | |

## EXISTING SWMM DIAGRAMS




**PROJECT BENCHMARK:**

BM: 5S6529SE001
RECOVERED 3" BRASS CAP LOCATED ON THE SOUTHEASTERLY CORNER OF CURB OPENING INLET ON THE EASTERLY SIDE OF SMOKY HILL ROAD AND BEING NEARLY ON A PROJECTED LINE WITH THE SOUTHEASTERLY BOUNDARY OF SERENITY RIDGE FILING NO. 3 AND THE NORTHWESTERLY BOUNDARY OF SERENITY RIDGE FILING NO. 1.

DATUM ELEV. = 6145.93' (NAVD 88)

Approved For One Year From This Date

City Engineer — Date

Water Department — Date

300 0 150 300
SCALE
1 inch = 300 ft.


ILCM Innovative Land Consultants, Inc.
12071 Tejon Street, Suite 470
Westminster, CO 80234
303.421.4224
www.innovativelandinc.com


| No. | Rev. Date: | Revision Type: |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

Designed By: XWL
Prepared By: XWL
Approved By: TRH

Date: April 15, 2021
Horiz. Scale: 1" = 300'
Vert. Scale: N/A

Sheet: 1 of 2
Job No.: 1002-98

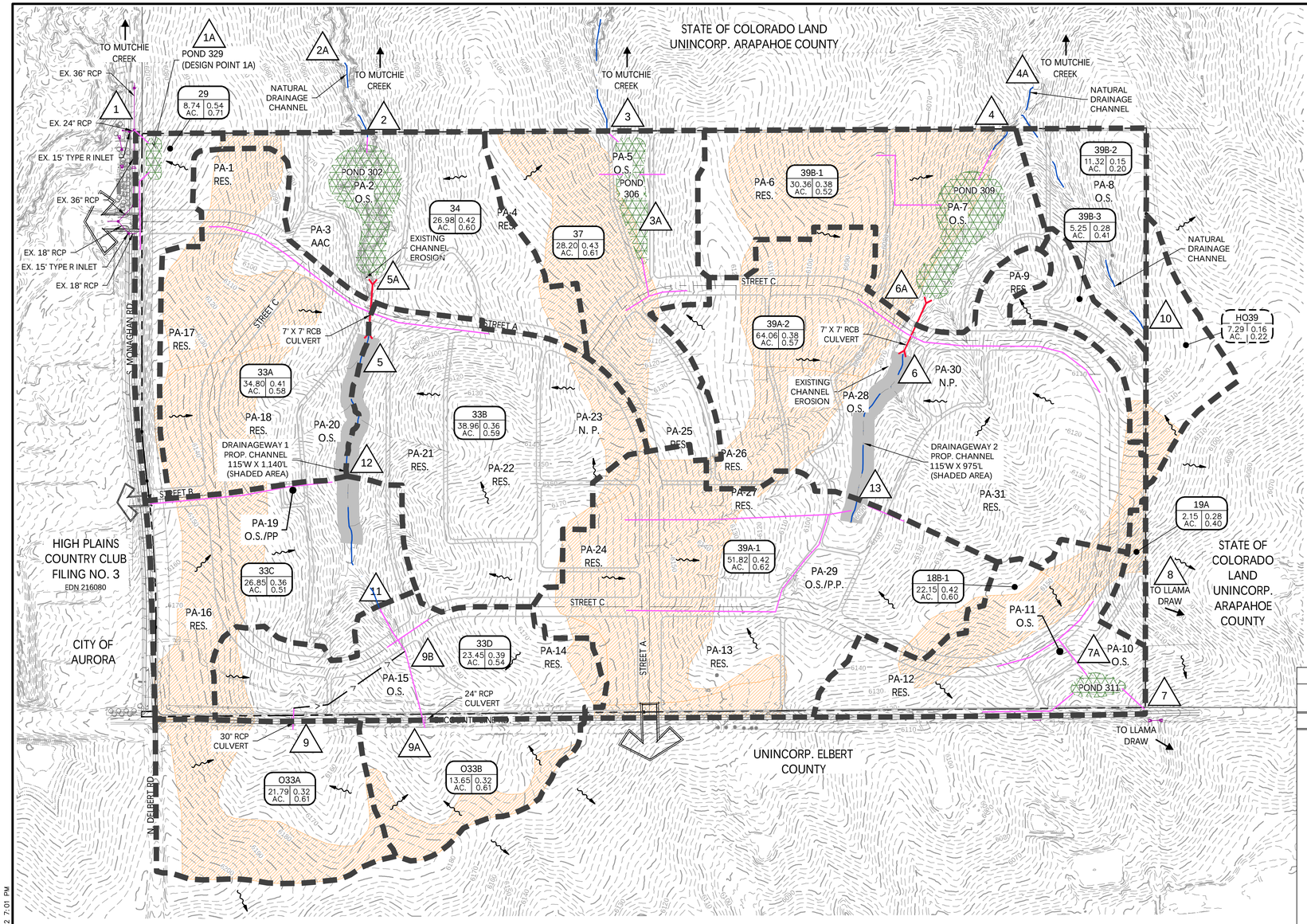
Prog. Name:
Location:
Plan Set:
Sheet Name:

Trails at Overland Ranch
Aurora, Colorado
Master Drainage Plans
Master Drainage Plan - Existing Conditions

Know what's below.
**Call before you dig.**

Sheet: 1

I:\JOB FOLDERS\1002 - RICHMOND HOMES\1002-98\PROD\MD\HIST MD OVERALL PRINTED ON: 4/16/2022 6:59 PM

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## LEGEND

- Property Line
- Basin Boundary
- Ex. Major Contour (10')
- Ex. Minor Contour (2')
- Ex. Drainageway FL
- Prop. Channel FL
- Ex. Storm Manhole
- Ex. Storm Sewer Line
- Prop. Storm Sewer Line
- Prop. Storm Box Culvert
- Prop. Detention Pond
- Flow Arrow
- Prop. Basin Designation (Name; Area AC. | C2 | C100)
- Ex. Basin Designation (Name; Area AC. | C2 | C100)
- Design Point (1)
- Type C Soils
- Drainageway Imprv. Corridor

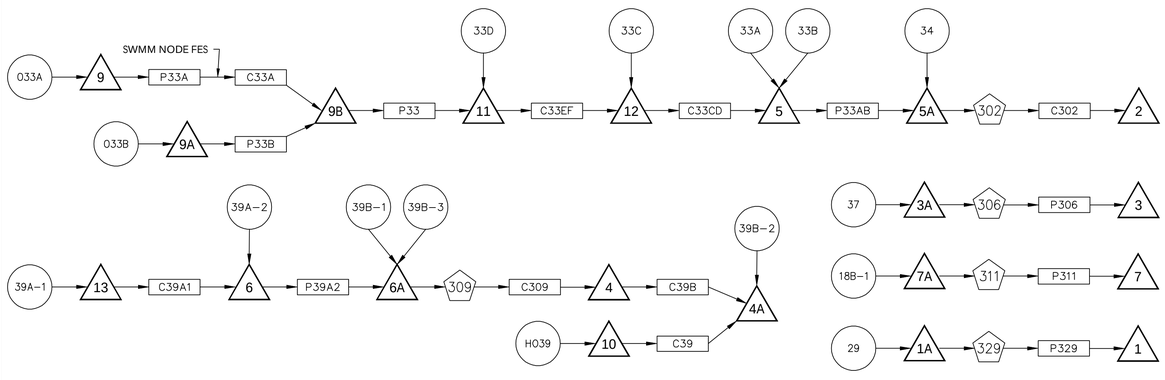
### Runoff Comparison Table

| Design Point | Existing | | | Proposed | | | |
|---|---|---|---|---|---|---|---|
| | | | | | Pre-Detention | | Detained |
| | Contrib. Basin | $Q_2$ | $Q_{100}$ | Contrib. Basin | $Q_2$ | $Q_{100}$ | $Q_{100}$ |
| 1 | H29 | 0.0 | 10.0 | 29 | 9.0 | 34.0 | 7.4 |
| 2 | H33, H34, HO33 | 4.9 | 312.5 | 33A, 33B, 33C, 33D, 34, O33A, O33B | 89.4 | 522.9 | 127.9 |
| 3 | H37 | 1.0 | 52.0 | 37 | 17.0 | 76.0 | 23.4 |
| 4 | H39A, H39B | 2.8 | 269.3 | 39A-1, 39A-2, 39B-1, 39B-3 | 98.0 | 508.7 | 128.3 |
| 4A | H39A, H39B, HO39 | 2.9 | 284.8 | 39A-1, 39A-2, 39B-1, 39B-2, 39B-3, HO39 | 0.4 | 151.2 | N/A |
| 5 | H33, HO33 | 3.9 | 225.4 | 33A, 33B, 33C, 33D, O33A, O33B | 74.9 | 451.1 | N/A |
| 6 | H39A | 2.0 | 121.0 | 39A-1, 39A-2 | 81.8 | 409.3 | N/A |
| 7 | H18B | 1.0 | 23.0 | 18B-1 | 12.0 | 59.0 | 10.5 |
| 8 | H19 | 0.0 | 15.0 | 19A | 1.0 | 8.0 | N/A |
| 9 (9B) | HO33 | 2.0 | 81.0 | O33A, O33B | 6.6 | 82.4 | N/A |
| 10 | HO39 | 0.0 | 17.0 | HO39 | 0.0 | 17.0 | N/A |

### Basin Runoff Calculations - Direct Runoff

| Basin ID | Design Point | Total Area (A.c.) | Imp (%) | Time Peak (min) 2-yr | Time Peak (min) 100-yr | Runoff Coeff. $C_2$ | Runoff Coeff. $C_5$ | Runoff Coeff. $C_{100}$ | Peak Flow (cfs) $Q_2$ | Peak Flow (cfs) $Q_{100}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **Proposed** | | | | | | | | | | |
| 18B-1 | 7 | 22.15 | 51% | 32.0 | 37.0 | 0.42 | 0.47 | 0.60 | 12.00 | 59.00 |
| 19A | 8 | 2.15 | 28% | 30.0 | 35.0 | 0.28 | 0.31 | 0.40 | 1.00 | 8.00 |
| 29 | 1 | 8.74 | 68% | 30.0 | 35.0 | 0.54 | 0.58 | 0.71 | 9.00 | 34.00 |
| 33A | 5 | 34.80 | 51% | 30.0 | 35.0 | 0.41 | 0.45 | 0.58 | 27.00 | 127.00 |
| 33B | 5 | 38.96 | 44% | 31.0 | 37.0 | 0.36 | 0.41 | 0.59 | 21.00 | 113.00 |
| 33C | 12 | 26.85 | 41% | 32.0 | 37.0 | 0.36 | 0.40 | 0.51 | 12.00 | 68.00 |
| 33D | 11 | 23.45 | 46% | 31.0 | 36.0 | 0.39 | 0.43 | 0.54 | 14.00 | 72.00 |
| 34 | 5A | 26.98 | 50% | 32.0 | 37.0 | 0.42 | 0.46 | 0.60 | 15.00 | 72.00 |
| 37 | 3 | 28.20 | 54% | 32.0 | 37.0 | 0.43 | 0.47 | 0.61 | 17.00 | 76.00 |
| 39A-1 | 13 | 51.82 | 53% | 31.0 | 36.0 | 0.42 | 0.47 | 0.62 | 37.00 | 171.00 |
| 39A-2 | 6 | 64.06 | 47% | 30.0 | 35.0 | 0.38 | 0.43 | 0.57 | 49.00 | 246.00 |
| 39B-1 | 6A | 30.36 | 39% | 31.0 | 36.0 | 0.38 | 0.41 | 0.52 | 15.00 | 92.00 |
| 39B-2 | 4A | 11.32 | 2% | 35.0 | 41.0 | 0.15 | 0.16 | 0.20 | 0.00 | 19.00 |
| 39B-3 | 6A | 5.25 | 29% | 39.0 | 45.0 | 0.28 | 0.31 | 0.41 | 1.00 | 8.00 |
| O33A | 9 | 21.79 | 17% | 32.0 | 39.0 | 0.32 | 0.36 | 0.61 | 4.00 | 49.00 |
| O33B | 9A | 13.65 | 17% | 31.0 | 36.0 | 0.32 | 0.37 | 0.61 | 3.00 | 34.00 |
| Pond 302 | 5A/2 | 186.48 | 46% | | 84.0 | 0.39 | 0.43 | 0.57 | 0.18 | 127.90 |
| Pond 306 | 3A/3 | 28.20 | 54% | | 85.0 | 0.43 | 0.47 | 0.61 | 0.18 | 23.40 |
| Pond 309 | 6A/4 | 151.49 | 47% | | 76.0 | 0.39 | 0.43 | 0.57 | 0.19 | 128.30 |
| Pond 311 | 7A/7 | 22.15 | 51% | | 84.0 | 0.42 | 0.47 | 0.60 | 0.17 | 10.50 |
| Pond 329 | 1A/1 | 8.74 | 68% | | 72.0 | 0.54 | 0.58 | 0.71 | 0.12 | 7.40 |
| | | | | | | | | 2 Year $P_1$ = | 0.99 | |
| | | | | | | | | 5 Year $P_1$ = | 1.39 | |
| | | | | | | | | 100 Year $P_1$ = | 2.65 | |

## PROPOSED SWMM DIAGRAMS




### Detention Pond Table

| Desc. | Units | Pond Name 302 | 306 | 309 | 311 | 329 |
|---|---|---|---|---|---|---|
| Area | Acre | 151.04 | 28.20 | 151.49 | 22.15 | 8.74 |
| Imperv. | % | 46% | 54% | 47% | 51% | 68% |
| WQCV | Acre-Ft | 3.66 | 0.58 | 2.99 | 0.46 | 0.08 |
| EURV | Acre-Ft | 8.73 | 1.49 | 7.48 | 1.21 | 0.23 |
| 100-Yr | Acre-Ft | 16.53 | 2.37 | 14.71 | 1.92 | 0.38 |
| 100-Yr +1/2 EURV | Acre-Ft | 20.90 | 3.12 | 18.45 | 2.53 | 0.50 |
| Hist. Release Rate | CFS | 312.50 | 52.00 | 284.80 | 23.00 | 10.00 |
| Aurora Release Rate | CFS | 128.38 | 23.97 | 128.77 | 18.83 | 7.43 |
| Allow. Release Rate | CFS | 128.38 | 23.97 | 128.77 | 10.83* | 7.43 |

*Pond 311 Allowable Release Rate reduced to account for Basin 19A Free Release Rate

## PROJECT BENCHMARK:

BM: 5S6529SE001
RECOVERED 3" BRASS CAP LOCATED ON THE SOUTHEASTERLY CORNER OF CURB OPENING INLET ON THE EASTERLY SIDE OF SMOKY HILL ROAD AND BEING NEARLY ON A PROJECTED LINE WITH THE SOUTHEASTERLY BOUNDARY OF SERENITY RIDGE FILING NO. 3 AND THE NORTHWESTERLY BOUNDARY OF SERENITY RIDGE FILING NO. 1.

DATUM ELEV. = 6145.93' (NAVD 88)

300 0 150 300
SCALE
1 inch = 300 ft.


Innovative Land Consultants, Inc.
12071 Tejon Street, Suite 470
Westminster, CO 80234
303.421.4224
www.innovativelandinc.com


| No. | Revision Type: | Rev. Date: |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

Date: April 15, 2021
Horiz. Scale: 1" = 300'
Vert. Scale: N/A
Sheet: 2 of 2
Job No.: 1002.98
Designed By: XWL
Prepared By: XWL
Approved By: TRH

Proj. Name: Trails at Overland Ranch
Location: Aurora, Colorado
Plan Set: Master Drainage Plans
Sheet Name: Master Drainage Plan - Proposed Conditions

Know what's below.
**Call before you dig.**

Sheet: 2

I:\JOB FOLDERS\1002 - RICHMOND HOMES\1002-98\PROD\MD\MD OVERALL PRINTED ON: 4/16/2022 7:01 PM

## Basin Runoff Calculations - Direct Runoff

Project No.: 1002-98

16-Apr-22

| Basin ID | Design Point | Total Area (Ac.) | Imp (%) | Time Peak (min) | | Runoff Coeff. | | | Peak Flow (cfs) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2-yr | 100-yr | $C_2$ | $C_5$ | $C_{100}$ | $Q_2$ | $Q_{100}$ |
| **Proposed** | | | | | | | | | | |
| 18B-1 | 7 | 22.15 | 51% | 32.0 | 37.0 | 0.42 | 0.47 | 0.60 | 12.00 | 59.00 |
| 19A | 8 | 2.15 | 28% | 30.0 | 35.0 | 0.28 | 0.31 | 0.40 | 1.00 | 8.00 |
| 29 | 1 | 8.74 | 68% | 30.0 | 35.0 | 0.54 | 0.58 | 0.71 | 9.00 | 34.00 |
| 33A | 5 | 34.80 | 51% | 30.0 | 35.0 | 0.41 | 0.45 | 0.58 | 27.00 | 127.00 |
| 33B | 5 | 38.96 | 44% | 31.0 | 37.0 | 0.36 | 0.41 | 0.59 | 21.00 | 113.00 |
| 33C | 12 | 26.85 | 41% | 32.0 | 37.0 | 0.36 | 0.40 | 0.51 | 12.00 | 68.00 |
| 33D | 11 | 23.45 | 46% | 31.0 | 36.0 | 0.39 | 0.43 | 0.54 | 14.00 | 72.00 |
| 34 | 5A | 26.98 | 50% | 32.0 | 37.0 | 0.42 | 0.46 | 0.60 | 15.00 | 72.00 |
| 37 | 3 | 28.20 | 54% | 32.0 | 37.0 | 0.43 | 0.47 | 0.61 | 17.00 | 76.00 |
| 39A-1 | 13 | 51.82 | 53% | 31.0 | 36.0 | 0.42 | 0.47 | 0.62 | 37.00 | 171.00 |
| 39A-2 | 6 | 64.06 | 47% | 30.0 | 35.0 | 0.38 | 0.43 | 0.57 | 49.00 | 246.00 |
| 39B-1 | 6A | 30.36 | 39% | 31.0 | 36.0 | 0.38 | 0.41 | 0.52 | 15.00 | 92.00 |
| 39B-2 | 4A | 11.32 | 2% | 35.0 | 41.0 | 0.15 | 0.16 | 0.20 | 0.00 | 19.00 |
| 39B-3 | 6A | 5.25 | 29% | 39.0 | 45.0 | 0.28 | 0.31 | 0.41 | 1.00 | 8.00 |
| O33A | 9 | 21.79 | 17% | 32.0 | 39.0 | 0.32 | 0.36 | 0.61 | 4.00 | 49.00 |
| O33B | 9A | 13.65 | 17% | 31.0 | 36.0 | 0.32 | 0.37 | 0.61 | 3.00 | 34.00 |
| Pond 302 | 5A/2 | 186.48 | 46% | | 84.0 | 0.39 | 0.43 | 0.57 | 0.18 | 127.90 |
| Pond 306 | 3A/3 | 28.20 | 54% | | 85.0 | 0.43 | 0.47 | 0.61 | 0.18 | 23.40 |
| Pond 309 | 6A/4 | 151.49 | 47% | | 76.0 | 0.39 | 0.43 | 0.57 | 0.19 | 128.30 |
| Pond 311 | 7A/7 | 22.15 | 51% | | 84.0 | 0.42 | 0.47 | 0.60 | 0.17 | 10.50 |
| Pond 329 | 1A/1 | 8.74 | 68% | | 72.0 | 0.54 | 0.58 | 0.71 | 0.12 | 7.40 |
| **Existing** | | | | | | | | | | |
| H18B | 7 | 23.07 | 7% | 44.0 | 54.0 | 0.22 | 0.23 | 0.29 | 1.0 | 23.0 |
| H19 | 8 | 6.17 | 4% | 31.0 | 36.0 | 0.20 | 0.22 | 0.28 | 0.0 | 15.0 |
| H29 | 1 | 12.76 | 2% | 45.0 | 63.0 | 0.15 | 0.16 | 0.20 | 0.0 | 10.0 |
| H33 | 5 | 86.85 | 4% | 38.0 | 43.0 | 0.18 | 0.19 | 0.24 | 3.0 | 149.0 |
| H34 | 2 | 57.26 | 3% | 39.0 | 45.0 | 0.17 | 0.18 | 0.23 | 1.0 | 88.0 |
| H37 | 3 | 33.53 | 4% | 39.0 | 44.0 | 0.20 | 0.22 | 0.28 | 1.0 | 52.0 |
| H39A | 6 | 71.84 | 3% | 38.0 | 43.0 | 0.19 | 0.20 | 0.26 | 2.0 | 121.0 |
| H39B | 4 | 83.60 | 3% | 36.0 | 42.0 | 0.19 | 0.20 | 0.26 | 2.0 | 156.0 |
| HO33 | 9 | 35.44 | 6% | 32.0 | 37.0 | 0.21 | 0.23 | 0.28 | 2.0 | 81.0 |
| HO39 | 10 | 7.29 | 2% | 31.0 | 36.0 | 0.16 | 0.18 | 0.22 | 0.0 | 17.0 |
| | | | | | | | | 2 Year $P_1$ = | 0.99 | |
| | | | | | | | | 5 Year $P_1$ = | 1.39 | |
| | | | | | | | | 100 Year $P_1$ = | 2.65 | |

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

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| 18B-1 | | 0.088 | 0.120 | 19.8 | 2.12 | 10.3 | 1.50 | 3.5 | 52 | 80,405 | 2.17 | 174,605 | 37.0 | 59 | 174,574 | 2.67 |
| 19A | | 0.103 | 0.029 | 10.1 | 0.53 | 5.2 | 0.37 | 0.9 | 10 | 7,805 | 1.87 | 14,632 | 35.0 | 8 | 14,486 | 3.63 |
| 29 | | 0.081 | 0.089 | 10.9 | 1.04 | 5.6 | 0.73 | 1.7 | 38 | 31,726 | 2.37 | 75,229 | 35.0 | 34 | 75,142 | 3.95 |
| 33A | | 0.088 | 0.147 | 12.0 | 1.65 | 6.2 | 1.17 | 2.8 | 136 | 126,324 | 2.19 | 277,160 | 35.0 | 127 | 276,965 | 3.64 |
| 33B | | 0.092 | 0.143 | 16.5 | 2.11 | 8.6 | 1.49 | 3.5 | 111 | 141,425 | 2.05 | 290,388 | 37.0 | 113 | 290,319 | 2.90 |
| 33C | | 0.093 | 0.116 | 20.1 | 2.09 | 10.4 | 1.48 | 3.5 | 63 | 97,466 | 2.04 | 199,305 | 37.0 | 68 | 199,274 | 2.55 |
| 33D | | 0.091 | 0.117 | 15.2 | 1.66 | 7.9 | 1.17 | 2.8 | 72 | 85,124 | 2.08 | 177,340 | 36.0 | 72 | 177,278 | 3.07 |
| 34 | | 0.089 | 0.130 | 19.5 | 2.24 | 10.1 | 1.58 | 3.7 | 65 | 97,937 | 2.14 | 209,175 | 37.0 | 72 | 209,145 | 2.67 |
| 37 | | 0.087 | 0.137 | 19.8 | 2.39 | 10.3 | 1.69 | 4.0 | 67 | 102,366 | 2.22 | 227,311 | 37.0 | 76 | 227,319 | 2.71 |
| 39A-1 | | 0.087 | 0.179 | 14.5 | 2.30 | 7.6 | 1.62 | 3.8 | 167 | 188,216 | 2.21 | 415,344 | 36.0 | 171 | 415,243 | 3.29 |
| 39A-2 | | 0.090 | 0.185 | 10.4 | 1.78 | 5.4 | 1.26 | 3.0 | 290 | 232,465 | 2.11 | 491,592 | 35.0 | 246 | 491,240 | 3.85 |
| 39B-1 | | 0.094 | 0.119 | 15.3 | 1.70 | 8.0 | 1.20 | 2.8 | 93 | 110,207 | 2.04 | 225,367 | 36.0 | 92 | 225,296 | 3.04 |
| 39B-2 | | 0.157 | 0.076 | 27.3 | 1.90 | 14.2 | 1.34 | 3.2 | 19 | 41,092 | 1.50 | 61,807 | 41.0 | 19 | 61,799 | 1.70 |
| 39B-3 | | 0.102 | 0.044 | 37.0 | 1.56 | 19.2 | 1.11 | 2.6 | 7 | 19,058 | 1.86 | 35,380 | 45.0 | 8 | 35,377 | 1.56 |
| O33A | | 0.116 | 0.081 | 21.2 | 1.62 | 11.0 | 1.14 | 2.7 | 48 | 79,098 | 1.76 | 139,028 | 39.0 | 49 | 139,000 | 2.23 |
| O33B | | 0.117 | 0.066 | 17.5 | 1.18 | 9.1 | 0.83 | 2.0 | 37 | 49,550 | 1.73 | 85,822 | 36.0 | 34 | 85,817 | 2.52 |
| HO39 | | 0.157 | 0.063 | 17.0 | 1.12 | 8.9 | 0.79 | 1.9 | 20 | 26,463 | 1.47 | 38,957 | 36.0 | 17 | 38,939 | 2.27 |

Proposed 100-yr Conditions

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| 18B-1 | 7A | RAINGAGE | 0.035 | 0.139 | 0.225 | 0.010 | 51.0 | 0.35 | 0.10 | 3.97 | 0.56 | 0.0018 | 0.00 | 0.86 | 0.23 | 49.96 |
| 19A | 8 | RAINGAGE | 0.003 | 0.013 | 0.061 | 0.075 | 28.0 | 0.35 | 0.10 | 3.99 | 0.57 | 0.0018 | 0.00 | 0.56 | 0.16 | 26.53 |
| 29 | 1A | RAINGAGE | 0.014 | 0.090 | 0.177 | 0.078 | 68.0 | 0.35 | 0.10 | 4.50 | 0.60 | 0.0018 | 0.00 | 0.92 | 0.29 | 67.12 |
| 33A | 5 | RAINGAGE | 0.054 | 0.119 | 0.284 | 0.040 | 51.0 | 0.35 | 0.10 | 3.60 | 0.54 | 0.0018 | 0.00 | 0.86 | 0.23 | 50.02 |
| 33B | 5 | RAINGAGE | 0.061 | 0.161 | 0.333 | 0.035 | 44.0 | 0.35 | 0.10 | 4.39 | 0.59 | 0.0018 | 0.00 | 0.82 | 0.21 | 42.83 |
| 33C | 12 | RAINGAGE | 0.042 | 0.154 | 0.322 | 0.034 | 41.0 | 0.35 | 0.10 | 3.94 | 0.56 | 0.0018 | 0.00 | 0.81 | 0.20 | 39.89 |
| 33D | 11 | RAINGAGE | 0.037 | 0.085 | 0.317 | 0.028 | 46.0 | 0.35 | 0.10 | 4.34 | 0.59 | 0.0018 | 0.00 | 0.83 | 0.22 | 44.85 |
| 34 | 5A | RAINGAGE | 0.042 | 0.118 | 0.379 | 0.016 | 50.0 | 0.35 | 0.10 | 4.35 | 0.59 | 0.0018 | 0.00 | 0.85 | 0.23 | 48.89 |
| 37 | 3A | RAINGAGE | 0.044 | 0.129 | 0.352 | 0.011 | 54.0 | 0.35 | 0.10 | 3.79 | 0.55 | 0.0018 | 0.00 | 0.87 | 0.25 | 53.03 |
| 39A-1 | 13 | RAINGAGE | 0.081 | 0.162 | 0.396 | 0.027 | 53.0 | 0.35 | 0.10 | 3.81 | 0.55 | 0.0018 | 0.00 | 0.87 | 0.24 | 52.01 |
| 39A-2 | 6 | RAINGAGE | 0.100 | 0.099 | 0.359 | 0.034 | 47.0 | 0.35 | 0.10 | 4.05 | 0.57 | 0.0018 | 0.00 | 0.84 | 0.22 | 45.91 |
| 39B-1 | 6A | RAINGAGE | 0.047 | 0.107 | 0.239 | 0.026 | 39.0 | 0.35 | 0.10 | 3.60 | 0.54 | 0.0018 | 0.00 | 0.78 | 0.20 | 37.90 |
| 39B-2 | 4A | RAINGAGE | 0.018 | 0.091 | 0.210 | 0.070 | 2.0 | 0.35 | 0.10 | 4.50 | 0.60 | 0.0018 | 0.00 | 0.04 | 0.02 | 1.75 |
| 39B-3 | 6A | RAINGAGE | 0.008 | 0.092 | 0.237 | 0.040 | 29.0 | 0.35 | 0.10 | 4.37 | 0.59 | 0.0018 | 0.00 | 0.58 | 0.17 | 27.45 |
| O33A | 9 | RAINGAGE | 0.034 | 0.095 | 0.189 | 0.040 | 17.0 | 0.35 | 0.10 | 3.77 | 0.55 | 0.0018 | 0.00 | 0.34 | 0.12 | 15.74 |
| O33B | 9A | RAINGAGE | 0.021 | 0.051 | 0.152 | 0.040 | 17.0 | 0.35 | 0.10 | 4.04 | 0.57 | 0.0018 | 0.00 | 0.34 | 0.12 | 15.68 |
| HO39 | 10 | RAINGAGE | 0.011 | 0.038 | 0.107 | 0.051 | 2.0 | 0.40 | 0.10 | 4.29 | 0.59 | 0.0018 | 0.00 | 0.00 | 0.02 | 1.75 |

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

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| H33 | | 0.150 | 0.183 | 27.7 | 4.19 | 14.4 | 2.96 | 7.0 | 147 | 315,266 | 1.52 | 479,916 | 43.0 | 149 | 479,890 | 1.72 |
| H34 | | 0.153 | 0.155 | 31.9 | 4.10 | 16.6 | 2.90 | 6.8 | 84 | 207,854 | 1.50 | 311,554 | 45.0 | 88 | 311,538 | 1.53 |
| H37 | | 0.150 | 0.119 | 32.2 | 3.25 | 16.7 | 2.29 | 5.4 | 49 | 121,714 | 1.56 | 189,804 | 44.0 | 52 | 189,798 | 1.55 |
| H39A | | 0.153 | 0.171 | 28.4 | 4.04 | 14.8 | 2.85 | 6.7 | 119 | 260,779 | 1.53 | 398,276 | 43.0 | 121 | 398,249 | 1.69 |
| H39B | | 0.153 | 0.184 | 24.6 | 3.77 | 12.8 | 2.66 | 6.3 | 159 | 303,468 | 1.53 | 463,724 | 42.0 | 156 | 463,718 | 1.87 |
| HO33 | | 0.143 | 0.117 | 18.2 | 1.94 | 9.4 | 1.37 | 3.2 | 91 | 128,647 | 1.57 | 201,444 | 37.0 | 81 | 201,406 | 2.29 |
| HO39 | | 0.157 | 0.063 | 17.0 | 1.12 | 8.9 | 0.79 | 1.9 | 20 | 26,463 | 1.47 | 38,957 | 36.0 | 17 | 38,939 | 2.27 |
| H18B | | 0.140 | 0.095 | 58.3 | 4.54 | 30.3 | 3.21 | 7.6 | 19 | 83,744 | 1.58 | 131,967 | 54.0 | 23 | 131,967 | 1.01 |
| H19 | | 0.150 | 0.056 | 16.2 | 0.99 | 8.4 | 0.70 | 1.7 | 18 | 22,397 | 1.56 | 34,917 | 36.0 | 15 | 34,885 | 2.45 |
| H29 | | 0.157 | 0.080 | 75.7 | 4.97 | 39.3 | 3.52 | 8.3 | 8 | 46,319 | 1.46 | 67,400 | 63.0 | 10 | 67,399 | 0.77 |

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| H33 | 5 | RAINGAGE | 0.136 | 0.204 | 0.503 | 0.041 | 4.0 | 0.40 | 0.10 | 4.12 | 0.57 | 0.0018 | 0.00 | 0.08 | 0.04 | 3.54 |
| H34 | 2 | RAINGAGE | 0.089 | 0.175 | 0.525 | 0.040 | 3.0 | 0.40 | 0.10 | 4.16 | 0.58 | 0.0018 | 0.00 | 0.06 | 0.03 | 2.64 |
| H37 | 3 | RAINGAGE | 0.052 | 0.165 | 0.404 | 0.055 | 4.0 | 0.40 | 0.10 | 3.69 | 0.55 | 0.0018 | 0.00 | 0.08 | 0.04 | 3.57 |
| H39A | 6 | RAINGAGE | 0.112 | 0.210 | 0.473 | 0.050 | 3.0 | 0.40 | 0.10 | 3.94 | 0.56 | 0.0018 | 0.00 | 0.06 | 0.03 | 2.66 |
| H39B | 4 | RAINGAGE | 0.131 | 0.170 | 0.479 | 0.046 | 3.0 | 0.40 | 0.10 | 3.92 | 0.56 | 0.0018 | 0.00 | 0.06 | 0.03 | 2.66 |
| HO33 | 9 | RAINGAGE | 0.055 | 0.088 | 0.248 | 0.057 | 6.0 | 0.40 | 0.10 | 3.87 | 0.56 | 0.0018 | 0.00 | 0.12 | 0.06 | 5.35 |
| HO39 | 10 | RAINGAGE | 0.011 | 0.038 | 0.107 | 0.051 | 2.0 | 0.40 | 0.10 | 4.29 | 0.59 | 0.0018 | 0.00 | 0.00 | 0.02 | 1.75 |
| H18B | 7 | RAINGAGE | 0.036 | 0.220 | 0.552 | 0.030 | 7.0 | 0.40 | 0.10 | 3.92 | 0.56 | 0.0018 | 0.00 | 0.14 | 0.07 | 6.26 |
| H19 | 8 | RAINGAGE | 0.010 | 0.042 | 0.105 | 0.100 | 4.0 | 0.40 | 0.10 | 3.70 | 0.55 | 0.0018 | 0.00 | 0.08 | 0.04 | 3.57 |
| H29 | 1 | RAINGAGE | 0.020 | 0.251 | 0.533 | 0.039 | 2.0 | 0.40 | 0.10 | 4.50 | 0.60 | 0.0018 | 0.00 | 0.04 | 0.02 | 1.75 |

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

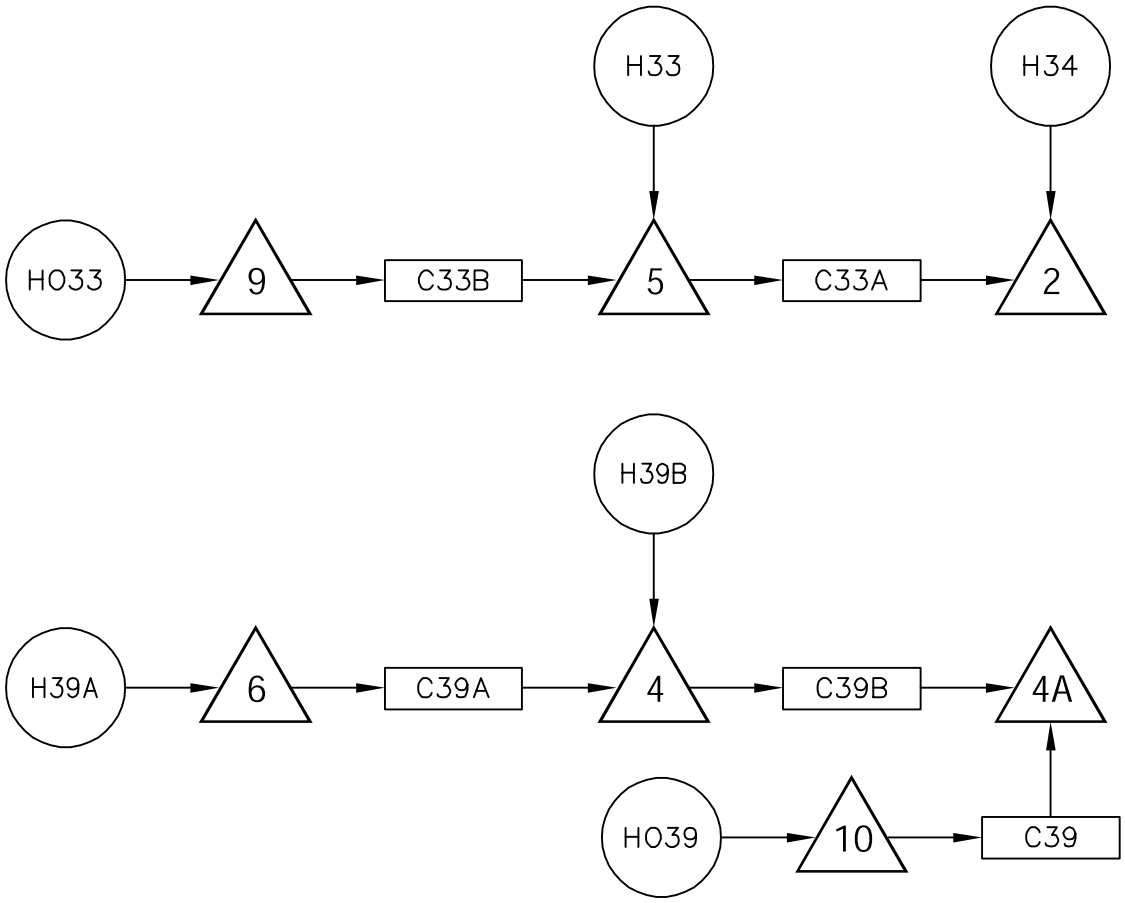
| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| 18B-1 | | 0.089 | 0.118 | 20.2 | 2.13 | 10.5 | 1.51 | 3.6 | 51 | 80,405 | 0.48 | 38,385 | 32.0 | 12 | 38,380 | 0.56 |
| 19A | | 0.105 | 0.028 | 10.7 | 0.53 | 5.6 | 0.37 | 0.9 | 9 | 7,805 | 0.24 | 1,862 | 30.0 | 1 | 1,845 | 0.46 |
| 29 | | 0.082 | 0.088 | 11.0 | 1.04 | 5.7 | 0.74 | 1.7 | 37 | 31,726 | 0.65 | 20,604 | 30.0 | 9 | 20,579 | 1.07 |
| 33A | | 0.089 | 0.145 | 12.2 | 1.66 | 6.4 | 1.18 | 2.8 | 133 | 126,324 | 0.48 | 60,758 | 30.0 | 27 | 60,717 | 0.77 |
| 33B | | 0.093 | 0.140 | 17.0 | 2.13 | 8.8 | 1.51 | 3.5 | 107 | 141,425 | 0.40 | 56,948 | 31.0 | 21 | 56,933 | 0.54 |
| 33C | | 0.094 | 0.113 | 20.7 | 2.10 | 10.8 | 1.49 | 3.5 | 61 | 97,466 | 0.38 | 36,683 | 32.0 | 12 | 36,674 | 0.44 |
| 33D | | 0.092 | 0.114 | 15.6 | 1.67 | 8.1 | 1.18 | 2.8 | 70 | 85,124 | 0.42 | 36,036 | 31.0 | 14 | 36,021 | 0.59 |
| 34 | | 0.089 | 0.128 | 20.0 | 2.26 | 10.4 | 1.60 | 3.8 | 63 | 97,937 | 0.46 | 45,465 | 32.0 | 15 | 45,463 | 0.55 |
| 37 | | 0.087 | 0.136 | 20.2 | 2.40 | 10.5 | 1.70 | 4.0 | 65 | 102,366 | 0.51 | 52,198 | 32.0 | 17 | 52,196 | 0.59 |
| 39A-1 | | 0.088 | 0.177 | 14.8 | 2.31 | 7.7 | 1.63 | 3.9 | 164 | 188,216 | 0.50 | 93,999 | 31.0 | 37 | 93,978 | 0.72 |
| 39A-2 | | 0.091 | 0.182 | 10.6 | 1.79 | 5.5 | 1.26 | 3.0 | 282 | 232,465 | 0.44 | 101,298 | 30.0 | 49 | 101,250 | 0.76 |
| 39B-1 | | 0.095 | 0.116 | 15.8 | 1.71 | 8.2 | 1.21 | 2.9 | 90 | 110,207 | 0.36 | 39,569 | 31.0 | 15 | 39,549 | 0.51 |
| 39B-2 | | 0.158 | 0.077 | 27.3 | 1.91 | 14.2 | 1.35 | 3.2 | 19 | 41,092 | 0.01 | 516 | 35.0 | 0 | 516 | 0.02 |
| 39B-3 | | 0.104 | 0.042 | 39.7 | 1.59 | 20.7 | 1.12 | 2.7 | 6 | 19,058 | 0.24 | 4,656 | 39.0 | 1 | 4,656 | 0.19 |
| O33A | | 0.119 | 0.082 | 21.5 | 1.65 | 11.2 | 1.17 | 2.7 | 48 | 79,098 | 0.14 | 10,748 | 32.0 | 4 | 10,746 | 0.18 |
| O33B | | 0.119 | 0.066 | 17.7 | 1.20 | 9.2 | 0.85 | 2.0 | 36 | 49,550 | 0.13 | 6,604 | 31.0 | 3 | 6,604 | 0.21 |
| HO39 | | 0.158 | 0.063 | 17.0 | 1.12 | 8.9 | 0.79 | 1.9 | 20 | 26,463 | 0.01 | 311 | 31.0 | 0 | 311 | 0.02 |

Proposed 2-yr Conditions

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| 18B-1 | 7A | RAINGAGE-2YR | 0.035 | 0.139 | 0.225 | 0.010 | 51.0 | 0.35 | 0.10 | 3.97 | 0.56 | 0.0018 | 0.00 | 0.86 | 0.23 | 48.57 |
| 19A | 8 | RAINGAGE-2YR | 0.003 | 0.013 | 0.061 | 0.075 | 28.0 | 0.35 | 0.10 | 3.99 | 0.57 | 0.0018 | 0.00 | 0.56 | 0.16 | 24.49 |
| 29 | 1A | RAINGAGE-2YR | 0.014 | 0.090 | 0.177 | 0.078 | 68.0 | 0.35 | 0.10 | 4.50 | 0.60 | 0.0018 | 0.00 | 0.92 | 0.29 | 65.94 |
| 33A | 5 | RAINGAGE-2YR | 0.054 | 0.119 | 0.284 | 0.040 | 51.0 | 0.35 | 0.10 | 3.60 | 0.54 | 0.0018 | 0.00 | 0.86 | 0.23 | 48.71 |
| 33B | 5 | RAINGAGE-2YR | 0.061 | 0.161 | 0.333 | 0.035 | 44.0 | 0.35 | 0.10 | 4.39 | 0.59 | 0.0018 | 0.00 | 0.82 | 0.21 | 41.25 |
| 33C | 12 | RAINGAGE-2YR | 0.042 | 0.154 | 0.322 | 0.034 | 41.0 | 0.35 | 0.10 | 3.94 | 0.56 | 0.0018 | 0.00 | 0.81 | 0.20 | 38.41 |
| 33D | 11 | RAINGAGE-2YR | 0.037 | 0.085 | 0.317 | 0.028 | 46.0 | 0.35 | 0.10 | 4.34 | 0.59 | 0.0018 | 0.00 | 0.83 | 0.22 | 43.31 |
| 34 | 5A | RAINGAGE-2YR | 0.042 | 0.118 | 0.379 | 0.016 | 50.0 | 0.35 | 0.10 | 4.35 | 0.59 | 0.0018 | 0.00 | 0.85 | 0.23 | 47.40 |
| 37 | 3A | RAINGAGE-2YR | 0.044 | 0.129 | 0.352 | 0.011 | 54.0 | 0.35 | 0.10 | 3.79 | 0.55 | 0.0018 | 0.00 | 0.87 | 0.25 | 51.74 |
| 39A-1 | 13 | RAINGAGE-2YR | 0.081 | 0.162 | 0.396 | 0.027 | 53.0 | 0.35 | 0.10 | 3.81 | 0.55 | 0.0018 | 0.00 | 0.87 | 0.24 | 50.69 |
| 39A-2 | 6 | RAINGAGE-2YR | 0.100 | 0.099 | 0.359 | 0.034 | 47.0 | 0.35 | 0.10 | 4.05 | 0.57 | 0.0018 | 0.00 | 0.84 | 0.22 | 44.44 |
| 39B-1 | 6A | RAINGAGE-2YR | 0.047 | 0.107 | 0.239 | 0.026 | 39.0 | 0.35 | 0.10 | 3.60 | 0.54 | 0.0018 | 0.00 | 0.78 | 0.20 | 36.41 |
| 39B-2 | 4A | RAINGAGE-2YR | 0.018 | 0.091 | 0.210 | 0.070 | 2.0 | 0.35 | 0.10 | 4.50 | 0.60 | 0.0018 | 0.00 | 0.04 | 0.02 | 1.40 |
| 39B-3 | 6A | RAINGAGE-2YR | 0.008 | 0.092 | 0.237 | 0.040 | 29.0 | 0.35 | 0.10 | 4.37 | 0.59 | 0.0018 | 0.00 | 0.58 | 0.17 | 25.31 |
| O33A | 9 | RAINGAGE-2YR | 0.034 | 0.095 | 0.189 | 0.040 | 17.0 | 0.35 | 0.10 | 3.77 | 0.55 | 0.0018 | 0.00 | 0.34 | 0.12 | 13.96 |
| O33B | 9A | RAINGAGE-2YR | 0.021 | 0.051 | 0.152 | 0.040 | 17.0 | 0.35 | 0.10 | 4.04 | 0.57 | 0.0018 | 0.00 | 0.34 | 0.12 | 13.84 |
| HO39 | 10 | RAINGAGE-2YR | 0.011 | 0.038 | 0.107 | 0.051 | 2.0 | 0.40 | 0.10 | 4.29 | 0.59 | 0.0018 | 0.00 | 0.00 | 0.02 | 1.40 |

# EXISTING SWMM DIAGRAMS



```
[TITLE]
;;Project Title/Notes
Trails at Overland Ridge
Existing Conditions
2-yr

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2005
START_TIME           00:00:00
REPORT_START_DATE    01/01/2005
REPORT_START_TIME    00:00:00
END_DATE             01/01/2005
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:00:30

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
```

```
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5

[FILES]
;;Interfacing Files
USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Existing\Output\BF-SWMM-Ex-2.txt"

[EVAPORATION]
;;Evap Data      Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[JUNCTIONS]
;;Junction       Invert     Dmax       Dinit      Dsurch     Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
9                6144       0          0          0          0
5                6066       0          0          0          0
6                6064       0          0          0          0
4                6028       0          0          0          0
10               6087       0          0          0          0

[OUTFALLS]
;;Outfall        Invert     Type       Stage Data       Gated
;;-------------- ---------- ---------- ---------------- --------
4A               6026       FREE                        NO
2                6034       FREE                        NO

[CONDUITS]
;;Conduit        From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow

;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
C33B             9                5                2075       0.05       0          0          0          0

C33A             5                2                1095       .05        13         0          0          0
```

```
C39A             6                4                1515       .05        0          0          0          0

C39B             4                4A               135        .05        0          0          0          0

C39              10               4A               1345       .05        0          0          0          0


[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C33B             TRAPEZOIDAL  15               20         8          8          1
C33A             IRREGULAR    C33A             0          0          0          1
C39A             TRAPEZOIDAL  20               25         10         10         1
C39B             TRAPEZOIDAL  20               20         9          9          1
C39              IRREGULAR    C39B             0          0          0          1

[TRANSECTS]
;;Transect Data in HEC-1 format
;
NC .05      .05      .045
X1 C33A             6        84       103      0.0      0.0      0.0      0.0      0.0
GR 6070     0        6062     59       6048     84       6045.7   92       6052     103
GR 6070     260
;
NC .05      .05      .04
X1 C34              6        106      136      0.0      0.0      0.0      0.0      0.0
GR 6050     0        6038     68       6028     106      6027.5   114      6030     136
GR 6050     158
;
NC .05      .05      .04
X1 C39B             5        64       154      0.0      0.0      0.0      0.0      0.0
GR 6080     0        6072     64       6063     100      6074     154      6080     208

[LOSSES]
;;Link           Kin        Kout       Kavg       Flap Gate  SeepRate
;;-------------- ---------- ---------- ---------- ---------- ----------
```

```
[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
9                -3173.633          3236.501
5                -2440.889          4183.432
6                2482.079           2437.276
4                2517.921           4354.839
10               3987.455           5985.663
4A               2428.315           6541.219
2                -2213.262          5448.029

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)
--------------------------------------------------------------

Trails at Overland Ridge
Existing Conditions
2-yr

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

***************
Analysis Options
***************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ JAN-01-2005 00:00:00
Ending Date .............. JAN-01-2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Routing Time Step ........ 30.00 sec


*************************        Volume        Volume
Flow Routing Continuity       acre-feet      10^6 gal
*************************     ---------     ---------
```

```
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.000         0.000
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.643         0.209
External Outflow .........         0.664         0.216
Internal Outflow .........         0.000         0.000
Evaporation Loss .........         0.000         0.000
Seepage Loss .............         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -3.257


*******************************
Highest Flow Instability Indexes
*******************************
Link C39A2 (1)


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


******************
Node Depth Summary
******************

--------------------------------------------------------------------------
                              Average  Maximum  Maximum  Time of Max
```

| Node | Type | Depth Feet | Depth Feet | HGL Feet | Occurrence days | hr:min |
|---|---|---|---|---|---|---|
| 9 | JUNCTION | 0.01 | 0.10 | 6144.10 | 0 | 00:32 |
| 5 | JUNCTION | 13.21 | 13.66 | 6079.66 | 0 | 00:46 |
| 6 | JUNCTION | 0.02 | 0.08 | 6064.08 | 0 | 00:38 |
| 4 | JUNCTION | 0.03 | 0.14 | 6028.14 | 0 | 00:48 |
| 10 | JUNCTION | 0.03 | 0.13 | 6087.13 | 0 | 00:31 |
| 4A | OUTFALL | 0.03 | 0.14 | 6026.14 | 0 | 00:50 |
| 2 | OUTFALL | 0.17 | 0.66 | 6034.66 | 0 | 00:51 |

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

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Time of Max Occurrence days | hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| 9 | JUNCTION | 2.41 | 2.41 | 0 | 00:32 | 0.038 | 0.038 | 0.000 |
| 5 | JUNCTION | 2.84 | 3.88 | 0 | 00:46 | 0.0594 | 0.104 | 0.000 |
| 6 | JUNCTION | 1.76 | 1.76 | 0 | 00:38 | 0.0374 | 0.0374 | 0.000 |
| 4 | JUNCTION | 2.29 | 2.76 | 0 | 00:48 | 0.0436 | 0.0832 | 0.000 |
| 10 | JUNCTION | 0.17 | 0.17 | 0 | 00:31 | 0.00232 | 0.00232 | 0.000 |
| 4A | OUTFALL | 0.00 | 2.87 | 0 | 00:50 | 0 | 0.0848 | 0.000 |
| 2 | OUTFALL | 1.24 | 4.87 | 0 | 00:49 | 0.0286 | 0.131 | 0.000 |

**********
Node Surcharge Summary
**********

No nodes were surcharged.

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

No nodes were flooded.

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

| Outfall Node | Flow Freq Pcnt | Avg Flow CFS | Max Flow CFS | Total Volume 10^6 gal |
|---|---|---|---|---|
| 4A | 42.72 | 1.23 | 2.87 | 0.085 |
| 2 | 55.34 | 1.47 | 4.87 | 0.131 |
| System | 49.03 | 2.70 | 7.73 | 0.216 |

**********
Link Flow Summary
**********

| Link | Type | Maximum \|Flow\| CFS | Time of Max Occurrence days hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|
| C33B | CONDUIT | 1.64 | 0 00:55 | 1.17 | 0.00 | 0.00 |
| C33A | CHANNEL | 3.84 | 0 00:51 | 3.44 | 0.00 | 0.03 |
| C39A1 | CONDUIT | 1.27 | 0 01:00 | 0.83 | 0.00 | 0.00 |
| C39A2 | CONDUIT | 2.75 | 0 00:50 | 0.93 | 0.00 | 0.01 |
| C39B | CHANNEL | 0.11 | 0 00:48 | 2.67 | 0.00 | 0.01 |

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

No conduits were surcharged.


Analysis begun on:  Thu Dec 16 17:51:45 2021
Analysis ended on:  Thu Dec 16 17:51:45 2021
Total elapsed time: < 1 sec
```

```
[TITLE]
;;Project Title/Notes
Trails at Overland Ridge
Existing Conditions
100-yr

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2005
START_TIME           00:00:00
REPORT_START_DATE    01/01/2005
REPORT_START_TIME    00:00:00
END_DATE             01/01/2005
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:00:30

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
```

```
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5

[FILES]
;;Interfacing Files
USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Existing\Output\BF-SWMM-Ex-100.txt"

[EVAPORATION]
;;Evap Data      Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[JUNCTIONS]
;;Junction       Invert     Dmax       Dinit      Dsurch     Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
9                6144       0          0          0          0
5                6066       0          0          0          0
6                6064       0          0          0          0
4                6028       0          0          0          0
10               6087       0          0          0          0

[OUTFALLS]
;;Outfall        Invert     Type       Stage Data       Gated
;;-------------- ---------- ---------- ---------------- --------
4A               6026       FREE                        NO
2                6034       FREE                        NO

[CONDUITS]
;;Conduit        From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow

;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----------
C33B             9                5                2075       0.05       0          0          0          0

C33A             5                2                1095       .05        13         0          0          0
```

```
C39A             6                4                1515       .05        0          0          0          0

C39B             4                4A               135        .05        0          0          0          0

C39              10               4A               1345       .05        0          0          0          0


[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C33B             TRAPEZOIDAL  15               20         8          8          1
C33A             IRREGULAR    C33A             0          0          0          1
C39A             TRAPEZOIDAL  20               25         10         10         1
C39B             TRAPEZOIDAL  20               20         9          9          1
C39              IRREGULAR    C39B             0          0          0          1

[TRANSECTS]
;;Transect Data in HEC-1 format
;
NC .05      .05      .045
X1 C33A             6        84       103      0.0      0.0      0.0      0.0      0.0
GR 6070     0        6062     59       6048     84       6045.7   92       6052     103
GR 6070     260
;
NC .05      .05      .04
X1 C34              6        106      136      0.0      0.0      0.0      0.0      0.0
GR 6050     0        6038     68       6028     106      6027.5   114      6030     136
GR 6050     158
;
NC .05      .05      .04
X1 C39B             5        64       154      0.0      0.0      0.0      0.0      0.0
GR 6080     0        6072     64       6063     100      6074     154      6080     208

[LOSSES]
;;Link           Kin        Kout       Kavg       Flap Gate  SeepRate
;;-------------- ---------- ---------- ---------- ---------- ----------
```

```
[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
9                -3173.633          3236.501
5                -2440.889          4183.432
6                2482.079           2437.276
4                2517.921           4354.839
10               3987.455           5985.663
4A               2428.315           6541.219
2                -2213.262          5448.029

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)
--------------------------------------------------------------

Trails at Overland Ridge
Existing Conditions
100-yr

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

***************
Analysis Options
***************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ JAN-01-2005 00:00:00
Ending Date .............. JAN-01-2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Routing Time Step ........ 30.00 sec


*************************        Volume        Volume
Flow Routing Continuity       acre-feet      10^6 gal
*************************     ---------     ---------
```

```
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........        43.473         14.166
External Outflow .........        43.691         14.237
Internal Outflow .........         0.000          0.000
Evaporation Loss .........         0.000          0.000
Seepage Loss .............         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.000          0.000
Continuity Error (%) .....        -0.502


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


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


******************
Node Depth Summary
******************

---------------------------------------------------------------------------
                              Average  Maximum  Maximum  Time of Max
```

| Node | Type | Depth Feet | Depth Feet | HGL Feet | Occurrence days | Occurrence hr:min |
|---|---|---|---|---|---|---|
| 9 | JUNCTION | 0.12 | 0.75 | 6144.75 | 0 | 00:37 |
| 5 | JUNCTION | 13.77 | 16.10 | 6082.10 | 0 | 00:44 |
| 6 | JUNCTION | 0.19 | 0.94 | 6064.94 | 0 | 00:43 |
| 4 | JUNCTION | 0.38 | 1.79 | 6029.79 | 0 | 00:46 |
| 10 | JUNCTION | 0.16 | 0.89 | 6087.89 | 0 | 00:36 |
| 4A | OUTFALL | 0.38 | 1.79 | 6027.79 | 0 | 00:47 |
| 2 | OUTFALL | 0.74 | 3.10 | 6037.10 | 0 | 00:46 |

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

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Time of Max Occurrence days | Time of Max Occurrence hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| 9 | JUNCTION | 81.22 | 81.22 | 0 | 00:37 | 1.51 | 1.51 | 0.000 |
| 5 | JUNCTION | 149.00 | 225.37 | 0 | 00:44 | 3.59 | 5.13 | 0.000 |
| 6 | JUNCTION | 121.17 | 121.17 | 0 | 00:43 | 2.98 | 2.98 | 0.000 |
| 4 | JUNCTION | 155.98 | 269.32 | 0 | 00:46 | 3.47 | 6.48 | 0.000 |
| 10 | JUNCTION | 16.54 | 16.54 | 0 | 00:36 | 0.291 | 0.291 | 0.000 |
| 4A | OUTFALL | 0.00 | 284.84 | 0 | 00:46 | 0 | 6.77 | 0.000 |
| 2 | OUTFALL | 87.55 | 312.49 | 0 | 00:46 | 2.33 | 7.46 | 0.000 |

**********
Node Surcharge Summary
**********

No nodes were surcharged.

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

No nodes were flooded.

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

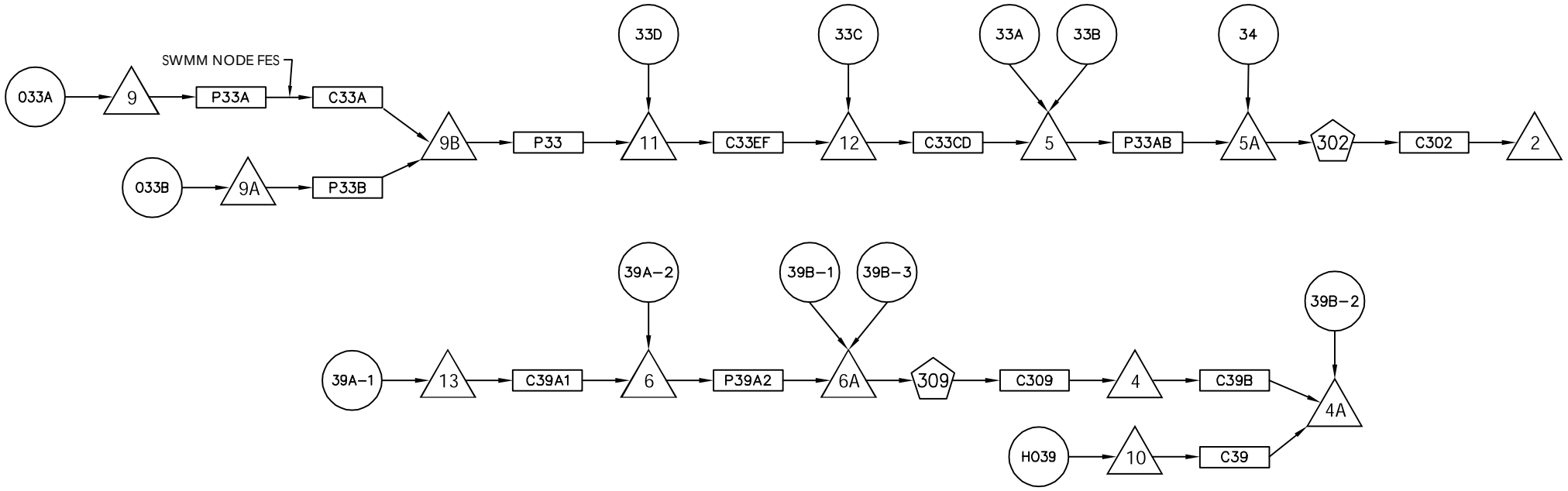
| Outfall Node | Flow Freq Pcnt | Avg Flow CFS | Max Flow CFS | Total Volume 10^6 gal |
|---|---|---|---|---|
| 4A | 64.22 | 65.19 | 284.84 | 6.773 |
| 2 | 64.63 | 71.37 | 312.49 | 7.463 |
| System | 64.42 | 136.56 | 597.14 | 14.236 |

**********
Link Flow Summary
**********

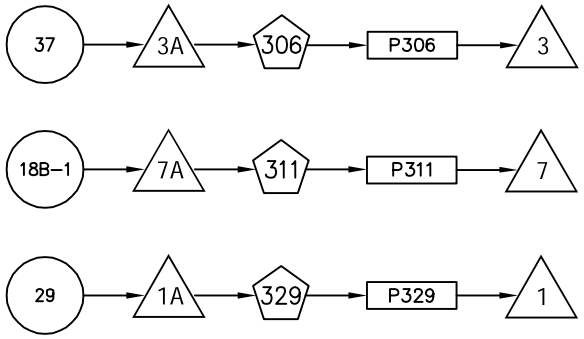
| Link | Type | Maximum \|Flow\| CFS | Time of Max Occurrence days hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|
| C33B | CONDUIT | 77.23 | 0 00:46 | 4.17 | 0.00 | 0.05 |
| C33A | CHANNEL | 225.11 | 0 00:46 | 9.16 | 0.00 | 0.13 |
| C39A1 | CONDUIT | 119.07 | 0 00:49 | 3.77 | 0.00 | 0.05 |
| C39A2 | CONDUIT | 269.30 | 0 00:47 | 4.16 | 0.00 | 0.09 |
| C39B | CHANNEL | 16.25 | 0 00:42 | 4.57 | 0.00 | 0.05 |

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

No conduits were surcharged.


Analysis begun on:  Thu Dec 16 17:26:41 2021
Analysis ended on:  Thu Dec 16 17:26:41 2021
Total elapsed time: < 1 sec
```

## PROPOSED SWMM DIAGRAMS




## PROPOSED SWMM DIAGRAMS



```
[TITLE]
;;Project Title/Notes
Trail at Overland Ranch
Proposed Conditions
2-yr

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2005
START_TIME           00:00:00
REPORT_START_DATE    01/01/2005
REPORT_START_TIME    00:00:00
END_DATE             01/01/2005
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:00:30

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
```

```
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5

[FILES]
;;Interfacing Files
USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Proposed\Output\BF-SWMM-Pr-2.txt"

[EVAPORATION]
;;Evap Data      Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[JUNCTIONS]
;;Junction       Invert     Dmax       Dinit      Dsurch     Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
9                6142       0          0          0          0
11               6110       0          0          0          0
12               6087       0          0          0          0
13               6090       0          0          0          0
6                6060       0          0          14         0
9A               6142       0          0          0          0
5                6066       0          0          16         0
3A               6080       0          0          0          0
306Out           6078       0          0          0          0
7A               6100       0          0          0          0
311Out           6098       0          0          0          0
1A               6080       0          0          0          0
329Out           6078       0          0          0          0
5A               6063       0          0          0          0
6A               6057       0          0          0          0
302Out           6061       0          0          0          0
4                6046       0          0          0          0
10               6090       0          0          0          0
FES              6148       0          0          0          0
9B               6131       0          0          0          0
```

```
[OUTFALLS]
;;Outfall         Invert     Type       Stage Data       Gated
;;-------------- ---------- ---------- ---------------- --------
3                6076       FREE                        NO
7                6093       FREE                        NO
1                6076.6     FREE                        NO
2                6059       FREE                        NO
4A               6044       FREE                        NO

[STORAGE]
;;Storage Node   Invert   Dmax     Dinit     Curve      Name/Params                  Aponded  Fevap    SeepRate
;;-------------- -------- -------- --------- ---------- ---------------------------- -------- -------- --------
306              6080     7        0         TABULAR    Pond306                      0        0        0
311              6100     7        0         TABULAR    Pond311                      0        0        0
329              6080     6        0         TABULAR    Pond329                      0        0        0
302              6063     8        0         TABULAR    Pond302                      0        0        0
309              6048     8        0         TABULAR    Pond309                      0        0        0

[CONDUITS]
;;Conduit         From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
P33A             9                FES              200        .013       10         0          0          0

C33EF            11               12               735        .05        0          0          0          0

C33CD            12               5                760        .05        0          0          0          0

C39A1            13               6                950        .05        0          0          0          0

P39A2            6                6A               300        .016       0          0          0          0

P33AB            5                5A               300        .016       0          0          0          0

P33B             9A               9B               455        .013       5          0          0          0
```

```
3A-Dum           3A              306             400        0.01       0          0          0          0

P306             306Out          3               50         .016       1          0          0          0

7A-Dum           7A              311             400        0.01       0          0          0          0

11               311Out          7               170        .016       1          0          0          0

1A-Dum           1A              329             400        0.01       0          0          0          0

14               329Out          1               70         .016       1          0          0          0

5A-Dum           5A              302             400        0.01       0          0          0          0

C302             302Out          2               70         .016       0          0          0          0

6A-Dum           6A              309             400        0.01       0          0          0          0

C39B             4               4A              100        .016       0          0          0          0

C39              10              4A              1260       0.01       0          0          0          0

C33A             FES             9B              600        .035       0          5          0          0

P33              9B              11              265        .013       0          10         0          0


[ORIFICES]
;;Orifice        From Node       To Node         Type         CrestHt    Qcoeff     Gated    CloseTime
;;-------------- --------------- --------------- ------------ ---------- ---------- -------- ----------
306-Orif         306             306Out          SIDE         0          0.65       NO       0
311-Orif         311             311Out          SIDE         0          0.65       NO       0
329-Orif         329             329Out          SIDE         0          0.65       NO       0
309-Orif         309             4               SIDE         0          0.65       NO       0
302-Orif         302             302Out          SIDE         0          0.65       NO       0
```

```
[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
P33A             CIRCULAR     2.5              0          0          0          1
C33EF            IRREGULAR    C33EF            0          0          0          1
C33CD            IRREGULAR    C33EF            0          0          0          1
C39A1            IRREGULAR    C39A1A           0          0          0          1
P39A2            RECT_OPEN    7                6          0          0          1
P33AB            RECT_OPEN    7                7          0          0          1
P33B             CIRCULAR     2                0          0          0          1
3A-Dum           DUMMY        0                0          0          0          1
P306             CIRCULAR     2.5              0          0          0          1
7A-Dum           DUMMY        0                0          0          0          1
11               CIRCULAR     3                0          0          0          1
1A-Dum           DUMMY        0                0          0          0          1
14               CIRCULAR     1.5              0          0          0          1
5A-Dum           DUMMY        0                0          0          0          1
C302             CIRCULAR     4                0          0          0          1
6A-Dum           DUMMY        0                0          0          0          1
C39B             IRREGULAR    C39A1A           0          0          0          1
C39              IRREGULAR    C39B             0          0          0          1
C33A             TRAPEZOIDAL  2                5          4          4          1
P33              CIRCULAR     3                0          0          0          1
306-Orif         CIRCULAR     .15              0          0          0
311-Orif         CIRCULAR     .15              0          0          0
329-Orif         CIRCULAR     .15              0          0          0
309-Orif         CIRCULAR     .15              0          0          0
302-Orif         CIRCULAR     .15              0          0          0

[TRANSECTS]
;;Transect Data in HEC-1 format
;
NC .05      .05      .045
X1 C33EF            6        84       103      0.0      0.0      0.0      0.0      0.0
GR 6070     0        6062     59       6048     84       6045.7   92       6052     103
GR 6070     260
;
```

```
NC .05      .05      .04
X1 C34              6        106      136      0.0      0.0      0.0      0.0      0.0
GR 6050     0        6038     68       6028     106      6027.5   114      6030     136
GR 6050     158
;
NC .05      .05      .04
X1 C39B             5        64       154      0.0      0.0      0.0      0.0      0.0
GR 6080     0        6072     64       6063     100      6074     154      6080     208
;
NC .05      .05      .045
X1 C39A1A           6        95       135      0.0      0.0      0.0      0.0      0.0
GR 6084     0        6078     65       6071     95       6070     115      6074     135
GR 6084     235

[LOSSES]
;;Link           Kin        Kout       Kavg       Flap Gate  SeepRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[CURVES]
;;Curve          Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Pond306          Storage    0          0
Pond306                     7          51500
;
Pond311          Storage    0          0
Pond311                     7          45000
;
Pond329          Storage    0          0
Pond329                     6          80000
;
Pond309          Storage    0          0
Pond309                     8          200000
;
Pond302          Storage    0          0
Pond302                     8          250000

[REPORT]
```

```
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
9                -3897.849          2329.749
11               -2440.889          4183.432
12               -2213.262          5448.029
13               1693.548           3835.125
6                1980.287           5197.133
9A               -2051.971          2311.828
5                -1998.208          6917.563
3A               5188.172           6810.036
306Out           8037.634           6845.878
7A               5188.172           5591.398
311Out           8091.398           5573.477
1A               5152.330           4390.681
329Out           8091.398           4390.681
5A               -1890.681          7939.068
6A               2159.498           6415.771
302Out           -313.620           9372.760
4                3270.609           8405.018
10               4166.667           7813.620
FES              -3575.269          2885.305
9B               -2267.025          3333.333
3                9740.143           6845.878
```

```
7               9686.380          5609.319
1               9632.616          4426.523
2               672.043           9032.258
4A              4704.301          8817.204
306             6729.391          6810.036
311             6657.706          5573.477
329             6675.627          4390.681
302             -1102.151         8476.703
309             2589.606          7634.409

[VERTICES]
;;Link          X-Coord           Y-Coord
;;--------------- ------------------ ------------------
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)
--------------------------------------------------------------

Trail at Overland Ranch
Proposed Conditions
2-yr
WARNING 04: minimum elevation drop used for Conduit 3A-Dum
WARNING 04: minimum elevation drop used for Conduit 7A-Dum
WARNING 04: minimum elevation drop used for Conduit 1A-Dum
WARNING 04: minimum elevation drop used for Conduit 5A-Dum

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

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ JAN-01-2005 00:00:00
Ending Date .............. JAN-01-2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Routing Time Step ........ 30.00 sec
```

| Flow Routing Continuity | Volume acre-feet | Volume 10^6 gal |
|---|---|---|
| Dry Weather Inflow ..... | 0.000 | 0.000 |
| Wet Weather Inflow ..... | 0.000 | 0.000 |
| Groundwater Inflow ..... | 0.000 | 0.000 |
| RDII Inflow ..... | 0.000 | 0.000 |
| External Inflow ..... | 13.879 | 4.523 |
| External Outflow ..... | 0.393 | 0.128 |
| Internal Outflow ..... | 0.000 | 0.000 |
| Evaporation Loss ..... | 0.000 | 0.000 |
| Seepage Loss ..... | 0.000 | 0.000 |
| Initial Stored Volume .... | 0.000 | 0.000 |
| Final Stored Volume ..... | 13.495 | 4.398 |
| Continuity Error (%) ..... | -0.065 | |

**Highest Flow Instability Indexes**

Link C39A1 (1)
Link P39A2 (1)
Link P33AB (1)

**Routing Time Step Summary**

| | | |
|---|---|---|
| Minimum Time Step | : | 30.00 sec |
| Average Time Step | : | 30.00 sec |
| Maximum Time Step | : | 30.00 sec |
| Percent in Steady State | : | 0.00 |
| Average Iterations per Step | : | 1.02 |
| Percent Not Converging | : | 0.00 |

**********
Node Depth Summary
**********

| Node | Type | Average Depth Feet | Maximum Depth Feet | Maximum HGL Feet | Time of Max Occurrence days hr:min |
|---|---|---|---|---|---|
| 9 | JUNCTION | 10.09 | 10.44 | 6152.44 | 0 00:32 |
| 11 | JUNCTION | 10.10 | 10.45 | 6120.45 | 0 00:35 |
| 12 | JUNCTION | 0.41 | 1.61 | 6088.61 | 0 00:34 |
| 13 | JUNCTION | 0.20 | 0.91 | 6090.91 | 0 00:31 |
| 6 | JUNCTION | 0.25 | 1.48 | 6061.48 | 0 00:32 |
| 9A | JUNCTION | 5.06 | 5.35 | 6147.35 | 0 00:31 |
| 5 | JUNCTION | 0.40 | 1.61 | 6067.61 | 0 00:37 |
| 3A | JUNCTION | 0.00 | 0.00 | 6080.00 | 0 00:00 |
| 306Out | JUNCTION | 1.08 | 1.09 | 6079.09 | 0 02:48 |
| 7A | JUNCTION | 0.00 | 0.00 | 6100.00 | 0 00:00 |
| 311Out | JUNCTION | 1.08 | 1.09 | 6099.09 | 0 02:45 |
| 1A | JUNCTION | 0.00 | 0.00 | 6080.00 | 0 00:00 |
| 329Out | JUNCTION | 1.09 | 1.09 | 6079.09 | 0 02:21 |
| 5A | JUNCTION | 0.22 | 1.23 | 6064.23 | 0 00:34 |
| 6A | JUNCTION | 0.23 | 1.48 | 6058.48 | 0 00:32 |
| 302Out | JUNCTION | 0.09 | 0.09 | 6061.09 | 0 03:06 |
| 4 | JUNCTION | 0.09 | 0.10 | 6046.10 | 0 03:03 |
| 10 | JUNCTION | 0.03 | 0.14 | 6090.14 | 0 00:31 |
| FES | JUNCTION | 0.09 | 0.44 | 6148.44 | 0 00:32 |
| 9B | JUNCTION | 5.05 | 5.28 | 6136.28 | 0 00:37 |
| 3 | OUTFALL | 0.08 | 0.09 | 6076.09 | 0 02:48 |
| 7 | OUTFALL | 0.08 | 0.09 | 6093.09 | 0 02:46 |
| 1 | OUTFALL | 0.09 | 0.09 | 6076.69 | 0 02:21 |
| 2 | OUTFALL | 0.09 | 0.09 | 6059.09 | 0 03:06 |
| 4A | OUTFALL | 0.08 | 0.09 | 6044.09 | 0 03:05 |
| 306 | STORAGE | 3.24 | 3.71 | 6083.71 | 0 02:48 |
| 311 | STORAGE | 2.96 | 3.39 | 6103.39 | 0 02:45 |
| 329 | STORAGE | 1.52 | 1.72 | 6081.72 | 0 02:21 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 302 | STORAGE | 3.51 | 4.01 | 6067.01 | 0 | 03:06 |
| 309 | STORAGE | 3.85 | 4.36 | 6052.36 | 0 | 03:03 |

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

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Time of Max Occurrence days hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|
| 9 | JUNCTION | 3.98 | 3.98 | 0 00:32 | 0.0804 | 0.0804 | 0.000 |
| 11 | JUNCTION | 13.89 | 19.85 | 0 00:32 | 0.269 | 0.399 | 0.000 |
| 12 | JUNCTION | 11.86 | 31.29 | 0 00:34 | 0.274 | 0.673 | -0.000 |
| 13 | JUNCTION | 37.19 | 37.19 | 0 00:31 | 0.703 | 0.703 | 0.000 |
| 6 | JUNCTION | 48.97 | 81.79 | 0 00:32 | 0.757 | 1.46 | 0.000 |
| 9A | JUNCTION | 2.83 | 2.83 | 0 00:31 | 0.0494 | 0.0494 | 0.000 |
| 5 | JUNCTION | 47.70 | 74.89 | 0 00:33 | 0.88 | 1.55 | 0.000 |
| 3A | JUNCTION | 16.77 | 16.77 | 0 00:32 | 0.39 | 0.39 | 0.000 |
| 306Out | JUNCTION | 0.00 | 0.18 | 0 02:48 | 0 | 0.0257 | 0.000 |
| 7A | JUNCTION | 12.36 | 12.36 | 0 00:32 | 0.287 | 0.287 | 0.000 |
| 311Out | JUNCTION | 0.00 | 0.17 | 0 02:45 | 0 | 0.0245 | 0.000 |
| 1A | JUNCTION | 9.33 | 9.33 | 0 00:30 | 0.154 | 0.154 | 0.000 |
| 329Out | JUNCTION | 0.00 | 0.12 | 0 02:21 | 0 | 0.0175 | 0.000 |
| 5A | JUNCTION | 14.78 | 89.43 | 0 00:34 | 0.34 | 1.89 | 0.000 |
| 6A | JUNCTION | 16.41 | 97.96 | 0 00:32 | 0.331 | 1.79 | 0.000 |
| 302Out | JUNCTION | 0.00 | 0.18 | 0 03:06 | 0 | 0.0268 | 0.000 |
| 4 | JUNCTION | 0.00 | 0.19 | 0 03:03 | 0 | 0.0281 | 0.000 |
| 10 | JUNCTION | 0.17 | 0.17 | 0 00:31 | 0.00232 | 0.00232 | 0.000 |
| FES | JUNCTION | 0.00 | 3.98 | 0 00:32 | 0 | 0.0803 | 0.000 |
| 9B | JUNCTION | 0.00 | 6.57 | 0 00:35 | 0 | 0.13 | 0.000 |
| 3 | OUTFALL | 0.00 | 0.18 | 0 02:48 | 0 | 0.0257 | 0.000 |
| 7 | OUTFALL | 0.00 | 0.17 | 0 02:46 | 0 | 0.0245 | 0.000 |
| 1 | OUTFALL | 0.00 | 0.12 | 0 02:21 | 0 | 0.0174 | 0.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2 | OUTFALL | 0.00 | 0.18 | 0 | 03:06 | 0 | 0.0267 | 0.000 |
| 4A | OUTFALL | 0.19 | 0.43 | 0 | 00:44 | 0.00386 | 0.0336 | 0.000 |
| 306 | STORAGE | 0.00 | 16.77 | 0 | 00:32 | 0 | 0.39 | -0.001 |
| 311 | STORAGE | 0.00 | 12.36 | 0 | 00:32 | 0 | 0.287 | -0.001 |
| 329 | STORAGE | 0.00 | 9.33 | 0 | 00:30 | 0 | 0.154 | -0.002 |
| 302 | STORAGE | 0.00 | 89.43 | 0 | 00:34 | 0 | 1.89 | -0.000 |
| 309 | STORAGE | 0.00 | 97.96 | 0 | 00:32 | 0 | 1.79 | -0.000 |

**********
Node Surcharge Summary
**********

Surcharging occurs when water rises above the top of the highest conduit.

| Node | Type | Hours Surcharged | Max. Height Above Crown Feet | Min. Depth Below Rim Feet |
|---|---|---|---|---|
| 3A | JUNCTION | 6.01 | 0.000 | 0.000 |
| 7A | JUNCTION | 6.01 | 0.000 | 0.000 |
| 1A | JUNCTION | 6.01 | 0.000 | 0.000 |
| 306 | STORAGE | 5.75 | 3.562 | 3.288 |
| 311 | STORAGE | 5.75 | 3.241 | 3.609 |
| 329 | STORAGE | 5.74 | 1.571 | 4.279 |
| 302 | STORAGE | 5.73 | 3.861 | 3.989 |
| 309 | STORAGE | 5.74 | 4.213 | 3.637 |

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

No nodes were flooded.

**********

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

| Storage Unit | Average Volume 1000 ft3 | Avg Pcnt Full | Evap Pcnt Loss | Infil Pcnt Loss | Maximum Volume 1000 ft3 | Max Pcnt Full | Time of Max Occurrence days hr:min | Maximum Outflow CFS |
|---|---|---|---|---|---|---|---|---|
| 306 | 41.991 | 23 | 0 | 0 | 50.692 | 28 | 0 02:48 | 0.18 |
| 311 | 30.553 | 19 | 0 | 0 | 36.966 | 23 | 0 02:44 | 0.17 |
| 329 | 16.620 | 7 | 0 | 0 | 19.748 | 8 | 0 02:20 | 0.12 |
| 302 | 210.440 | 21 | 0 | 0 | 251.359 | 25 | 0 03:05 | 0.18 |
| 309 | 201.200 | 25 | 0 | 0 | 237.949 | 30 | 0 03:03 | 0.19 |

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

| Outfall Node | Flow Freq Pcnt | Avg Flow CFS | Max Flow CFS | Total Volume 10^6 gal |
|---|---|---|---|---|
| 3 | 96.26 | 0.17 | 0.18 | 0.026 |
| 7 | 95.98 | 0.16 | 0.17 | 0.024 |
| 1 | 96.26 | 0.11 | 0.12 | 0.017 |
| 2 | 95.98 | 0.17 | 0.18 | 0.027 |
| 4A | 95.56 | 0.22 | 0.43 | 0.034 |
| System | 96.01 | 0.82 | 0.96 | 0.128 |

**********
Link Flow Summary
**********

| Link | Type | Maximum \|Flow\| CFS | Time of Max Occurrence days | hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|---|
| P33A | CONDUIT | 3.98 | 0 | 00:32 | 6.77 | 0.07 | 0.18 |
| C33EF | CHANNEL | 19.68 | 0 | 00:35 | 4.24 | 0.00 | 0.05 |
| C33CD | CHANNEL | 31.11 | 0 | 00:37 | 4.54 | 0.00 | 0.07 |
| C39A1 | CHANNEL | 36.17 | 0 | 00:34 | 13.75 | 0.00 | 0.06 |
| P39A2 | CONDUIT | 81.73 | 0 | 00:32 | 9.23 | 0.13 | 0.21 |
| P33AB | CONDUIT | 74.87 | 0 | 00:34 | 8.72 | 0.09 | 0.18 |
| P33B | CONDUIT | 2.81 | 0 | 00:32 | 7.67 | 0.07 | 0.17 |
| 3A-Dum | DUMMY | 16.77 | 0 | 00:32 | | | |
| P306 | CONDUIT | 0.18 | 0 | 02:48 | 3.34 | 0.00 | 0.03 |
| 7A-Dum | DUMMY | 12.36 | 0 | 00:32 | | | |
| 11 | CONDUIT | 0.17 | 0 | 02:46 | 2.66 | 0.00 | 0.03 |
| 1A-Dum | DUMMY | 9.33 | 0 | 00:30 | | | |
| 14 | CONDUIT | 0.12 | 0 | 02:21 | 2.63 | 0.01 | 0.06 |
| 5A-Dum | DUMMY | 89.43 | 0 | 00:34 | | | |
| C302 | CONDUIT | 0.18 | 0 | 03:06 | 2.45 | 0.00 | 0.02 |
| 6A-Dum | DUMMY | 97.96 | 0 | 00:32 | | | |
| C39B | CHANNEL | 0.19 | 0 | 03:05 | 1.75 | 0.00 | 0.01 |
| C39 | CHANNEL | 0.11 | 0 | 00:48 | 2.48 | 0.00 | 0.01 |
| C33A | CONDUIT | 3.90 | 0 | 00:37 | 2.30 | 0.02 | 0.14 |
| P33 | CONDUIT | 6.57 | 0 | 00:35 | 9.95 | 0.05 | 0.15 |
| 306-Orif | ORIFICE | 0.18 | 0 | 02:48 | | | 0.00 |
| 311-Orif | ORIFICE | 0.17 | 0 | 02:45 | | | 0.00 |
| 329-Orif | ORIFICE | 0.12 | 0 | 02:21 | | | 0.00 |
| 309-Orif | ORIFICE | 0.19 | 0 | 03:03 | | | 0.00 |
| 302-Orif | ORIFICE | 0.18 | 0 | 03:06 | | | 0.00 |

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

No conduits were surcharged.

```
Analysis begun on:  Sat Apr 16 18:06:06 2022
Analysis ended on:  Sat Apr 16 18:06:06 2022
Total elapsed time: < 1 sec
```

```
[TITLE]
;;Project Title/Notes
Trail at Overland Ranch
Proposed Conditions
100-yr

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2005
START_TIME           00:00:00
REPORT_START_DATE    01/01/2005
REPORT_START_TIME    00:00:00
END_DATE             01/01/2005
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:00:30

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
```

```
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5

[FILES]
;;Interfacing Files
USE INFLOWS "D:\Temp Projects\1002-98\Drainage Rpt\Calcs\CUHP\Proposed\Output\BF-SWMM-Pr-100.txt"

[EVAPORATION]
;;Evap Data      Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[JUNCTIONS]
;;Junction       Invert     Dmax       Dinit      Dsurch     Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
9                6142       0          0          0          0
11               6110       0          0          0          0
12               6087       0          0          0          0
13               6090       0          0          0          0
6                6060       0          0          14         0
9A               6142       0          0          0          0
5                6066       0          0          16         0
3A               6080       0          0          0          0
306Out           6078       0          0          0          0
7A               6100       0          0          0          0
311Out           6098       0          0          0          0
1A               6080       0          0          0          0
329Out           6078       0          0          0          0
5A               6063       0          0          0          0
6A               6057       0          0          0          0
302Out           6061       0          0          0          0
4                6046       0          0          0          0
10               6090       0          0          0          0
FES              6148       0          0          0          0
9B               6131       0          0          0          0
```

```
[OUTFALLS]
;;Outfall        Invert     Type       Stage Data       Gated
;;-------------- ---------- ---------- ---------------- --------
3                6076       FREE                        NO
7                6093       FREE                        NO
1                6076.6     FREE                        NO
2                6059       FREE                        NO
4A               6044       FREE                        NO

[STORAGE]
;;Storage Node   Invert   Dmax     Dinit     Curve      Name/Params                  Aponded  Fevap    SeepRate
;;-------------- -------- -------- --------- ---------- ---------------------------- -------- -------- --------
306              6080     7        0         TABULAR    Pond306                      0        0        0
311              6100     7        0         TABULAR    Pond311                      0        0        0
329              6080     6        0         TABULAR    Pond329                      0        0        0
302              6063     8        0         TABULAR    Pond302                      0        0        0
309              6048     8        0         TABULAR    Pond309                      0        0        0

[CONDUITS]
;;Conduit        From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
P33A             9                FES              200        .013       10         0          0          0

C33EF            11               12               735        .05        0          0          0          0

C33CD            12               5                760        .05        0          0          0          0

C39A1            13               6                950        .05        0          0          0          0

P39A2            6                6A               300        .016       0          0          0          0

P33AB            5                5A               300        .016       0          0          0          0

P33B             9A               9B               455        .013       5          0          0          0
```

```
3A-Dum           3A              306             400        0.01       0          0          0          0

P306             306Out          3               50         .016       1          0          0          0

7A-Dum           7A              311             400        0.01       0          0          0          0

11               311Out          7               170        .016       1          0          0          0

1A-Dum           1A              329             400        0.01       0          0          0          0

14               329Out          1               70         .016       1          0          0          0

5A-Dum           5A              302             400        0.01       0          0          0          0

C302             302Out          2               70         .016       0          0          0          0

6A-Dum           6A              309             400        0.01       0          0          0          0

C39B             4               4A              100        .016       0          0          0          0

C39              10              4A              1260       0.01       0          0          0          0

C33A             FES             9B              600        .035       0          5          0          0

P33              9B              11              265        .013       0          10         0          0


[ORIFICES]
;;Orifice        From Node       To Node         Type         CrestHt    Qcoeff     Gated    CloseTime
;;-------------- --------------- --------------- ------------ ---------- ---------- -------- ----------
306-Orif         306             306Out          SIDE         0          0.65       NO       0
311-Orif         311             311Out          SIDE         0          0.65       NO       0
329-Orif         329             329Out          SIDE         0          0.65       NO       0
309-Orif         309             4               SIDE         0          0.65       NO       0
302-Orif         302             302Out          SIDE         0          0.65       NO       0
```

```
[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
P33A             CIRCULAR     2.5              0          0          0          1
C33EF            IRREGULAR    C33EF            0          0          0          1
C33CD            IRREGULAR    C33EF            0          0          0          1
C39A1            IRREGULAR    C39A1A           0          0          0          1
P39A2            RECT_OPEN    7                6          0          0          1
P33AB            RECT_OPEN    7                7          0          0          1
P33B             CIRCULAR     2                0          0          0          1
3A-Dum           DUMMY        0                0          0          0          1
P306             CIRCULAR     2.5              0          0          0          1
7A-Dum           DUMMY        0                0          0          0          1
11               CIRCULAR     3                0          0          0          1
1A-Dum           DUMMY        0                0          0          0          1
14               CIRCULAR     1.5              0          0          0          1
5A-Dum           DUMMY        0                0          0          0          1
C302             CIRCULAR     4                0          0          0          1
6A-Dum           DUMMY        0                0          0          0          1
C39B             IRREGULAR    C39A1A           0          0          0          1
C39              IRREGULAR    C39B             0          0          0          1
C33A             TRAPEZOIDAL  2                5          4          4          1
P33              CIRCULAR     3                0          0          0          1
306-Orif         CIRCULAR     1.6              0          0          0
311-Orif         CIRCULAR     1.04             0          0          0
329-Orif         CIRCULAR     1.12             0          0          0
309-Orif         CIRCULAR     3.64             0          0          0
302-Orif         CIRCULAR     3.64             0          0          0

[TRANSECTS]
;;Transect Data in HEC-1 format
;
NC .05      .05      .045
X1 C33EF            6        84       103      0.0      0.0      0.0      0.0      0.0
GR 6070     0        6062     59       6048     84       6045.7   92       6052     103
GR 6070     260
;
```

```
NC .05      .05      .04
X1 C34              6        106      136      0.0      0.0      0.0      0.0      0.0
GR 6050     0        6038     68       6028     106      6027.5   114      6030     136
GR 6050     158
;
NC .05      .05      .04
X1 C39B             5        64       154      0.0      0.0      0.0      0.0      0.0
GR 6080     0        6072     64       6063     100      6074     154      6080     208
;
NC .05      .05      .045
X1 C39A1A           6        95       135      0.0      0.0      0.0      0.0      0.0
GR 6084     0        6078     65       6071     95       6070     115      6074     135
GR 6084     235

[LOSSES]
;;Link           Kin        Kout       Kavg       Flap Gate  SeepRate
;;-------------- ---------- ---------- ---------- ---------- ----------

[CURVES]
;;Curve          Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Pond306          Storage    0          0
Pond306                     7          51500
;
Pond311          Storage    0          0
Pond311                     7          45000
;
Pond329          Storage    0          0
Pond329                     6          80000
;
Pond309          Storage    0          0
Pond309                     8          200000
;
Pond302          Storage    0          0
Pond302                     8          250000

[REPORT]
```

```
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
9                -3897.849          2329.749
11               -2440.889          4183.432
12               -2213.262          5448.029
13               1693.548           3835.125
6                1980.287           5197.133
9A               -2051.971          2311.828
5                -1998.208          6917.563
3A               5188.172           6810.036
306Out           8037.634           6845.878
7A               5188.172           5591.398
311Out           8091.398           5573.477
1A               5152.330           4390.681
329Out           8091.398           4390.681
5A               -1890.681          7939.068
6A               2159.498           6415.771
302Out           -313.620           9372.760
4                3270.609           8405.018
10               4166.667           7813.620
FES              -3575.269          2885.305
9B               -2267.025          3333.333
3                9740.143           6845.878
```

```
7                9686.380           5609.319
1                9632.616           4426.523
2                672.043            9032.258
4A               4704.301           8817.204
306              6729.391           6810.036
311              6657.706           5573.477
329              6675.627           4390.681
302              -1102.151          8476.703
309              2589.606           7634.409

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.006)
--------------------------------------------------------------

Trail at Overland Ranch
Proposed Conditions
100-yr
WARNING 04: minimum elevation drop used for Conduit 3A-Dum
WARNING 04: minimum elevation drop used for Conduit 7A-Dum
WARNING 04: minimum elevation drop used for Conduit 1A-Dum
WARNING 04: minimum elevation drop used for Conduit 5A-Dum

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

***************
Analysis Options
***************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ JAN-01-2005 00:00:00
Ending Date .............. JAN-01-2005 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Routing Time Step ........ 30.00 sec
```

| Flow Routing Continuity | Volume acre-feet | Volume 10^6 gal |
|---|---|---|
| Dry Weather Inflow ..... | 0.000 | 0.000 |
| Wet Weather Inflow ..... | 0.000 | 0.000 |
| Groundwater Inflow ..... | 0.000 | 0.000 |
| RDII Inflow ..... | 0.000 | 0.000 |
| External Inflow ..... | 71.685 | 23.360 |
| External Outflow ..... | 71.545 | 23.314 |
| Internal Outflow ..... | 0.000 | 0.000 |
| Evaporation Loss ..... | 0.000 | 0.000 |
| Seepage Loss ..... | 0.000 | 0.000 |
| Initial Stored Volume .... | 0.000 | 0.000 |
| Final Stored Volume ..... | 0.134 | 0.044 |
| Continuity Error (%) ..... | 0.009 | |

**Highest Flow Instability Indexes**

Link C302 (7)
Link P306 (2)
Link P33AB (1)
Link C39A1 (1)
Link 5A-Dum (1)

**Routing Time Step Summary**

| | | |
|---|---|---|
| Minimum Time Step | : | 30.00 sec |
| Average Time Step | : | 30.00 sec |
| Maximum Time Step | : | 30.00 sec |
| Percent in Steady State | : | 0.00 |
| Average Iterations per Step | : | 1.31 |
| Percent Not Converging | : | 0.00 |

**********
Node Depth Summary
**********

| Node | Type | Average Depth Feet | Maximum Depth Feet | Maximum HGL Feet | Time of Max Occurrence days | hr:min |
|---|---|---|---|---|---|---|
| 9 | JUNCTION | 10.32 | 11.75 | 6153.75 | 0 | 00:39 |
| 11 | JUNCTION | 10.31 | 11.69 | 6121.69 | 0 | 00:39 |
| 12 | JUNCTION | 0.76 | 3.32 | 6090.32 | 0 | 00:38 |
| 13 | JUNCTION | 0.34 | 1.61 | 6091.61 | 0 | 00:36 |
| 6 | JUNCTION | 0.65 | 4.86 | 6064.86 | 0 | 00:36 |
| 9A | JUNCTION | 5.22 | 6.37 | 6148.37 | 0 | 00:36 |
| 5 | JUNCTION | 0.83 | 4.44 | 6070.44 | 0 | 00:38 |
| 3A | JUNCTION | 0.00 | 0.00 | 6080.00 | 0 | 00:00 |
| 306Out | JUNCTION | 1.48 | 1.92 | 6079.92 | 0 | 01:26 |
| 7A | JUNCTION | 0.00 | 0.00 | 6100.00 | 0 | 00:00 |
| 311Out | JUNCTION | 1.55 | 1.65 | 6099.65 | 0 | 01:37 |
| 1A | JUNCTION | 0.00 | 0.00 | 6080.00 | 0 | 00:00 |
| 329Out | JUNCTION | 1.41 | 1.72 | 6079.72 | 0 | 01:12 |
| 5A | JUNCTION | 0.67 | 4.44 | 6067.44 | 0 | 00:38 |
| 6A | JUNCTION | 0.63 | 4.86 | 6061.86 | 0 | 00:36 |
| 302Out | JUNCTION | 1.42 | 2.35 | 6063.35 | 0 | 01:25 |
| 4 | JUNCTION | 0.89 | 1.57 | 6047.57 | 0 | 01:16 |
| 10 | JUNCTION | 0.17 | 0.93 | 6090.93 | 0 | 00:36 |
| FES | JUNCTION | 0.32 | 1.75 | 6149.75 | 0 | 00:39 |
| 9B | JUNCTION | 5.20 | 6.08 | 6137.08 | 0 | 00:41 |
| 3 | OUTFALL | 0.48 | 0.92 | 6076.92 | 0 | 01:26 |
| 7 | OUTFALL | 0.54 | 0.65 | 6093.65 | 0 | 01:37 |
| 1 | OUTFALL | 0.41 | 0.72 | 6077.32 | 0 | 01:13 |
| 2 | OUTFALL | 1.42 | 2.35 | 6061.35 | 0 | 01:25 |
| 4A | OUTFALL | 0.89 | 1.57 | 6045.57 | 0 | 01:17 |
| 306 | STORAGE | 2.35 | 5.79 | 6085.79 | 0 | 01:26 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 311 | STORAGE | 3.98 | 6.13 | 6106.13 | 0 | 01:37 |
| 329 | STORAGE | 1.18 | 2.64 | 6082.64 | 0 | 01:12 |
| 302 | STORAGE | 3.60 | 7.37 | 6070.37 | 0 | 01:25 |
| 309 | STORAGE | 3.05 | 7.41 | 6055.41 | 0 | 01:16 |

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

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Time of Max Occurrence days hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|
| 9 | JUNCTION | 48.68 | 48.68 | 0 00:39 | 1.04 | 1.04 | 0.000 |
| 11 | JUNCTION | 72.07 | 152.87 | 0 00:37 | 1.33 | 3.01 | 0.000 |
| 12 | JUNCTION | 68.43 | 220.85 | 0 00:38 | 1.49 | 4.5 | 0.000 |
| 13 | JUNCTION | 170.70 | 170.70 | 0 00:36 | 3.11 | 3.11 | 0.000 |
| 6 | JUNCTION | 246.43 | 409.29 | 0 00:36 | 3.67 | 6.78 | 0.000 |
| 9A | JUNCTION | 34.35 | 34.35 | 0 00:36 | 0.642 | 0.642 | 0.000 |
| 5 | JUNCTION | 239.11 | 451.12 | 0 00:38 | 4.24 | 8.74 | 0.000 |
| 3A | JUNCTION | 76.46 | 76.46 | 0 00:37 | 1.7 | 1.7 | 0.000 |
| 306Out | JUNCTION | 0.00 | 23.43 | 0 01:26 | 0 | 1.7 | 0.000 |
| 7A | JUNCTION | 59.13 | 59.13 | 0 00:37 | 1.31 | 1.31 | 0.000 |
| 311Out | JUNCTION | 0.00 | 10.50 | 0 01:37 | 0 | 1.27 | 0.000 |
| 1A | JUNCTION | 34.49 | 34.49 | 0 00:35 | 0.562 | 0.562 | 0.000 |
| 329Out | JUNCTION | 0.00 | 7.41 | 0 01:12 | 0 | 0.562 | 0.000 |
| 5A | JUNCTION | 71.97 | 522.88 | 0 00:38 | 1.56 | 10.3 | 0.000 |
| 6A | JUNCTION | 99.86 | 508.72 | 0 00:36 | 1.95 | 8.73 | 0.000 |
| 302Out | JUNCTION | 0.00 | 127.86 | 0 01:25 | 0 | 10.3 | 0.000 |
| 4 | JUNCTION | 0.00 | 128.29 | 0 01:16 | 0 | 8.73 | 0.000 |
| 10 | JUNCTION | 16.54 | 16.54 | 0 00:36 | 0.291 | 0.291 | 0.000 |
| FES | JUNCTION | 0.00 | 48.68 | 0 00:39 | 0 | 1.04 | 0.000 |
| 9B | JUNCTION | 0.00 | 82.40 | 0 00:39 | 0 | 1.68 | 0.000 |
| 3 | OUTFALL | 0.00 | 23.43 | 0 01:26 | 0 | 1.7 | 0.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7 | OUTFALL | 0.00 | 10.50 | 0 | 01:37 | 0 | 1.26 | 0.000 |
| 1 | OUTFALL | 0.00 | 7.41 | 0 | 01:13 | 0 | 0.562 | 0.000 |
| 2 | OUTFALL | 0.00 | 127.86 | 0 | 01:25 | 0 | 10.3 | 0.000 |
| 4A | OUTFALL | 19.26 | 151.19 | 0 | 00:59 | 0.462 | 9.49 | 0.000 |
| 306 | STORAGE | 0.00 | 76.46 | 0 | 00:37 | 0 | 1.7 | 0.016 |
| 311 | STORAGE | 0.00 | 59.13 | 0 | 00:37 | 0 | 1.31 | 0.011 |
| 329 | STORAGE | 0.00 | 34.49 | 0 | 00:35 | 0 | 0.562 | 0.066 |
| 302 | STORAGE | 0.00 | 522.88 | 0 | 00:38 | 0 | 10.3 | 0.026 |
| 309 | STORAGE | 0.00 | 508.72 | 0 | 00:36 | 0 | 8.73 | 0.023 |

**********
Node Surcharge Summary
**********

Surcharging occurs when water rises above the top of the highest conduit.

| Node | Type | Hours Surcharged | Max. Height Above Crown Feet | Min. Depth Below Rim Feet |
|---|---|---|---|---|
| 3A | JUNCTION | 6.01 | 0.000 | 0.000 |
| 7A | JUNCTION | 6.01 | 0.000 | 0.000 |
| 1A | JUNCTION | 6.01 | 0.000 | 0.000 |
| 306 | STORAGE | 3.12 | 4.189 | 1.211 |
| 311 | STORAGE | 5.60 | 5.095 | 0.865 |
| 329 | STORAGE | 2.92 | 1.518 | 3.362 |
| 302 | STORAGE | 2.91 | 3.729 | 0.631 |
| 309 | STORAGE | 2.47 | 3.766 | 0.594 |

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

No nodes were flooded.

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

| Storage Unit | Average Volume 1000 ft3 | Avg Pcnt Full | Evap Pcnt Loss | Infil Pcnt Loss | Maximum Volume 1000 ft3 | Max Pcnt Full | Time of Max Occurrence days hr:min | Maximum Outflow CFS |
|---|---|---|---|---|---|---|---|---|
| 306 | 38.397 | 21 | 0 | 0 | 123.292 | 68 | 0 01:25 | 23.43 |
| 311 | 60.525 | 38 | 0 | 0 | 120.985 | 77 | 0 01:37 | 10.50 |
| 329 | 15.287 | 6 | 0 | 0 | 46.411 | 19 | 0 01:12 | 7.41 |
| 302 | 302.425 | 30 | 0 | 0 | 848.467 | 85 | 0 01:24 | 127.86 |
| 309 | 207.448 | 26 | 0 | 0 | 685.724 | 86 | 0 01:16 | 128.29 |

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

| Outfall Node | Flow Freq Pcnt | Avg Flow CFS | Max Flow CFS | Total Volume 10^6 gal |
|---|---|---|---|---|
| 3 | 73.93 | 14.21 | 23.43 | 1.700 |
| 7 | 97.09 | 8.05 | 10.50 | 1.265 |
| 1 | 90.43 | 3.84 | 7.41 | 0.562 |
| 2 | 97.23 | 65.47 | 127.86 | 10.298 |
| 4A | 86.41 | 67.87 | 151.19 | 9.488 |
| System | 89.02 | 159.44 | 314.96 | 23.312 |

**********
Link Flow Summary

**********

| Link | Type | Maximum \|Flow\| CFS | Time of Max Occurrence days | hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|---|
| P33A | CONDUIT | 48.68 | 0 | 00:39 | 13.23 | 0.84 | 0.70 |
| C33EF | CHANNEL | 152.59 | 0 | 00:39 | 7.40 | 0.00 | 0.12 |
| C33CD | CHANNEL | 220.55 | 0 | 00:40 | 15.13 | 0.00 | 0.14 |
| C39A1 | CHANNEL | 169.47 | 0 | 00:38 | 13.78 | 0.01 | 0.11 |
| P39A2 | CONDUIT | 409.09 | 0 | 00:36 | 14.03 | 0.64 | 0.69 |
| P33AB | CONDUIT | 451.02 | 0 | 00:38 | 14.53 | 0.56 | 0.63 |
| P33B | CONDUIT | 34.31 | 0 | 00:36 | 15.04 | 0.81 | 0.68 |
| 3A-Dum | DUMMY | 76.46 | 0 | 00:37 | | | |
| P306 | CONDUIT | 23.43 | 0 | 01:26 | 14.37 | 0.29 | 0.37 |
| 7A-Dum | DUMMY | 59.13 | 0 | 00:37 | | | |
| 11 | CONDUIT | 10.50 | 0 | 01:37 | 9.29 | 0.10 | 0.22 |
| 1A-Dum | DUMMY | 34.49 | 0 | 00:35 | | | |
| 14 | CONDUIT | 7.41 | 0 | 01:13 | 8.80 | 0.47 | 0.48 |
| 5A-Dum | DUMMY | 522.88 | 0 | 00:38 | | | |
| C302 | CONDUIT | 127.86 | 0 | 01:25 | 16.69 | 0.65 | 0.59 |
| 6A-Dum | DUMMY | 508.72 | 0 | 00:36 | | | |
| C39B | CHANNEL | 128.29 | 0 | 01:17 | 4.53 | 0.01 | 0.11 |
| C39 | CHANNEL | 16.24 | 0 | 00:42 | 4.22 | 0.00 | 0.05 |
| C33A | CONDUIT | 48.66 | 0 | 00:41 | 4.86 | 0.27 | 0.54 |
| P33 | CONDUIT | 82.40 | 0 | 00:39 | 20.14 | 0.61 | 0.56 |
| 306-Orif | ORIFICE | 23.43 | 0 | 01:26 | | | 0.00 |
| 311-Orif | ORIFICE | 10.50 | 0 | 01:37 | | | 0.00 |
| 329-Orif | ORIFICE | 7.41 | 0 | 01:12 | | | 0.00 |
| 309-Orif | ORIFICE | 128.29 | 0 | 01:16 | | | 0.00 |
| 302-Orif | ORIFICE | 127.86 | 0 | 01:25 | | | 0.00 |

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

No conduits were surcharged.

Analysis begun on:  Sat Apr 16 18:02:45 2022
Analysis ended on:  Sat Apr 16 18:02:45 2022
Total elapsed time: < 1 sec

| Runoff Comparison Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Design Point | Existing | | | Proposed | | | |
| | | | | | Pre-Detention | | Detained |
| | Contrib. Basin | $Q_2$ | $Q_{100}$ | Contrib. Basin | $Q_2$ | $Q_{100}$ | $Q_{100}$ |
| 1 | H29 | 0.0 | 10.0 | 29 | 9.0 | 34.0 | 7.4 |
| 2 | H33, H34, HO33 | 4.9 | 312.5 | 33A, 33B, 33C, 33D, 34, O33A, 033B | 89.4 | 522.9 | 127.9 |
| 3 | H37 | 1.0 | 52.0 | 37 | 17.0 | 76.0 | 23.4 |
| 4 | H39A, H39B | 2.8 | 269.3 | 39A-1, 39A-2, 39B-1, 39B-3 | 98.0 | 508.7 | 128.3 |
| 4A | H39A, H39B, HO39 | 2.9 | 284.8 | 39A-1, 39A-2, 39B-1, 39B-2, 39B-3, HO39 | 0.4 | 151.2 | N/A |
| 5 | H33, HO33 | 3.9 | 225.4 | 33A, 33B, 33C, 33D, O33A, 033B | 74.9 | 451.1 | N/A |
| 6 | H39A | 2.0 | 121.0 | 39A-1, 39A-2 | 81.8 | 409.3 | N/A |
| 7 | H18B | 1.0 | 23.0 | 18B-1 | 12.0 | 59.0 | 10.5 |
| 8 | H19 | 0.0 | 15.0 | 19A | 1.0 | 8.0 | N/A |
| 9 (9B) | HO33 | 2.0 | 81.0 | O33A, O33B | 6.6 | 82.4 | N/A |
| 10 | HO39 | 0.0 | 17.0 | HO39 | 0.0 | 17.0 | N/A |

# Coal Creek (E. Yale Avenue to E. County Line Road)

## Flood Hazard Area Delineation

## August 2014

Urban Drainage & Flood Control District

Arapahoe County

Matrix Design Group

1601 Blake Street, Suite 200
Denver, CO 80202

Kersten Gully
Dreamers Draw
Walush Gulch
Llama Draw
Mutchie Creek
Coal Creek
Senac Creek
Aurora Reservoir
E Yale Ave
E Quincy Ave
County Line Rd
Arapahoe County
Elbert County
End Reach 1
End Reach 2
End Reach 3
End Reach 4
End Reach 5
End Reach 6
Begin Study
Project Site
0 0.25 0.5 1
Miles

FILE: G:\gis_projects\UDFCD_Coal_Creek\activeapps\Report\Fig_2-3_Reach_Map.mxd, 5/15/2014, wilson_wheeler

| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

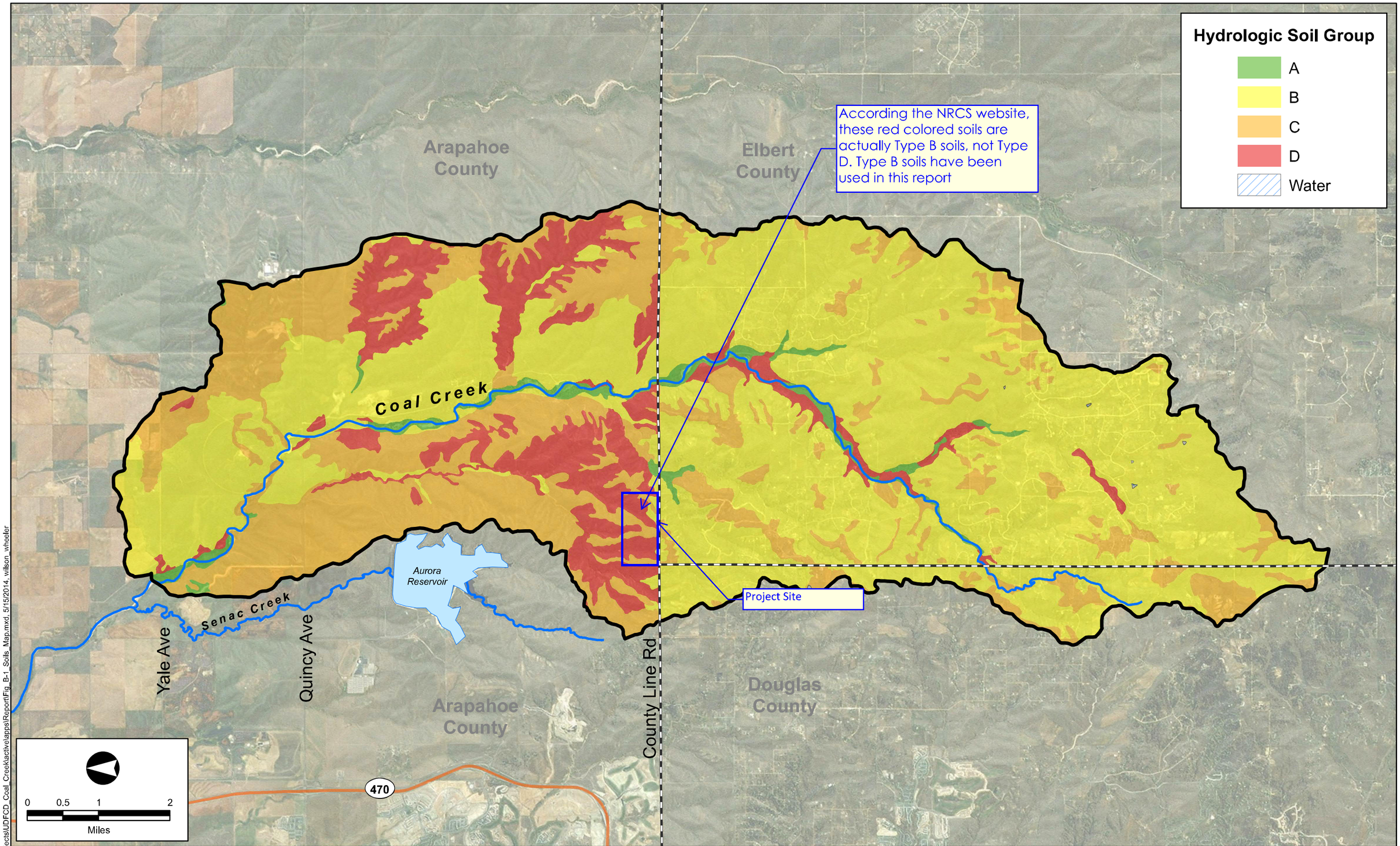
designed by:
drawn by: WW
checked by: RK
project no.: 11.155.019
date: 4/7/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT AND ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION
COAL CREEK (YALE TO COUNTY LINE RD)

REACH DEFINITION MAP

FIGURE 2-3




FILE: G:\gis_projects\UDFCD_Coal_Creek\activeiapps\Report\Fig_B-1_Soils_Map.mxd, 5/15/2014, wilson_wheeler

| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

designed by:
drawn by: WW
checked by: RK
project no.: 11.155.019
date: 4/7/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT AND ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION
COAL CREEK (YALE TO COUNTY LINE RD)

HYDROLOGIC SOIL GROUPS

FIGURE
B-1

**Future Land Use**

- Open Space, 2%
- Agricultural, 2%
- Semi-Rural Residential, 15%
- High Density Rural Residential (~1 DU/3-10 AC), 15%
- Residential - 1 DU/AC, 30%
- State Land Board (LR), 40%
- Residential - 2 DU/AC, 45%
- Residential - 3 DU/AC, 50%
- Future Development Area (LR), 60%
- Urban Development Area (LR), 60%
- Extraction/Disposal Utilities, 90%
- Commercial, 95%
- Roadway, 100%

Lower than the anticipated residential density of 3 DU/Ac for this project

Arapahoe County

Coal Creek

Aurora Reservoir

Senac Creek

Yale Ave

Quincy Ave

County Line Rd

Project Site

Douglas County

Arapahoe County

470

0 0.5 1 2

Miles

FILE: G:\gis_projects\UDFCD_Coal_Creek\activelapps\Report\Fig_B-4_FLU_Map.mxd, 5/15/2014, wilson_wheeler

| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

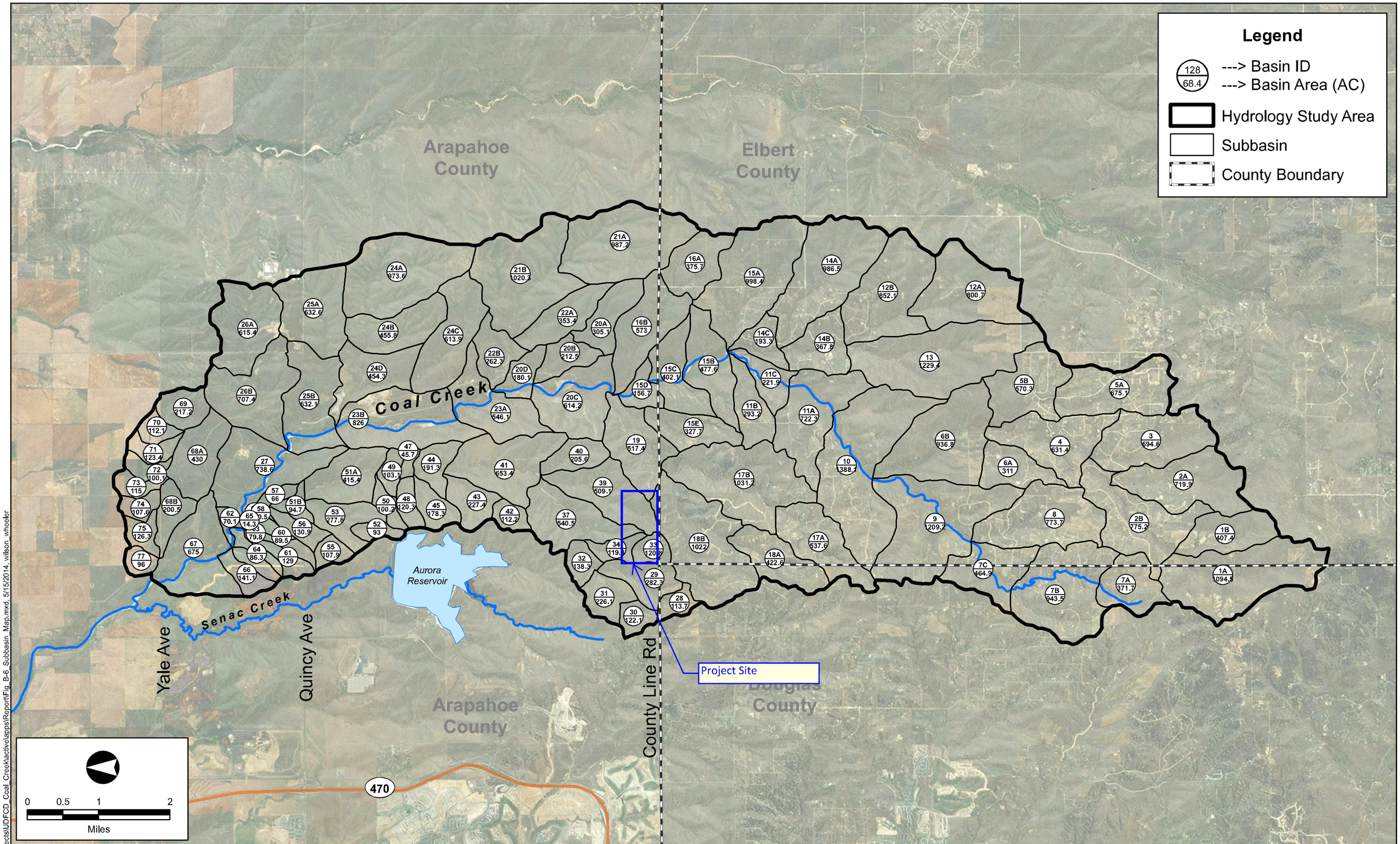
designed by:
drawn by: WW
checked by: RK
project no.: 11.155.019
date: 4/7/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT AND ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION
COAL CREEK (YALE TO COUNTY LINE RD)

LAND USE
FUTURE CONDITIONS

FIGURE
B-5




| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

designed by:
drawn by: WW
checked by: RK
project no.: 11.155.019
date: 4/7/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT AND ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION
COAL CREEK (YALE TO COUNTY LINE RD)

SUBWATERSHED MAP

FIGURE
B-6

FILE: G:\gis_projects\UDFCD_Coal_Creek\activeIapps\Report\Fig_B-6_Subbasin_Map.mxd, 5/15/2014, wilson_wheeler

Arapahoe County

Elbert County

Douglas County

Coal Creek

Senac Creek

Aurora Reservoir

Yale Ave

Quincy Ave

County Line Rd

470

Project Site

**Legend**

- Hydrology Study Area
- Subbasin

% Impervious - Existing Conditions

- 2 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 91

0 0.5 1 2

Miles

FILE: G:\gis_projects\UDFCD_Coal_Creek\activeleapps\Report\Fig_B-7_ELU_Impervious_Map.mxd, 5/15/2014, wilson_wheeler

| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

designed by:
drawn by: WW
checked by: RK
project no.: 11.155.019
date: 4/7/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT AND ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION
COAL CREEK (YALE TO COUNTY LINE RD)

PERCENT IMPERVIOUS
EXISTING CONDITIONS

FIGURE
B-7

**Legend**

- Hydrology Study Area
- Subbasin

% Impervious - Future Conditions

- 2 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100

Arapahoe County

Elbert County

Douglas County

Coal Creek

Senac Creek

Aurora Reservoir

Yale Ave

Quincy Ave

County Line Rd

Project Site

470

0 0.5 1 2

Miles

| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

designed by:
drawn by: WW
checked by: RK
project no.: 11.155.019
date: 4/7/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT AND ARAPAHOE COUNTY

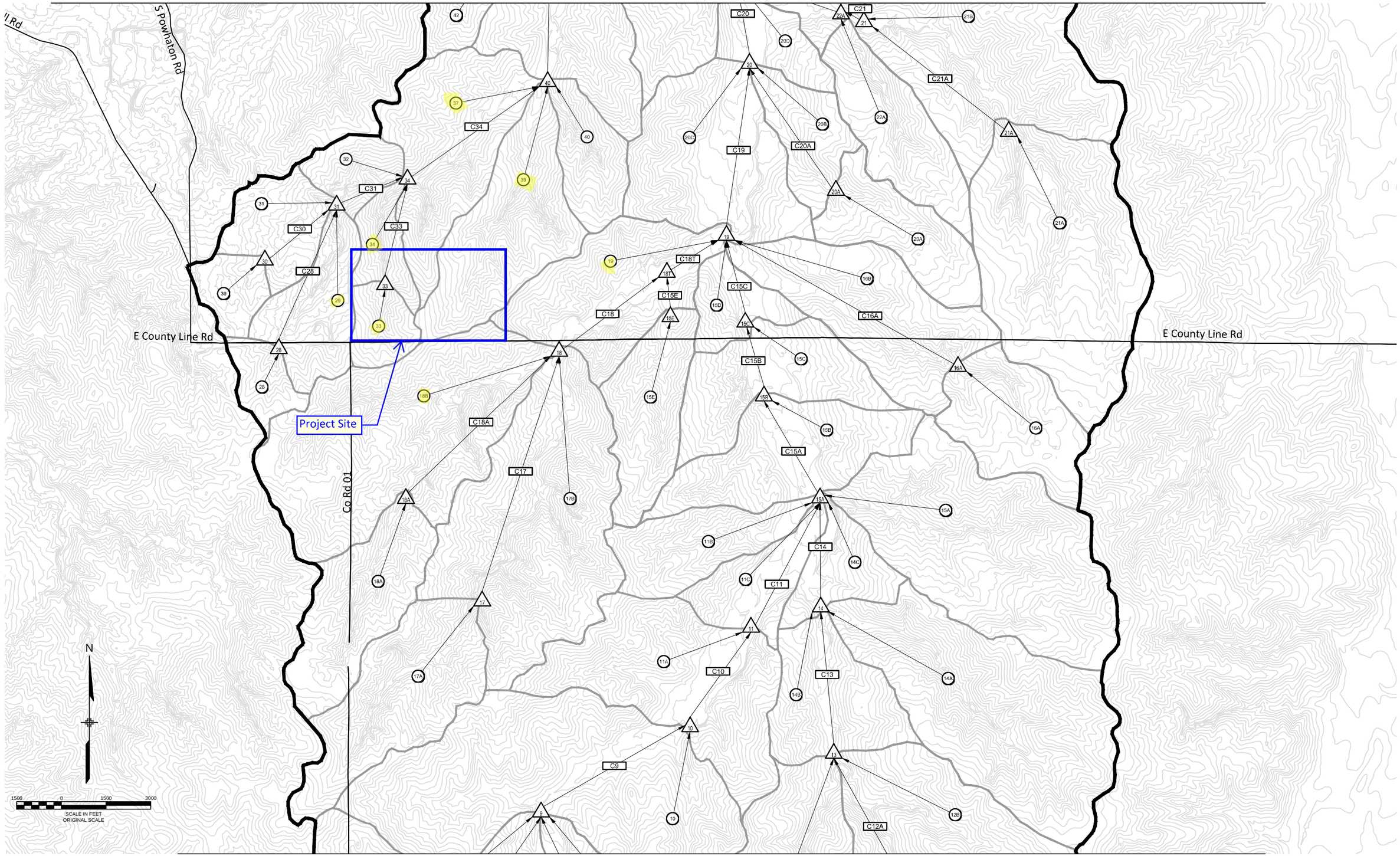
FLOOD HAZARD AREA DELINEATION
COAL CREEK (YALE TO COUNTY LINE RD)

PERCENT IMPERVIOUS
FUTURE CONDITIONS

FIGURE
B-8

FILE: G:\gis_projects\UDFCD_Coal_Creek\activeleapps\Report\Fig_B-8_FLU_Impervious_Map.mxd, 5/15/2014, wilson_wheeler

MATCHLINE SEE SHEET B-9-A




MATCHLINE SEE SHEET B-9-C

| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

Designed by: HTH
Drawn by: HTH
Checked by: RK
Project no.: 11.155.019
Date: 5/12/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION COAL CREEK (YALE TO COUNTY LINE RD)

BASIN DELINEATION AND CONVEYANCE ELEMENTS

FIGURE B-9-B

MATCHLINE SEE SHEET B-10-A

**LEGEND:**

- XXX — BASIN ID "out"
- XXX — DESIGN POINT "dp"
- XXX — CONVEYANCE ELEMENT "re"
- XXX — DETENTION ELEMENT

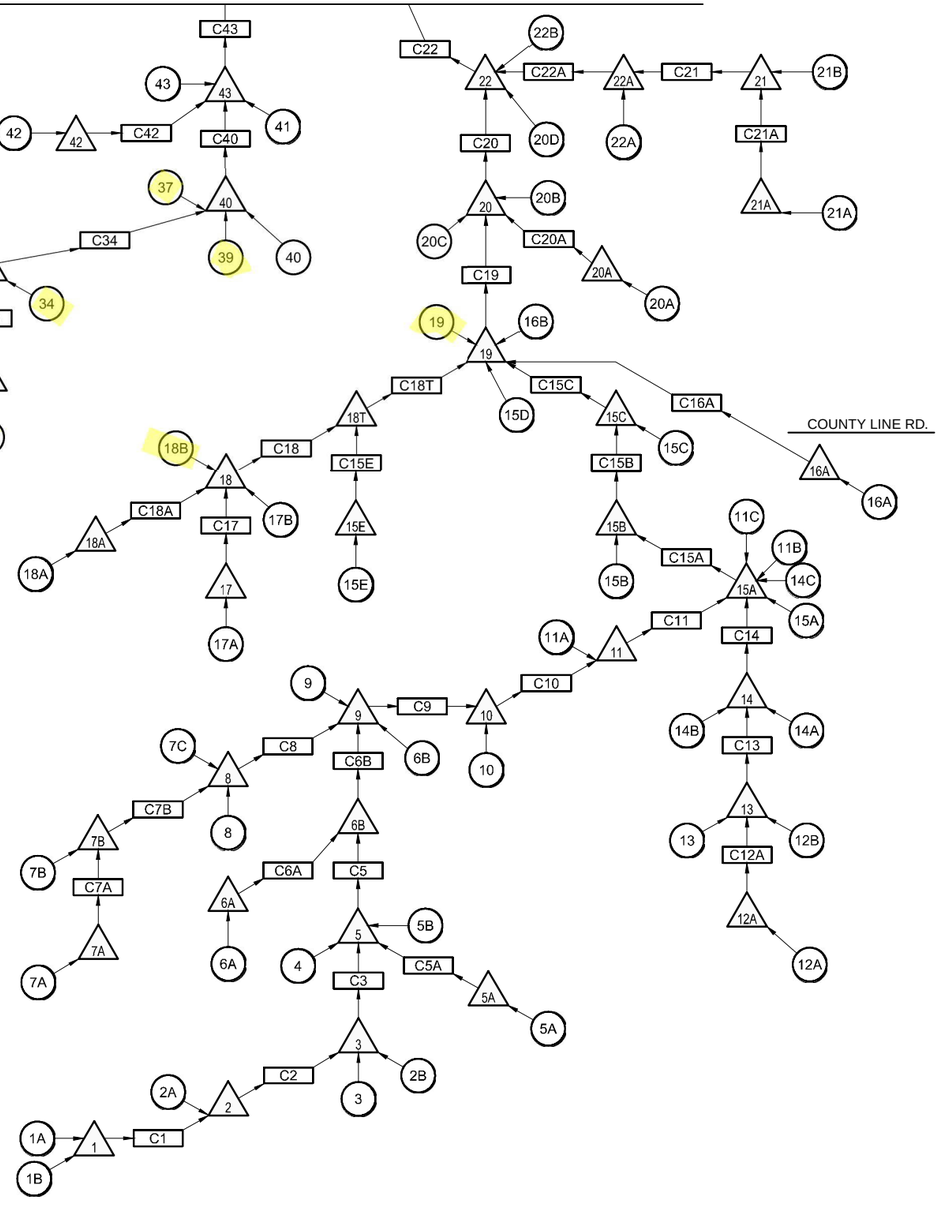
E SMOKY HILL RD.

ARAPAHOE RD.

E SMOKY HILL PKWY.

CO RD 194/COUNTY LINE RD

COUNTY LINE RD.




| No. | DATE | DESCRIPTION | APPR. |
|---|---|---|---|
| | | | |

Matrix DESIGN GROUP

Designed by: HTH
Drawn by: HTH
Checked by: RK
Project no.: 11.155.019
Date: 5/12/2014

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, ARAPAHOE COUNTY

FLOOD HAZARD AREA DELINEATION
COAL CREEK (YALE TO COUNTY LINE RD)

EPA SWMM 5.0 ROUTING SCHEMATIC

FIGURE
B-10-B

## Table B-3 - CUHP 2005 Input Parameters

| Catchment Name | Area | Area | Distance to Centroid | Length | Slope | Existing Percent Imperviousness | Future Percent Imperviousness | Exisitng Depression Storage on Pervious | Future Depression Storage on Pervious | Exisitng Depression Storage on Impervious | Future Depression Storage on Impervious | Initial Infiltration Rate | Horton's Decay Coefficient | Final Infiltration Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | acres | $mi^2$ | mi | mi | ft/ft | % | % | in | in | in | in | in/hr | 1/seconds | in/hr |
| 3 | 695 | 1.0853 | 0.9387 | 1.9597 | 0.0203 | 14 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.44 | 0.00180 | 0.60 |
| 4 | 631 | 0.9866 | 1.0782 | 2.2626 | 0.0159 | 14 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.47 | 0.00177 | 0.61 |
| 8 | 774 | 1.2089 | 1.0883 | 2.0585 | 0.0244 | 15 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.38 | 0.00180 | 0.59 |
| 9 | 1209 | 1.8893 | 1.4375 | 2.6741 | 0.0188 | 6 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.29 | 0.00175 | 0.60 |
| 10 | 1388 | 2.1689 | 0.9819 | 2.6139 | 0.0225 | 9 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.32 | 0.00176 | 0.60 |
| 13 | 1229 | 1.9210 | 1.4035 | 3.1932 | 0.0176 | 4 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.30 | 0.00180 | 0.59 |
| 19 | 517 | 0.8084 | 0.8833 | 1.8310 | 0.0217 | 3 | 38 | 0.4 | 0.35 | 0.1 | 0.1 | 3.48 | 0.00175 | 0.55 |
| 27 | 739 | 1.1541 | 0.8648 | 1.9189 | 0.0158 | 2 | 52 | 0.4 | 0.35 | 0.1 | 0.1 | 4.10 | 0.00180 | 0.57 |
| 28 | 114 | 0.1777 | 0.2422 | 0.6560 | 0.0375 | 4 | 16 | 0.4 | 0.35 | 0.1 | 0.1 | 4.39 | 0.00180 | 0.59 |
| 29 | 282 | 0.4411 | 0.7774 | 1.3217 | 0.0301 | 22 | 28 | 0.35 | 0.35 | 0.1 | 0.1 | 3.54 | 0.00180 | 0.54 |
| 30 | 122 | 0.1908 | 0.3030 | 0.5886 | 0.0322 | 30 | 30 | 0.35 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 31 | 226 | 0.3533 | 0.4602 | 0.9485 | 0.0339 | 28 | 32 | 0.35 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 32 | 138 | 0.2162 | 0.3737 | 0.8610 | 0.0330 | 4 | 42 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 33 | 121 | 0.1888 | 0.2881 | 0.6049 | 0.0407 | 2 | 37 | 0.4 | 0.35 | 0.1 | 0.1 | 3.35 | 0.00180 | 0.52 |
| 34 | 120 | 0.1872 | 0.4756 | 1.0236 | 0.0370 | 2 | 42 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 37 | 541 | 0.8446 | 0.7203 | 1.9572 | 0.0261 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.03 | 0.00180 | 0.50 |
| 39 | 509 | 0.7955 | 0.9772 | 1.9550 | 0.0262 | 2 | 41 | 0.4 | 0.35 | 0.1 | 0.1 | 3.04 | 0.00180 | 0.50 |
| 40 | 206 | 0.3212 | 0.6156 | 1.1606 | 0.0326 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 41 | 653 | 1.0210 | 0.9950 | 2.0323 | 0.0210 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.06 | 0.00180 | 0.50 |
| 42 | 112 | 0.1754 | 0.3015 | 0.6705 | 0.0430 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 43 | 227 | 0.3553 | 0.6073 | 1.0815 | 0.0280 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 44 | 191 | 0.2990 | 0.3538 | 1.0026 | 0.0208 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.05 | 0.00180 | 0.50 |
| 45 | 178 | 0.2786 | 0.5430 | 1.0254 | 0.0332 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.09 | 0.00180 | 0.51 |
| 47 | 46 | 0.0714 | 0.2702 | 0.5106 | 0.0334 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.18 | 0.00180 | 0.51 |
| 48 | 120 | 0.1880 | 0.3819 | 0.8408 | 0.0360 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 49 | 103 | 0.1611 | 0.2186 | 0.6484 | 0.0321 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.27 | 0.00180 | 0.52 |
| 50 | 100 | 0.1565 | 0.3990 | 0.8798 | 0.0323 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.01 | 0.00180 | 0.50 |
| 52 | 93 | 0.1454 | 0.3778 | 0.8007 | 0.0307 | 2 | 39 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 53 | 278 | 0.4341 | 0.5765 | 1.3116 | 0.0231 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 55 | 108 | 0.1687 | 0.2421 | 0.5817 | 0.0261 | 4 | 41 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 56 | 131 | 0.2045 | 0.6176 | 1.0461 | 0.0221 | 2 | 47 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 57 | 66 | 0.1032 | 0.3942 | 0.7389 | 0.0231 | 2 | 44 | 0.4 | 0.35 | 0.1 | 0.1 | 4.23 | 0.00180 | 0.58 |
| 58 | 30 | 0.0476 | 0.2052 | 0.4800 | 0.0260 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.31 | 0.00163 | 0.58 |
| 59 | 60 | 0.0944 | 0.2918 | 0.7444 | 0.0254 | 2 | 54 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 60 | 90 | 0.1399 | 0.5677 | 1.1275 | 0.0252 | 3 | 56 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 61 | 129 | 0.2015 | 0.6462 | 1.2126 | 0.0266 | 31 | 68 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 62 | 70 | 0.1096 | 0.2790 | 0.6320 | 0.0300 | 2 | 42 | 0.4 | 0.35 | 0.1 | 0.1 | 4.38 | 0.00170 | 0.63 |
| 63 | 80 | 0.1246 | 0.3793 | 0.8992 | 0.0337 | 13 | 55 | 0.4 | 0.35 | 0.1 | 0.1 | 3.06 | 0.00180 | 0.50 |
| 64 | 86 | 0.1348 | 0.3925 | 0.8206 | 0.0346 | 39 | 69 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 65 | 14 | 0.0223 | 0.0910 | 0.2393 | 0.0396 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.33 | 0.00178 | 0.53 |
| 66 | 141 | 0.2204 | 0.3796 | 0.9819 | 0.0312 | 71 | 79 | 0.4 | 0.35 | 0.1 | 0.1 | 3.02 | 0.00179 | 0.50 |
| 67 | 675 | 1.0546 | 0.8464 | 1.5693 | 0.0193 | 31 | 61 | 0.4 | 0.35 | 0.1 | 0.1 | 4.04 | 0.00159 | 0.64 |
| 69 | 217 | 0.3394 | 0.4907 | 0.9242 | 0.0246 | 2 | 59 | 0.4 | 0.35 | 0.1 | 0.1 | 3.07 | 0.00180 | 0.50 |
| 70 | 112 | 0.1752 | 0.2362 | 0.7225 | 0.0204 | 2 | 23 | 0.4 | 0.35 | 0.1 | 0.1 | 3.00 | 0.00180 | 0.50 |
| 71 | 123 | 0.1927 | 0.1922 | 0.7182 | 0.0295 | 2 | 24 | 0.4 | 0.35 | 0.1 | 0.1 | 3.63 | 0.00180 | 0.54 |
| 72 | 100 | 0.1563 | 0.1728 | 0.5918 | 0.0307 | 2 | 12 | 0.4 | 0.35 | 0.1 | 0.1 | 3.95 | 0.00180 | 0.56 |
| 73 | 115 | 0.1797 | 0.2014 | 0.6257 | 0.0260 | 2 | 10 | 0.4 | 0.35 | 0.1 | 0.1 | 4.32 | 0.00180 | 0.59 |

## Table B-3 - CUHP 2005 Input Parameters

| Catchment Name | Area | Area | Distance to Centroid | Length | Slope | Existing Percent Imperviousness | Future Percent Imperviousness | Exisitng Depression Storage on Pervious | Future Depression Storage on Pervious | Exisitng Depression Storage on Impervious | Future Depression Storage on Impervious | Initial Infiltration Rate | Horton's Decay Coefficient | Final Infiltration Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | acres | $mi^2$ | mi | mi | ft/ft | % | % | in | in | in | in | in/hr | 1/seconds | in/hr |
| 74 | 108 | 0.1681 | 0.3158 | 0.8051 | 0.0249 | 2 | 48 | 0.4 | 0.35 | 0.1 | 0.1 | 4.50 | 0.00180 | 0.60 |
| 75 | 126 | 0.1973 | 0.6302 | 1.0552 | 0.0162 | 2 | 50 | 0.4 | 0.35 | 0.1 | 0.1 | 4.48 | 0.00180 | 0.60 |
| 77 | 96 | 0.1500 | 0.3044 | 0.5750 | 0.0204 | 2 | 52 | 0.4 | 0.35 | 0.1 | 0.1 | 4.47 | 0.00180 | 0.60 |
| 11A | 722 | 1.1286 | 0.7086 | 1.8515 | 0.0245 | 15 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.33 | 0.00170 | 0.62 |
| 11B | 293 | 0.4581 | 0.6791 | 1.2900 | 0.0338 | 14 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.16 | 0.00179 | 0.58 |
| 11C | 222 | 0.3466 | 0.8438 | 1.5005 | 0.0227 | 15 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 3.94 | 0.00165 | 0.61 |
| 12A | 801 | 1.2512 | 0.8888 | 1.8603 | 0.0204 | 2 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.08 | 0.00180 | 0.57 |
| 12B | 852 | 1.3314 | 1.0252 | 2.1073 | 0.0211 | 5 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.35 | 0.00180 | 0.59 |
| 14A | 986 | 1.5414 | 1.3647 | 2.3975 | 0.0205 | 7 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.33 | 0.00179 | 0.59 |
| 14B | 368 | 0.5747 | 0.6088 | 1.3559 | 0.0279 | 15 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.53 | 0.00168 | 0.64 |
| 14C | 193 | 0.3021 | 0.6937 | 1.1198 | 0.0245 | 15 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.47 | 0.00163 | 0.66 |
| 15A | 998 | 1.5601 | 1.1564 | 2.3761 | 0.0223 | 12 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.46 | 0.00180 | 0.60 |
| 15B | 478 | 0.7463 | 0.4431 | 1.3418 | 0.0311 | 15 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 3.96 | 0.00169 | 0.60 |
| 15C | 402 | 0.6283 | 0.3926 | 1.1697 | 0.0324 | 14 | 18 | 0.4 | 0.35 | 0.1 | 0.1 | 4.35 | 0.00165 | 0.64 |
| 15D | 157 | 0.2448 | 0.3961 | 0.8643 | 0.0241 | 3 | 39 | 0.4 | 0.35 | 0.1 | 0.1 | 3.78 | 0.00170 | 0.58 |
| 15E | 328 | 0.5121 | 0.6749 | 1.4683 | 0.0310 | 10 | 18 | 0.4 | 0.35 | 0.1 | 0.1 | 3.91 | 0.00180 | 0.56 |
| 16A | 376 | 0.5871 | 0.6204 | 1.3541 | 0.0224 | 11 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.21 | 0.00180 | 0.58 |
| 16B | 573 | 0.8953 | 1.1078 | 2.0336 | 0.0214 | 5 | 34 | 0.4 | 0.35 | 0.1 | 0.1 | 3.99 | 0.00180 | 0.57 |
| 17A | 538 | 0.8400 | 0.7212 | 1.9241 | 0.0276 | 12 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.17 | 0.00180 | 0.58 |
| 17B | 1031 | 1.6113 | 1.4497 | 2.6002 | 0.0202 | 12 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.13 | 0.00177 | 0.58 |
| 18A | 423 | 0.6603 | 0.7600 | 1.6984 | 0.0256 | 13 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.05 | 0.00179 | 0.57 |
| 18B | 1022 | 1.5969 | 1.3303 | 2.3851 | 0.0242 | 11 | 16 | 0.4 | 0.35 | 0.1 | 0.1 | 4.35 | 0.00177 | 0.60 |
| 1A | 1094 | 1.7101 | 0.9520 | 2.4697 | 0.0222 | 3 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 3.94 | 0.00180 | 0.56 |
| 1B | 407 | 0.6365 | 0.7487 | 1.5371 | 0.0271 | 2 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.26 | 0.00180 | 0.58 |
| 20A | 305 | 0.4767 | 0.5404 | 1.2765 | 0.0267 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 4.05 | 0.00180 | 0.57 |
| 20B | 212 | 0.3320 | 0.5675 | 1.1648 | 0.0244 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 4.51 | 0.00178 | 0.61 |
| 20C | 614 | 0.9597 | 0.7529 | 1.6497 | 0.0218 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.73 | 0.00162 | 0.61 |
| 20D | 180 | 0.2814 | 0.6335 | 1.1616 | 0.0245 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 4.26 | 0.00154 | 0.67 |
| 21A | 987 | 1.5425 | 1.3179 | 2.5205 | 0.0158 | 3 | 36 | 0.4 | 0.35 | 0.1 | 0.1 | 3.17 | 0.00180 | 0.51 |
| 21B | 1020 | 1.5942 | 1.2206 | 2.5331 | 0.0157 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.22 | 0.00180 | 0.51 |
| 22A | 353 | 0.5523 | 0.8340 | 1.8097 | 0.0246 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.67 | 0.00180 | 0.54 |
| 22B | 262 | 0.4099 | 0.6326 | 1.2697 | 0.0269 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.90 | 0.00180 | 0.56 |
| 23A | 546 | 0.8533 | 0.6130 | 1.6856 | 0.0247 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.65 | 0.00172 | 0.57 |
| 23B | 826 | 1.2906 | 0.9624 | 2.2202 | 0.0145 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.98 | 0.00168 | 0.61 |
| 24A | 974 | 1.5212 | 0.9813 | 2.1416 | 0.0203 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.05 | 0.00180 | 0.50 |
| 24B | 456 | 0.7122 | 0.5367 | 1.5821 | 0.0287 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.57 | 0.00180 | 0.54 |
| 24C | 614 | 0.9593 | 0.8132 | 1.9125 | 0.0208 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 4.46 | 0.00180 | 0.60 |
| 24D | 454 | 0.7098 | 0.8875 | 1.9429 | 0.0205 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 4.47 | 0.00176 | 0.61 |
| 25A | 633 | 0.9884 | 0.7513 | 1.6204 | 0.0222 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.25 | 0.00180 | 0.52 |
| 25B | 632 | 0.9877 | 0.7506 | 1.9718 | 0.0211 | 2 | 47 | 0.4 | 0.35 | 0.1 | 0.1 | 4.27 | 0.00180 | 0.58 |
| 26A | 615 | 0.9616 | 1.0308 | 1.8232 | 0.0249 | 2 | 46 | 0.4 | 0.35 | 0.1 | 0.1 | 3.02 | 0.00179 | 0.51 |
| 26B | 707 | 1.1053 | 0.8861 | 1.9958 | 0.0218 | 2 | 62 | 0.4 | 0.35 | 0.1 | 0.1 | 3.70 | 0.00180 | 0.55 |
| 2A | 720 | 1.1248 | 0.9570 | 2.0542 | 0.0258 | 9 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.46 | 0.00180 | 0.60 |
| 2B | 775 | 1.2113 | 1.2979 | 2.4662 | 0.0223 | 12 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.14 | 0.00180 | 0.58 |
| 51A | 415 | 0.6491 | 0.6957 | 1.5173 | 0.0187 | 2 | 40 | 0.4 | 0.35 | 0.1 | 0.1 | 3.26 | 0.00180 | 0.52 |
| 51B | 95 | 0.1479 | 0.4075 | 0.8263 | 0.0206 | 2 | 47 | 0.4 | 0.35 | 0.1 | 0.1 | 3.39 | 0.00180 | 0.53 |
| 5A | 675 | 1.0549 | 0.8654 | 2.0114 | 0.0160 | 15 | 15 | 0.4 | 0.35 | 0.1 | 0.1 | 4.46 | 0.00180 | 0.60 |

## Table B-4 Composite Infiltration Rates and Decay Coefficients Calculation

| BASIN_ID | Area of Soil Types and Water Body Distribution | | | | | | Area of Soil Types and Water Body Distribution | | | | | Area Weighted Composite Coefficients* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | Water | Total | A | B | C | D | Water | Initial $f_i$ | Decay Coefficient a | Final $f_o$ |
| | (ACRES) | (ACRES) | (ACRES) | (ACRES) | (ACRES) | (ACRES) | (%) | (%) | (%) | (%) | (%) | (in/hr) | (1/second) | (in/hr) |
| 3 | | 671.2 | 21.5 | 0.0 | 1.9 | 695 | 0% | 97% | 3% | 0% | 0% | 4.44 | 0.00180 | 0.60 |
| 4 | 17.9 | 596.7 | 3.3 | 13.5 | | 631 | 3% | 95% | 1% | 2% | 0% | 4.47 | 0.00177 | 0.61 |
| 8 | 0.1 | 711.4 | 62.1 | | | 774 | 0% | 92% | 8% | 0% | 0% | 4.38 | 0.00180 | 0.59 |
| 9 | 55.1 | 964.3 | 169.8 | 19.9 | | 1209 | 5% | 80% | 14% | 2% | 0% | 4.29 | 0.00175 | 0.60 |
| 10 | 44.8 | 1159.5 | 97.9 | 85.8 | | 1388 | 3% | 84% | 7% | 6% | 0% | 4.32 | 0.00176 | 0.60 |
| 13 | | 1066.6 | 162.9 | | | 1229 | 0% | 87% | 13% | 0% | 0% | 4.30 | 0.00180 | 0.59 |
| 19 | 22.5 | 137.0 | 128.8 | 229.1 | | 517 | 4% | 26% | 25% | 44% | 0% | 3.48 | 0.00175 | 0.55 |
| 27 | 0.8 | 541.0 | 196.8 | | | 739 | 0% | 73% | 27% | 0% | 0% | 4.10 | 0.00180 | 0.57 |
| 28 | | 105.5 | 8.0 | 0.2 | | 114 | 0% | 93% | 7% | 0% | 0% | 4.39 | 0.00180 | 0.59 |
| 29 | | 100.7 | 23.6 | 158.0 | | 282 | 0% | 36% | 8% | 56% | 0% | 3.54 | 0.00180 | 0.54 |
| 30 | | 0.3 | 100.1 | 21.7 | | 122 | 0% | 0% | 82% | 18% | 0% | 3.00 | 0.00180 | 0.50 |
| 31 | | | 143.0 | 83.1 | | 226 | 0% | 0% | 63% | 37% | 0% | 3.00 | 0.00180 | 0.50 |
| 32 | | | 32.4 | 105.9 | | 138 | 0% | 0% | 23% | 77% | 0% | 3.00 | 0.00180 | 0.50 |
| 33 | | 28.3 | 34.8 | 57.7 | | 121 | 0% | 23% | 29% | 48% | 0% | 3.35 | 0.00180 | 0.52 |
| 34 | | | 32.5 | 87.3 | | 120 | 0% | 0% | 27% | 73% | 0% | 3.00 | 0.00180 | 0.50 |
| 37 | | 11.3 | 381.2 | 148.0 | | 541 | 0% | 2% | 71% | 27% | 0% | 3.03 | 0.00180 | 0.50 |
| 39 | | 12.3 | 200.4 | 296.4 | | 509 | 0% | 2% | 39% | 58% | 0% | 3.04 | 0.00180 | 0.50 |
| 40 | | 0.1 | 25.4 | 180.0 | | 206 | 0% | 0% | 12% | 88% | 0% | 3.00 | 0.00180 | 0.50 |
| 41 | | 27.9 | 343.2 | 282.3 | | 653 | 0% | 4% | 53% | 43% | 0% | 3.06 | 0.00180 | 0.50 |
| 42 | | | 112.2 | | | 112 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 43 | | | 221.3 | 6.1 | | 227 | 0% | 0% | 97% | 3% | 0% | 3.00 | 0.00180 | 0.50 |
| 44 | | 6.7 | 98.4 | 86.2 | | 191 | 0% | 4% | 51% | 45% | 0% | 3.05 | 0.00180 | 0.50 |
| 45 | | 10.8 | 156.7 | 10.8 | | 178 | 0% | 6% | 88% | 6% | 0% | 3.09 | 0.00180 | 0.51 |
| 47 | | 5.5 | 35.1 | 5.1 | | 46 | 0% | 12% | 77% | 11% | 0% | 3.18 | 0.00180 | 0.51 |
| 48 | | | 110.6 | 9.7 | | 120 | 0% | 0% | 92% | 8% | 0% | 3.00 | 0.00180 | 0.50 |
| 49 | | 18.5 | 77.0 | 7.6 | | 103 | 0% | 18% | 75% | 7% | 0% | 3.27 | 0.00180 | 0.52 |
| 50 | | 0.4 | 98.6 | 1.1 | | 100 | 0% | 0% | 98% | 1% | 0% | 3.01 | 0.00180 | 0.50 |
| 52 | | | 93.0 | | | 93 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 53 | | | 277.8 | | | 278 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 55 | | | 107.9 | | | 108 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 56 | | | 130.9 | | | 131 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 57 | | 54.3 | 11.7 | | | 66 | 0% | 82% | 18% | 0% | 0% | 4.23 | 0.00180 | 0.58 |
| 58 | 4.7 | | 25.7 | | | 30 | 16% | 0% | 84% | 0% | 0% | 3.31 | 0.00163 | 0.58 |
| 59 | | | 60.4 | | | 60 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 60 | | | 89.5 | | | 90 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 61 | | | 129.0 | | | 129 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 62 | 6.4 | 56.3 | 4.6 | 2.9 | | 70 | 9% | 80% | 7% | 4% | 0% | 4.38 | 0.00170 | 0.63 |
| 63 | | 3.1 | 76.6 | | | 80 | 0% | 4% | 96% | 0% | 0% | 3.06 | 0.00180 | 0.50 |
| 64 | | | 86.3 | | | 86 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |

* Composite coefficients were calculated using Table RO-7 in the USDCM and weighting the area of the soil distribution in the individual subwatershed.

## Table B-4 Composite Infiltration Rates and Decay Coefficients Calculation

| BASIN_ID | Area of Soil Types and Water Body Distribution | | | | | | Area of Soil Types and Water Body Distribution | | | | | Area Weighted Composite Coefficients* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | Water | Total | A | B | C | D | Water | Initial $f_i$ | Decay Coefficient a | Final $f_o$ |
| | (ACRES) | (ACRES) | (ACRES) | (ACRES) | (ACRES) | (ACRES) | (%) | (%) | (%) | (%) | (%) | (in/hr) | (1/second) | (in/hr) |
| 65 | 0.2 | 2.8 | 11.2 | | | 14 | 1% | 20% | 79% | 0% | 0% | 3.33 | 0.00178 | 0.53 |
| 66 | 1.3 | | 139.7 | | | 141 | 1% | 0% | 99% | 0% | 0% | 3.02 | 0.00179 | 0.50 |
| 67 | 131.2 | 293.2 | 208.6 | 41.9 | | 675 | 19% | 43% | 31% | 6% | 0% | 4.04 | 0.00159 | 0.64 |
| 69 | | 9.6 | 187.0 | 20.6 | | 217 | 0% | 4% | 86% | 9% | 0% | 3.07 | 0.00180 | 0.50 |
| 70 | | 0.1 | 112.1 | | | 112 | 0% | 0% | 100% | 0% | 0% | 3.00 | 0.00180 | 0.50 |
| 71 | | 51.7 | 71.7 | | | 123 | 0% | 42% | 58% | 0% | 0% | 3.63 | 0.00180 | 0.54 |
| 72 | | 63.4 | 36.7 | | | 100 | 0% | 63% | 37% | 0% | 0% | 3.95 | 0.00180 | 0.56 |
| 73 | | 101.0 | 14.0 | | | 115 | 0% | 88% | 12% | 0% | 0% | 4.32 | 0.00180 | 0.59 |
| 74 | | 107.6 | | | | 108 | 0% | 100% | 0% | 0% | 0% | 4.50 | 0.00180 | 0.60 |
| 75 | | 124.7 | | 1.6 | | 126 | 0% | 99% | 0% | 1% | 0% | 4.48 | 0.00180 | 0.60 |
| 77 | 0.0 | 94.3 | | 1.7 | | 96 | 0% | 98% | 0% | 2% | 0% | 4.47 | 0.00180 | 0.60 |
| 11A | 63.5 | 556.4 | 39.6 | 62.8 | | 722 | 9% | 77% | 5% | 9% | 0% | 4.33 | 0.00170 | 0.62 |
| 11B | 2.5 | 223.3 | 42.7 | 24.8 | | 293 | 1% | 76% | 15% | 8% | 0% | 4.16 | 0.00179 | 0.58 |
| 11C | 30.8 | 98.7 | | 92.4 | | 222 | 14% | 45% | 0% | 42% | 0% | 3.94 | 0.00165 | 0.61 |
| 12A | | 578.8 | 221.9 | | | 801 | 0% | 72% | 28% | 0% | 0% | 4.08 | 0.00180 | 0.57 |
| 12B | 0.2 | 768.6 | 83.3 | | | 852 | 0% | 90% | 10% | 0% | 0% | 4.35 | 0.00180 | 0.59 |
| 14A | 10.2 | 863.1 | 113.2 | | | 986 | 1% | 87% | 11% | 0% | 0% | 4.33 | 0.00179 | 0.59 |
| 14B | 40.4 | 322.0 | 5.4 | | | 368 | 11% | 88% | 1% | 0% | 0% | 4.53 | 0.00168 | 0.64 |
| 14C | 30.4 | 148.7 | | 14.2 | | 193 | 16% | 77% | 0% | 7% | 0% | 4.47 | 0.00163 | 0.66 |
| 15A | 0.5 | 968.6 | 20.4 | 8.9 | | 998 | 0% | 97% | 2% | 1% | 0% | 4.46 | 0.00180 | 0.60 |
| 15B | 47.2 | 244.2 | 117.4 | 68.8 | | 478 | 10% | 51% | 25% | 14% | 0% | 3.96 | 0.00169 | 0.60 |
| 15C | 55.7 | 287.4 | 57.6 | 1.3 | | 402 | 14% | 71% | 14% | 0% | 0% | 4.35 | 0.00165 | 0.64 |
| 15D | 13.8 | 63.5 | 8.2 | 71.1 | | 157 | 9% | 41% | 5% | 45% | 0% | 3.78 | 0.00170 | 0.58 |
| 15E | | 198.1 | 100.8 | 28.8 | | 328 | 0% | 60% | 31% | 9% | 0% | 3.91 | 0.00180 | 0.56 |
| 16A | | 304.0 | 71.7 | | | 376 | 0% | 81% | 19% | 0% | 0% | 4.21 | 0.00180 | 0.58 |
| 16B | 1.4 | 375.7 | 41.0 | 154.9 | | 573 | 0% | 66% | 7% | 27% | 0% | 3.99 | 0.00180 | 0.57 |
| 17A | | 421.1 | 116.5 | | | 538 | 0% | 78% | 22% | 0% | 0% | 4.17 | 0.00180 | 0.58 |
| 17B | 23.8 | 747.8 | 259.5 | | | 1031 | 2% | 73% | 25% | 0% | 0% | 4.13 | 0.00177 | 0.58 |
| 18A | | 302.1 | 117.0 | | 3.5 | 423 | 0% | 71% | 28% | 0% | 1% | 4.05 | 0.00179 | 0.57 |
| 18B | 23.4 | 885.5 | 108.6 | 4.5 | | 1022 | 2% | 87% | 11% | 0% | 0% | 4.35 | 0.00177 | 0.60 |
| 1A | | 686.6 | 407.9 | | | 1094 | 0% | 63% | 37% | 0% | 0% | 3.94 | 0.00180 | 0.56 |
| 1B | | 341.8 | 65.5 | | | 407 | 0% | 84% | 16% | 0% | 0% | 4.26 | 0.00180 | 0.58 |
| 20A | | 213.7 | 91.3 | | | 305 | 0% | 70% | 30% | 0% | 0% | 4.05 | 0.00180 | 0.57 |
| 20B | 3.0 | 209.5 | | | | 212 | 1% | 99% | 0% | 0% | 0% | 4.51 | 0.00178 | 0.61 |
| 20C | 102.8 | 163.4 | 227.5 | 120.4 | | 614 | 17% | 27% | 37% | 20% | 0% | 3.73 | 0.00162 | 0.61 |
| 20D | 42.6 | 94.5 | 43.0 | 0.0 | | 180 | 24% | 52% | 24% | 0% | 0% | 4.26 | 0.00154 | 0.67 |
| 21A | | 113.4 | 593.4 | 280.3 | | 987 | 0% | 11% | 60% | 28% | 0% | 3.17 | 0.00180 | 0.51 |
| 21B | | 151.3 | 249.6 | 619.4 | | 1020 | 0% | 15% | 24% | 61% | 0% | 3.22 | 0.00180 | 0.51 |
| 22A | | 158.6 | 104.2 | 90.7 | | 353 | 0% | 45% | 29% | 26% | 0% | 3.67 | 0.00180 | 0.54 |

* Composite coefficients were calculated using Table RO-7 in the USDCM and weighting the area of the soil distribution in the individual subwatershed.

216080FD1
2005-3044
27Z

# High Plains (Blackstone) Country Club - Filing No. 3

## FINAL DRAINAGE REPORT

March 30, 2016
Rev. November 25, 2016
Rev. January 30, 2017
Rev. February 17, 2017

Prepared For:
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| APPROVED ONE YEAR FROM THIS DATE | |
|---|---|
| 03.07.17 | |
| CDP A.T. | 03/06/2017 |
| CITY ENGINEER | DATE |
| | 03/06/2017 |
| WATER DEPARTMENT | DATE |

To accommodate the construction of Filing No. 3, arterial roads South Monaghan Road and East Smoky Hill Road will be connected at the northeast corner of the HPCC property. The westerly half of the southern end of South Monaghan Road was completed with the improvement completed 2006. It is anticipated that the future development to the east will widened to add a bike lane and curb & gutter and storm facilities will be designed for the final layout. The full section of South Monaghan Road will be constructed from the Golf Maintenance building north to the intersection with East Smoky Hill Road. Existing storm sewer system Q will convey the majority of drainage in and along South Monaghan Road to Mutchie Creek while the northernmost portion will be conveyed through storm sewer system P to Pond D. The south half of East Smoky Hill Road will be constructed from South Country Club Parkway to South Monaghan Road. This runoff will also be conveyed through storm sewer system P to Pond D.

The following is a description of the storm sewer systems within Major Basin A that will convey runoff associated with the development of Filing 3:

### 4.2.1 Storm Sewer System 'P'

Storm sewer system 'P' consists of approximately 140 lf of 36" RCP that was stubbed from Pond D north to East Smoky Hill Road during the golf course construction (Reference 6). A sump inlet will be located at the low point of the curve intersection of South Monaghan Road and East Smoky Hill Road and will connect to the existing 36" RCP stub to convey the 2-year and 100-year storm events from Basins 132 and 314A to Pond D.

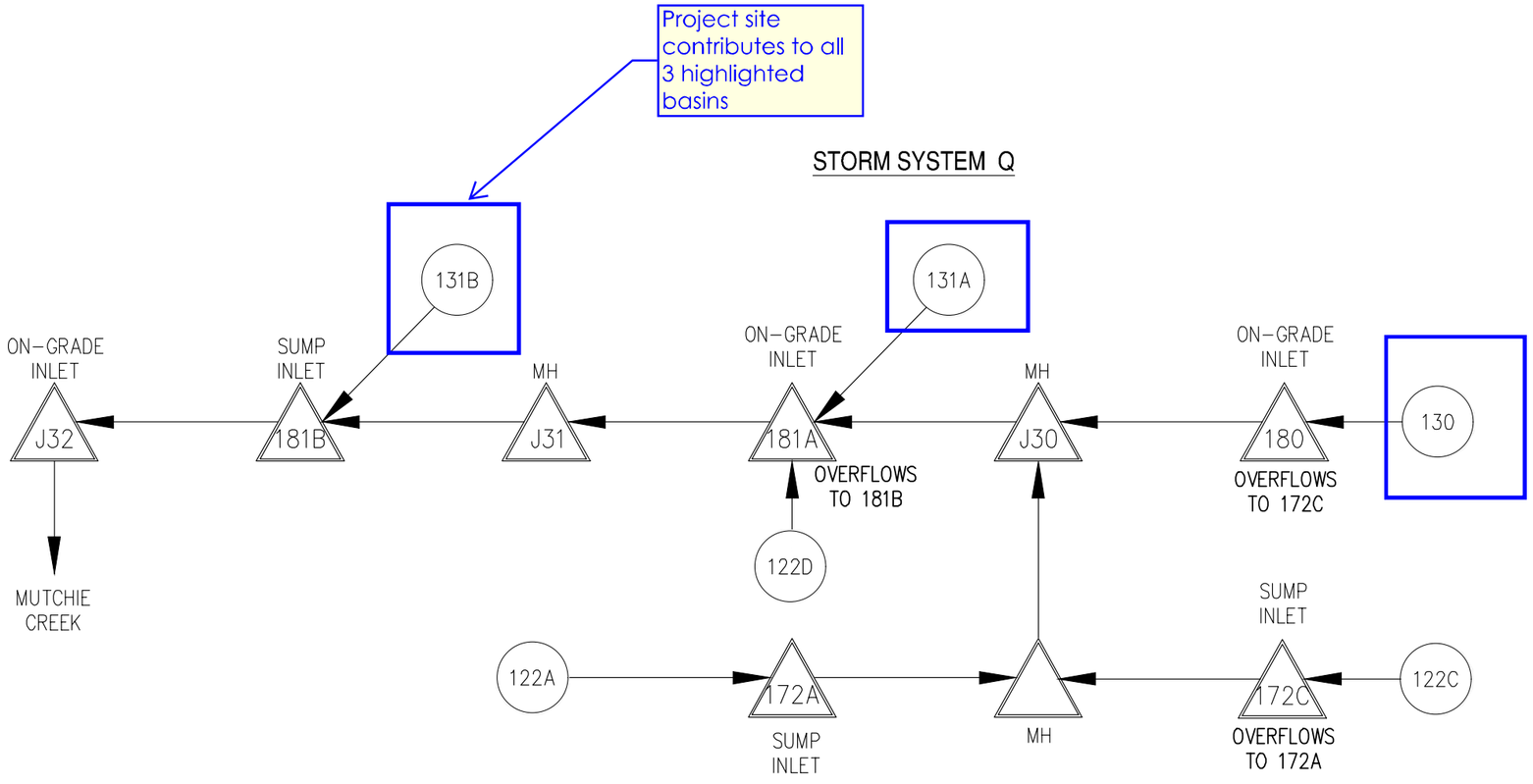
Basin 132 consists of the northern portion of S. Monaghan Road and unincorporated State property east of S. Monaghan Road. Runoff for the 2-year and 100-year events will be collected in the curb & gutter and conveyed to a sump inlet at DP 182, before then discharging into Pond D through a flared end section and rip-rap pad.

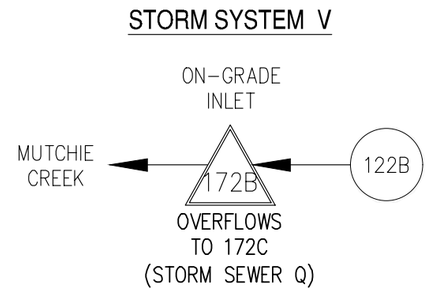
Basin 314A consists of the south half of E. Smoky Hill Road and adjacent southern right-of-way from S. Country Club Parkway to the intersection with S Monaghan Road. 2-year and 100-year runoff will be conveyed through curb & gutter to the sump inlet at DP 364A, which will connect to the existing 36" RCP stub and discharge into Pond D.

### 4.2.2 Storm Sewer System 'Q'

Storm sewer system 'Q' was installed during the previous development of Filing 3. The system begins on East Mineral Place and continues east then north through South Monaghan Road and discharges into Mutchie Creek north of the existing Golf Maintenance building. Based on the proposed road grading the off-site basins have been revised from the approved City of Aurora # 206088 storm sewer plan.

During the 2-year storm event, this system will convey runoff from Basins 122A, 122C, 122D, 130, 131A and 131B to Mutchie Creek.


Project site contributes to all 3 highlighted basins
STORM SYSTEM Q
131B
131A
ON-GRADE INLET
SUMP INLET
MH
ON-GRADE INLET
MH
ON-GRADE INLET
J32
181B
J31
181A
J30
180
130
OVERFLOWS TO 181B
OVERFLOWS TO 172C
MUTCHIE CREEK
122D
122A
172A
SUMP INLET
MH
SUMP INLET
172C
122C
OVERFLOWS TO 172A


STORM SYSTEM V
ON-GRADE INLET
MUTCHIE CREEK
172B
122B
OVERFLOWS TO 172C (STORM SEWER Q)

**PROJECT:** Blackstone Filing No. 3
**SUBJECT:** Site Improvements - Impervious Cover Calculations

**JOB #:** 020067
**DATE:** 2/17/17
**BY:** PDB

| | % Imp | C-2 | C-5 | C-100 |
|---|---|---|---|---|
| Park | 7 | 0.10 | 0.20 | 0.60 |
| Offiste Undeveloped | 5 | 0.25 | 0.27 | 0.35 |
| School/Rec Center/Clubhouse | 50 | 0.45 | 0.50 | 0.70 |
| Street, Paved | 100 | 0.87 | 0.88 | 0.93 |
| Open Space 2-7% slope | 5 | 0.18 | 0.19 | 0.22 |
| Road ROW Open Space | 5 | 0.25 | 0.27 | 0.35 |
| Parcel I | 50 | 0.40 | 0.45 | 0.60 |
| Parcel Q | 54 | 0.40 | 0.45 | 0.60 |
| Fire Station | 95 | 0.87 | 0.87 | 0.89 |

| Subbasin | Total Area (acres) | Land Use Area per Sub-Basin | | | | | | | | | % Check | Composite Imperviousness | Runoff Coefficients | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Park | Offiste Undeveloped | School/Rec Center/Clubhouse | Street, Paved | Open Space 2-7% slope | Road ROW Open Space | Parcel I | Parcel Q | Fire Station | | | C-2 | C-5 | C-100 |
| | | Area (acres) | Area (acres) | Area (acres) | Area (acres) | Area (acres) | Area (acres) | Area (acres) | Area (acres) | Area (acres) | | | | | |
| 101 | 28.80 | 0.00 | 27.92 | 0.00 | 0.53 | 0.00 | 0.35 | 0.00 | 0.00 | 0.00 | 100% | 7% | 0.26 | 0.28 | 0.36 |
| 112A | 5.88 | 0.00 | 0.00 | 0.00 | 0.23 | 0.62 | 0.00 | 1.58 | 3.45 | 0.00 | 100% | 50% | 0.40 | 0.44 | 0.57 |
| 112B | 2.57 | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 | 0.00 | 2.15 | 0.19 | 0.00 | 100% | 55% | 0.44 | 0.49 | 0.63 |
| 114D | 1.29 | 0.00 | 0.00 | 0.00 | 0.67 | 0.12 | 0.50 | 0.00 | 0.00 | 0.00 | 100% | 54% | 0.57 | 0.58 | 0.64 |
| 114E | 1.37 | 0.00 | 0.06 | 0.00 | 0.85 | 0.00 | 0.46 | 0.00 | 0.00 | 0.00 | 100% | 64% | 0.63 | 0.65 | 0.71 |
| 115A | 4.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.27 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 115B | 1.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.27 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 115C | 0.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.93 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 119A | 0.05 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.04 | 0.00 | 100% | 54% | 0.43 | 0.47 | 0.60 |
| 119B | 0.05 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.04 | 0.00 | 100% | 54% | 0.43 | 0.47 | 0.60 |
| 119C | 2.72 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 2.50 | 0.00 | 100% | 50% | 0.38 | 0.43 | 0.57 |
| 120A | 8.20 | 5.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.93 | 0.00 | 0.00 | 100% | 22% | 0.21 | 0.29 | 0.60 |
| 120B | 1.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.38 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 121A | 4.61 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.61 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 121B | 0.96 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.96 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 122A | 2.76 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 2.73 | 0.00 | 100% | 55% | 0.41 | 0.45 | 0.60 |
| 122B | 10.65 | 0.00 | 0.00 | 0.00 | 0.00 | 0.21 | 0.02 | 0.00 | 10.42 | 0.00 | 100% | 53% | 0.40 | 0.44 | 0.59 |
| 122C | 6.62 | 0.00 | 0.23 | 0.00 | 0.06 | 0.25 | 0.07 | 0.00 | 4.39 | 1.62 | 100% | 60% | 0.50 | 0.54 | 0.65 |
| 122D | 1.66 | 0.00 | 0.00 | 1.66 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100% | 50% | 0.45 | 0.50 | 0.70 |
| 123A | 0.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 123B | 4.68 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.68 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| 123C | 1.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.89 | 0.00 | 100% | 54% | 0.40 | 0.45 | 0.60 |
| ~~123D~~ | ~~5.85~~ | ~~0.00~~ | ~~0.00~~ | ~~0.00~~ | ~~0.00~~ | ~~0.90~~ | ~~0.05~~ | ~~0.00~~ | ~~4.82~~ | ~~0.00~~ | ~~100%~~ | ~~45%~~ | ~~0.36~~ | ~~0.40~~ | ~~0.53~~ |
| 130 | 10.93 | 0.00 | 7.01 | 0.00 | 2.59 | 0.00 | 1.33 | 0.00 | 0.00 | 0.00 | 100% | 28% | 0.40 | 0.41 | 0.49 |
| 131A | 4.04 | 0.00 | 3.28 | 0.00 | 0.42 | 0.00 | 0.34 | 0.00 | 0.00 | 0.00 | 100% | 15% | 0.31 | 0.33 | 0.41 |
| 131B | 10.79 | 0.00 | 9.51 | 0.00 | 1.09 | 0.00 | 0.19 | 0.00 | 0.00 | 0.00 | 100% | 15% | 0.31 | 0.33 | 0.41 |
| 132 | 3.88 | 0.00 | 1.58 | 0.00 | 1.52 | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 | 100% | 42% | 0.49 | 0.51 | 0.58 |
| 314A | 3.64 | 0.00 | 0.00 | 0.00 | 2.18 | 0.00 | 1.46 | 0.00 | 0.00 | 0.00 | 100% | 62% | 0.62 | 0.64 | 0.70 |
| **Total** | **142.58** | **5.27** | **52.16** | **1.66** | **14.54** | **2.72** | **8.74** | **6.66** | **49.21** | **1.62** | **100%** | **35%** | **0.37** | **0.41** | **0.52** |

1. From Table 1 in the City of Aurora SDTCM
2. Ruoff Coefficients based on equation RO-6 and RO-7 in the UDFCD

Bowman CONSULTING

**PROJECT:** Blackstone Filing No. 3 **JOB #:** 020067
**SUBJECT:** Site Improvements - Time of Concentration - Modified Form SF-1 **DATE:** 2/17/17

| | | | INITIAL/OVERLAND TIME (Ti) *[Max. 300']* | | | TRAVEL TIME (Tt) | | | | Tc CHECK (Urbanized Basins) | | | FINAL Tc | | RUNOFF SUMMARY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin No. | Area (acres) | 5Yr. co-eff. | Dist. (ft) | Slope (%) | Ti (min) | Dist. (ft) | Slope (%) | Vel. (fps) | Tt (min) | Tc | Length (ft) | Tc (min) | (min) | Remarks | $Q_2$ (cfs) | $Q_{100}$ (cfs) |
| 101 | 28.80 | 0.28 | 279 | 2.5 | 18.4 | 1113 | 5.2 | 3.42 | 5.4 | 23.8 | 1392 | 17.7 | 17.7 | | 15.2 | 63.0 |
| 112A | 5.88 | 0.44 | 70 | 6.4 | 5.4 | 1275 | 3.3 | 3.65 | 5.8 | 11.3 | 1345 | 17.5 | 11.3 | | 5.9 | 23.0 |
| 112B | 2.57 | 0.49 | 64 | 2.3 | 6.7 | 1248 | 3.4 | 3.67 | 5.7 | 12.4 | 1312 | 17.3 | 12.4 | | 2.7 | 10.7 |
| 114D | 1.29 | 0.58 | 78 | 1.1 | 8.2 | 843 | 2.8 | 3.32 | 4.2 | 12.4 | 921 | 15.1 | 12.4 | | 1.8 | 5.5 |
| 114E | 1.37 | 0.65 | 90 | 2.3 | 5.9 | 900 | 2.9 | 3.41 | 4.4 | 10.3 | 990 | 15.5 | 10.3 | | 2.2 | 6.9 |
| 115A | 4.27 | 0.45 | 231 | 7.1 | 9.4 | 613 | 3.3 | 3.65 | 2.8 | 12.2 | 844 | 14.7 | 12.2 | | 4.1 | 17.0 |
| 115B | 1.27 | 0.45 | 76 | 3.3 | 7.0 | 565 | 3.6 | 3.77 | 2.5 | 9.5 | 641 | 13.6 | 9.5 | | 1.4 | 5.6 |
| 115C | 0.93 | 0.45 | 88 | 2.6 | 8.2 | 298 | 0.9 | 1.91 | 2.6 | 10.8 | 386 | 12.1 | 10.8 | | 0.9 | 3.9 |
| 119A | 0.05 | 0.47 | 17 | 3.5 | 3.1 | 32 | 2.4 | 3.12 | 0.2 | 3.3 | 49 | 10.3 | 5.0 | 5 MIN MINIM | 0.1 | 0.3 |
| 119B | 0.05 | 0.47 | 17 | 3.3 | 3.2 | 32 | 0.8 | 1.77 | 0.3 | 3.5 | 49 | 10.3 | 5.0 | 5 MIN MINIM | 0.1 | 0.3 |
| 119C | 2.72 | 0.43 | 224 | 3.5 | 12.2 | 580 | 2.6 | 3.21 | 3.0 | 15.2 | 804 | 14.5 | 14.5 | | 2.3 | 9.5 |
| 120A | 8.20 | 0.29 | 300 | 4.4 | 15.7 | 1311 | 2.9 | 3.39 | 6.5 | 22.2 | 1611 | 19.0 | 19.0 | | 3.4 | 26.5 |
| 120B | 1.38 | 0.45 | 84 | 3.0 | 7.5 | 663 | 3.8 | 3.92 | 2.8 | 10.4 | 747 | 14.2 | 10.4 | | 1.4 | 5.9 |
| 121A | 4.61 | 0.45 | 84 | 3.2 | 7.4 | 800 | 4.4 | 4.20 | 3.2 | 10.6 | 884 | 14.9 | 10.6 | | 4.7 | 19.5 |
| 121B | 0.96 | 0.45 | 64 | 6.5 | 5.1 | 454 | 5.5 | 4.71 | 1.6 | 6.7 | 518 | 12.9 | 6.7 | | 1.2 | 4.8 |
| 122A | 2.76 | 0.45 | 93 | 2.2 | 8.9 | 1348 | 2.1 | 2.90 | 7.8 | 16.7 | 1441 | 18.0 | 16.7 | | 2.4 | 9.5 |
| 122B | 10.65 | 0.44 | 300 | 7.4 | 10.8 | 1112 | 3.4 | 3.71 | 5.0 | 15.8 | 1412 | 17.8 | 15.8 | | 9.2 | 37.2 |
| 122C | 6.62 | 0.54 | 300 | 6.1 | 9.8 | 896 | 1.8 | 2.67 | 5.6 | 15.4 | 1196 | 16.6 | 15.4 | | 7.2 | 25.8 |
| 122D | 1.66 | 0.50 | 120 | 9.8 | 5.6 | 493 | 1.9 | 2.75 | 3.0 | 8.6 | 613 | 13.4 | 8.6 | | 2.1 | 8.9 |
| 123A | 0.64 | 0.45 | 186 | 8.8 | 7.9 | 125 | 1.4 | 2.34 | 0.9 | 8.7 | 311 | 11.7 | 8.7 | | 0.7 | 2.9 |
| 123B | 4.68 | 0.45 | 70 | 1.6 | 8.6 | 1150 | 3.2 | 3.56 | 5.4 | 14.0 | 1220 | 16.8 | 14.0 | | 4.3 | 17.6 |
| 123C | 1.89 | 0.45 | 78 | 3.6 | 6.9 | 913 | 2.8 | 3.32 | 4.6 | 11.5 | 991 | 15.5 | 11.5 | | 1.9 | 7.7 |
| 123D | 5.85 | 0.40 | 171 | 4.0 | 10.5 | 1625 | 3.7 | 3.86 | 7.0 | 17.6 | 1796 | 20.0 | 17.6 | | 4.3 | 17.4 |
| 130 | 10.93 | 0.41 | 92 | 1.6 | 10.5 | 2512 | 3.7 | 3.83 | 10.9 | 21.4 | 2604 | 24.5 | 21.4 | | 8.0 | 27.1 |
| 131A | 4.04 | 0.33 | 202 | 14.9 | 8.2 | 496 | 4.1 | 4.03 | 2.1 | 10.2 | 698 | 13.9 | 10.2 | | 3.3 | 11.9 |
| 131B | 10.79 | 0.33 | 300 | 7.1 | 12.7 | 840 | 3.8 | 3.92 | 3.6 | 16.3 | 1140 | 16.3 | 16.3 | | 7.1 | 25.8 |
| 132 | 3.88 | 0.51 | 300 | 8.3 | 9.3 | 805 | 5.9 | 4.85 | 2.8 | 12.0 | 1105 | 16.1 | 12.0 | | 4.6 | 15.1 |
| 314A | 3.64 | 0.64 | 25 | 2.5 | 3.1 | 2575 | 4.2 | 4.08 | 10.5 | 13.6 | 2600 | 24.4 | 13.6 | | 5.2 | 16.2 |
| Total | 142.58 | | | | | | | | | | | | | | | |

Higher than proposed runoff from basin 29

**STANDARD FORM SF-2**
**STORM DRAINAGE SYSTEM DESIGN**
**(RATIONAL METHOD PROCEDURE)**

**CALCULATED BY:** BAR **P1=** 0.97 in **JOB NO:** 020067
**DATE:** 2/17/17 **PROJECT:** Blackstone Filing No. 3
**CHECKED BY:** CJD **DESIGN STORM:** 2 Year

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET/BASIN AREAS CONTRIBUTING TO DESIGN POINT | DESIGN POINT | AREA DESIG. | AREA (Acres) | RUNOFF COEFF | Tc (min) | C A (Acres) | I (in/hour) | Q (cfs) | Tc (min) | (C A) (Acres) | I (in/hour) | Q (cfs) | SLOPE (%) | STREET FLOW (cfs) | DESIGN FLOW (cfs) | SLOPE (%) | PIPE SIZE (in) | LENGTH (ft) | VELOCITY (fps) | Tt (min) | |
| **STORM SYSTEM 'P'** | | | | | | | | | | | | | | | | | | | | | |
| | **182** | 132 | 3.88 | 0.49 | 12.0 | 1.90 | 2.43 | **4.6** | | | | | | | | | | | | | |
| | **364A** | 314A | 3.64 | 0.62 | 13.6 | 2.26 | 2.30 | **5.2** | | | | | | | | | | | | | |
| 132, 314A | **182/364A** | | | | | | | | 13.6 | 4.16 | 2.30 | **9.6** | | | | | | | | | Outfall to Mutchie Creek |
| **STORM SYSTEM 'Q'** | | | | | | | | | | | | | | | | | | | | | |
| | **180** | 130 | 10.93 | 0.40 | 21.4 | 4.37 | 1.84 | **8.0** | | | | | | | | | | | | | Peak surface flow to DP180 |
| | **180** | | | | | | | | 21.4 | 4.22 | 1.84 | **7.8** | | | **7.8** | 7.25% | 18 | 82 | 13.8 | 0.1 | Captured by on-grade inlet at DP 180 |
| | **180** | | | | | | | | 21.4 | 0.15 | 1.84 | **0.3** | 2.85% | **0.3** | | | | 246 | 3.4 | 1.2 | Carryover from DP 180 to DP 172C |
| | **172B** | 122B | 10.65 | 0.40 | 15.8 | 4.26 | 2.15 | **9.2** | | | | | | | | | | | | | |
| | **172B** | | | | | | | | 15.8 | 4.26 | 2.15 | **9.2** | | | | | | | | | Captured by on-grade inlet at DP 172B |
| | **172C** | 122C | 6.62 | 0.50 | 15.4 | 3.31 | 2.17 | **7.2** | | | | | | | | | | | | | |
| 122B, 122C, 130 | **172C** | | | | | | | | 22.6 | 3.46 | 1.79 | **7.2** | | | **7.2** | 2.83% | 36 | 177 | 8.9 | 0.3 | Captured by sump inlet at DP 172C |
| | **172A** | 122A | 2.76 | 0.41 | 16.7 | 1.13 | 2.09 | **2.4** | | | | | | | **2.4** | 3.39% | 36 | 184 | 6.8 | 0.4 | Captured by sump inlet at DP 172A |
| 122B, 122C, 130, 180, 172B, 122A | **J30** | | | | | | | | 22.9 | 8.81 | 1.77 | **15.6** | | | **15.6** | 2.47% | 36 | 514 | 8.8 | 1.0 | Peak to DP J30 in pipe, to DP J31 |
| | **181A** | 122D | 1.66 | 0.45 | 8.6 | 0.75 | 2.78 | **2.1** | | | | | | | **2.1** | 9.16% | 24 | 14 | 9.8 | 0.0 | Captured by sump inlet |
| | **181A** | 131A | 4.04 | 0.31 | 10.2 | 1.25 | 2.60 | **3.3** | | | | | | | | | | | | | |
| | **181A** | | | | | | | | 10.2 | 1.25 | 2.60 | **3.3** | | | **3.3** | 6.35% | 24 | 27 | 9.9 | 0.0 | Captured by on-grade inlet at DP 181A |
| 122B, 122C, 130, 180, 172B, 122A, 122D, 131A | **J31** | | | | | | | | 23.9 | 10.81 | 1.73 | **18.7** | | | **18.7** | 1.08% | 36 | 326 | 4.0 | 1.4 | Peak to DP J31 in pipe, to DP J32 |
| | **181B** | 131B | 10.79 | 0.31 | 16.3 | 3.34 | 2.12 | **7.1** | | | | | | | | | | | | | |
| | | | | | | | | | 16.3 | 3.34 | 2.12 | **7.1** | | | **7.1** | 1.08% | 36 | 326 | 6.3 | 0.9 | Captured by sump inlet at DP 181B |
| 122B, 122C, 130, 172B, 122A, 122D, 131A, 181B | **J32** | | | | | | | | 25.3 | 14.15 | 1.68 | **23.8** | | | | | | | | | Outfall to Mutchie Creek |
| **STORM SYSTEM 'R'** | | | | | | | | | | | | | | | | | | | | | |
| | **151** | 101 | 28.80 | 0.26 | 17.7 | 7.49 | 2.03 | **15.2** | | | | | | | **15.2** | 1.98% | 42 | 500 | 9.6 | 0.87 | Captured by FES at DP 151 |
| | **164D** | 114D | 1.29 | 0.57 | 12.4 | 0.34 | 2.40 | **0.8** | | | | | | | | | | | | | Peak surface flow at DP 164D |
| | **164D** | | | | | | | | 12.4 | 0.33 | 2.40 | **0.8** | | | **0.8** | 2.00% | 18 | 35 | 4.5 | 0.13 | Captured by on-grade inlet at DP 164D |
| 114D, 119B | **169B** | 119B | 0.05 | 0.43 | 5.0 | 0.02 | 3.29 | **0.1** | | | | | | | **0.1** | 2.00% | 18 | 26 | 2.4 | 0.18 | Captured by sump inlet at DP 169B |
| 119A | **169A** | 119A | 0.05 | 0.43 | 5.0 | 0.02 | 3.29 | **0.1** | | | | | | | **0.1** | 2.00% | 18 | 26 | 2.4 | 0.18 | Captured by on-grade inlet at DP 169A |
| 101, 114D, 119B, 119A | **J34** | | | | | | | | 18.6 | 7.87 | 1.98 | **15.6** | | | **15.6** | 7.36% | 42 | 1077 | 15.4 | 1.17 | Peak to DP J34 in pipe, to DP J35 |
| | **169C** | 119C | 2.72 | 0.38 | 14.5 | 1.03 | 2.24 | **2.3** | | | | | | | | | | | | | Peak surface flow at DP 169C |
| | **169C** | | | | | | | | 14.5 | 0.86 | 2.24 | **1.9** | | | **1.9** | 7.36% | 42 | 1001 | 6.7 | 2.51 | Captured by inlets at DP 169C |
| 101, 114D,1 19B, 119A, 119C | **169C** | | | | | | | | 14.5 | 0.17 | 2.24 | **0.4** | | | | | | | | | Carryover from DP 169C to DP 162A |
| | **171A** | 121A | 4.61 | 0.40 | 10.6 | 1.84 | 2.56 | **4.7** | | | | | | | | | | | | | |
| | **171A** | | | | | | | | 10.6 | 1.13 | 2.56 | **2.9** | | | **2.9** | 2.00% | 18 | 13 | 6.0 | 0.04 | Captured by inlets at DP 171A |
| | **171A** | | | | | | | | 10.6 | 0.71 | 2.56 | **1.8** | 2.00% | **1.8** | | | | 30 | 2.8 | 0.2 | Carryover from DP 171A to DP 171B |
| | **171B** | 121B | 0.96 | 0.40 | 6.7 | 0.38 | 3.02 | **1.2** | | | | | | | | | | | | | |
| 121A, 121B, 171A | **171B** | | | | | | | | 10.8 | 1.10 | 2.55 | **2.8** | | | | | | | | | Peak surface flow to DP 171B |
| | **171B** | | | | | | | | 10.8 | 1.10 | 2.55 | **2.8** | | | **2.8** | 2.00% | 18 | 13 | 6.5 | 0.03 | Captured by on-grade inlet at DP 171B |
| 101, 114D,1 19B, 119A, 119C, 121A, 121B | **J35** | | | | | | | | 19.7 | 10.96 | 1.92 | **21.1** | | | **21.1** | 3.34% | 42 | 377 | 12.8 | 0.49 | Peak to DP J35 in pipe, to DP J36 |

Project site

Bowman CONSULTING

**STANDARD FORM SF-2**
**STORM DRAINAGE SYSTEM DESIGN**
**(RATIONAL METHOD PROCEDURE)**

| | | | | | |
|---|---|---|---|---|---|
| **CALCULATED BY:** | **BAR** | **P1=** | **2.67 in** | **JOB NO:** | **020067** |
| **DATE:** | **2/16/17** | | | **PROJECT:** | **Blackstone Filing No. 3** |
| **CHECKED BY:** | **CJD** | | | **DESIGN STORM:** | **100 Year** |

| | | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET/BASIN AREAS CONTRIBUTING TO DESIGN POINT | DESIGN POINT | AREA DESIG. | AREA (Acres) | RUNOFF COEFF | Tc (min) | C A (Acres) | I (in/hour) | Q (cfs) | Tc (min) | (C A) (Acres) | I (in/hour) | Q (cfs) | SLOPE (%) | STREET FLOW (cfs) | DESIGN FLOW (cfs) | SLOPE (%) | PIPE SIZE (in) | LENGTH (ft) | VELOCITY (fps) | Tt (min) | |
| **STORM SYSTEM 'P'** | | | | | | | | | | | | | | | | | | | | | |
| | **182** | 132 | 3.88 | 0.58 | 12.0 | 2.25 | 6.70 | **15.1** | | | | | | | | | | | | | |
| | **364A** | 314A | 3.64 | 0.70 | 13.6 | 2.55 | 6.34 | **16.2** | | | | | | | | | | | | | |
| 132, 314A | **182/364A** | | | | | | | | 13.6 | 4.80 | 6.34 | **30.4** | | | | | | | | | Outfall to Mutchie Creek |
| **STORM SYSTEM 'Q'** | | | | | | | | | | | | | | | | | | | | | |
| | **180** | 130 | 10.93 | 0.49 | 21.4 | 5.36 | 5.07 | **27.1** | | | | | | | | | | | | | Peak surface flow to DP180 |
| | **180** | | | | | | | | 21.4 | 3.12 | 5.07 | **15.8** | | | **15.8** | 7.25% | 18 | 82 | 15.9 | 0.1 | Captured by on-grade inlet at DP 180 |
| | **180** | | | | | | | | 21.4 | 2.23 | 5.07 | **11.3** | 2.85% | **11.3** | | | | 246 | 3.4 | 1.2 | Carryover from DP 180 to DP 172C |
| | **172B** | 122B | 10.65 | 0.59 | 15.8 | 6.28 | 5.91 | **37.2** | | | | | | | | | | | | | |
| | **172B** | | | | | | | | 15.8 | 3.28 | 5.91 | **19.4** | | | | | | | | | Captured by on-grade inlet at DP 172B |
| | **172B** | | | | | | | | 15.8 | 3.01 | 5.91 | **17.8** | 2.93% | **17.8** | | | | 762 | 3.4 | 3.7 | Carryover from DP 172B to DP 172C |
| | **172C** | 122C | 6.62 | 0.65 | 15.4 | 4.30 | 5.99 | **25.8** | | | | | | | | | | | | | |
| 122B, 122C, 130 | **172C** | | | | | | | | 22.6 | 9.54 | 4.92 | **46.9** | | | **46.9** | 2.83% | 36 | 177 | 14.6 | 0.2 | Captured by sump inlet at DP 172C |
| | **172A** | 122A | 2.76 | 0.60 | 16.7 | 1.66 | 5.76 | **9.5** | | | | | | | **9.5** | 3.39% | 36 | 184 | 10.3 | 0.3 | Captured by sump inlet at DP 172A |
| 122B, 122C, 130, 180, 172B, 122A | **J30** | | | | | | | | 22.8 | 14.32 | 4.89 | **70.1** | | | **70.1** | 2.47% | 36 | 514 | 14.5 | 0.6 | Peak to DP J30 in pipe, to DP J31 |
| | **181A** | 122D | 1.66 | 0.70 | 8.6 | 1.16 | 7.65 | **8.9** | | | | | | | **8.9** | 9.16% | 24 | 14 | 15.0 | 0.0 | Captured by sump inlet |
| | **181A** | 131A | 4.04 | 0.41 | 10.2 | 1.66 | 7.17 | **11.9** | | | | | | | | | | | | | |
| | **181A** | | | | | | | | 10.2 | 1.42 | 7.17 | **10.2** | | | **10.2** | 6.35% | 24 | 27 | 13.7 | 0.0 | Captured by on-grade inlet at DP 181A |
| | **181A** | | | | | | | | 10.2 | 0.23 | 7.17 | **1.7** | 1.55% | **1.7** | | | | 308 | 2.5 | 2.1 | Carryover from DP 181A to DP 181B |
| 122B, 122C, 130, 180, 172B, 122A, 122D, 131A | **J31** | | | | | | | | 23.4 | 16.91 | 4.83 | **81.6** | | | **81.6** | 1.08% | 36 | 326 | 11.1 | 0.5 | Peak to DP J31 in pipe, to DP J32 |
| | **181B** | 131B | 10.79 | 0.41 | 16.3 | 4.42 | 5.82 | **25.8** | | | | | | | | | | | | | |
| | | | | | | | | | 16.3 | 4.66 | 5.82 | **27.1** | | | **27.1** | 1.08% | 36 | 326 | 9.2 | 0.6 | Captured by sump inlet at DP 181B |
| 122B, 122C, 130, 172B, 122A, 122D, 131A, 181B | **J32** | | | | | | | | 23.9 | 21.56 | 4.77 | **102.9** | | | | | | | | | Outfall to Mutchie Creek |
| **STORM SYSTEM 'R'** | | | | | | | | | | | | | | | | | | | | | |
| | **151** | 101 | 28.80 | 0.39 | 17.7 | 11.27 | 5.59 | **63.0** | | | | | | | **63.0** | 1.98% | 42 | 500 | 14.3 | 0.58 | Captured by FES at DP 151 |
| | **164D** | 114D | 1.29 | 0.60 | 12.4 | 0.50 | 6.61 | **3.3** | | | | | | | | | | | | | Peak surface flow at DP 164D |
| | **164D** | | | | | | | | 12.4 | 0.32 | 6.61 | **2.1** | | | **2.1** | 2.00% | 18 | 35 | 6.6 | 0.09 | Captured by on-grade inlet at DP 164D |
| | **164D** | | | | | | | | 12.4 | 0.18 | 6.61 | **1.2** | 0.70% | **1.2** | | | | 40 | 1.7 | 0.4 | Carryover from DP 164D to DP 169B |
| | **169B** | 119B | 0.05 | 0.60 | 5.0 | 0.03 | 9.06 | **0.3** | | | | | | | | | | | | | |
| 114D, 119B | **169B** | | | | | | | | 12.5 | 0.21 | 6.59 | **1.4** | | | | | | | | | Peak surface flow at DP 169B |
| | **169B** | | | | | | | | 12.5 | 0.02 | 6.59 | **0.1** | | | **0.1** | 2.00% | 18 | 26 | 2.4 | 0.18 | Captured by sump inlet at DP 169B |
| | **169B** | | | | | | | | 12.5 | 0.20 | 6.59 | **1.3** | 0.70% | **1.3** | | | | 122 | 1.7 | 1.2 | Carryover from DP 169B to DP 169C |
| 119A | **169A** | 119A | 0.05 | 0.60 | 5.0 | 0.03 | 9.06 | **0.3** | | | | | | | **0.3** | 2.00% | 18 | 26 | 3.3 | 0.13 | Captured by on-grade inlet at DP 169A |
| 101, 114D, 119B, 119A | **J34** | | | | | | | | 18.3 | 11.64 | 5.50 | **64.0** | | | **64.0** | 7.36% | 42 | 1077 | 23.2 | 0.77 | Peak to DP J34 in pipe, to DP J35 |
| | **169C** | 119C | 2.72 | 0.57 | 14.5 | 1.55 | 6.16 | **9.5** | | | | | | | | | | | | | |
| | **169C** | | | | | | | | 13.7 | 1.75 | 6.32 | **11.1** | | | | | | | | | Peak surface flow at DP 169C |
| | **169C** | | | | | | | | 14.5 | 0.74 | 6.16 | **4.6** | | | **4.6** | 7.36% | 42 | 1001 | 11.1 | 1.50 | Captured by inlets at DP 169C |
| 101, 114D,1 19B, 119A, 119C | **169C** | | | | | | | | 14.5 | 0.81 | 6.16 | **5.0** | | | | | | | | | Carryover from DP 169C to DP 162A |
| | **171A** | 121A | 4.61 | 0.60 | 10.6 | 2.77 | 7.06 | **19.5** | | | | | | | | | | | | | Peak surface flow at 171A |
| | **171A** | | | | | | | | 10.6 | 1.98 | 7.06 | **14.0** | | | **14.0** | 2.00% | 18 | 13 | 7.8 | 0.03 | Captured by inlets at DP 171A |

Project site

Bowman
Vision Land

**PROJECT:** Blackstone Filing No. 3
**SUBJECT:** Site Improvements - Street Flow - 2 Year

**JOB #:** 020067
**DATE:** 2/17/17
**BY:** JHL

| Design Point | Minimum Slope (%) | Street Type | Curb and Gutter Type | Half Street Flow (cfs) | Allowable Half Street Capacity (cfs) | Flow Depth (in) |
|---|---|---|---|---|---|---|
| 162A | 1.0% | Local Type I | Mountable | 5.6 | 9.2 | 5.6 |
| 162B | 1.0% | Local Type I | Mountable | 2.7 | 9.2 | 5.6 |
| 165A | 1.0% | Local Type I | Mountable | 7.0 | 9.2 | 5.6 |
| 165B | 1.0% | Local Type I | Mountable | 7.8 | 9.2 | 5.6 |
| 165C | 1.0% | Local Type I | Mountable | 0.9 | 9.2 | 5.6 |
| 169A | 1.0% | Local Type I | Mountable | 0.1 | 9.2 | 5.6 |
| 169B | 1.0% | Local Type I | Mountable | 0.1 | 9.2 | 5.6 |
| 169C | 1.0% | Local Type I | Mountable | 2.3 | 9.2 | 5.6 |
| 170A | 5.0% | Local Type II | Mountable | 3.4 | 7.5 | 5.1 |
| 170B | 4.0% | Local Type II | Mountable | 1.9 | 9.2 | 5.1 |
| 171A | 2.0% | Local Type II | Mountable | 4.7 | 9.7 | 5.1 |
| 171B | 2.0% | Local Type II | Mountable | 2.8 | 9.7 | 5.1 |
| 172A | 1.0% | Local Type I | Mountable | 2.4 | 9.2 | 5.6 |
| 172B | 5.0% | Local Type I | Mountable | 9.2 | 10.1 | 5.6 |
| 172C | 1.0% | Local Type I | Mountable | 7.2 | 9.2 | 5.6 |
| 173A | 2.5% | Local Type II | Mountable | 0.7 | 9.5 | 5.1 |
| 173B | 1.0% | Local Type I | Mountable | 4.3 | 9.2 | 5.6 |
| 173C | 1.0% | Local Type I | Mountable | 1.9 | 9.2 | 5.6 |
| 173D | 1.0% | Local Type I | Mountable | 7.4 | 9.2 | 5.6 |
| 181A | 0.5% | Collector | Vertical | 3.3 | 8.1 | 6 |
| 181B | 0.5% | Collector | Vertical | 7.1 | 8.1 | 6 |
| 182 | 1.0% | Collector | Vertical | 5.2 | 11.5 | 6 |

Bowman
Vision Land

**PROJECT: Blackstone Filing No. 3**
**SUBJECT: Site Improvements - Street Capacities - 100 Year**

**JOB #: 020067**
**DATE: 2/17/17**
**BY: JHL**

| Design Point | Minimum Slope (%) | Street Type | Curb and Gutter Type | Full Street Flow (cfs) | Allowable Full Street Capacity (cfs) | Flow Depth (ft) |
|---|---|---|---|---|---|---|
| 162A | 1.0% | Local Type I | Mountable | 40.0 # | 212.0 | <1.0 |
| 162B | 1.0% | Local Type I | Mountable | 40.0 # | 212.0 | <1.0 |
| 165A | 1.0% | Local Type I | Mountable | 52.0 # | 212.0 | <1.0 |
| 165B | 1.0% | Local Type I | Mountable | 52.0 # | 212.0 | <1.0 |
| 165C | 1.0% | Local Type I | Mountable | 52.0 # | 212.0 | <1.0 |
| 169A | 1.0% | Local Type I | Mountable | 0.3 | 212.0 | <1.0 |
| 169B | 1.0% | Local Type I | Mountable | 1.4 | 212.0 | <1.0 |
| 169C | 1.0% | Local Type I | Mountable | 11.1 | 212.0 | <1.0 |
| 170A | 5.0% | Local Type II | Mountable | 26.8 | 178.0 | <1.0 |
| 170B | 4.0% | Local Type II | Mountable | 14.1 | 191.0 | <1.0 |
| 171A | 2.0% | Local Type II | Mountable | 19.5 | 237.0 | <1.0 |
| 171B | 2.0% | Local Type II | Mountable | 9.6 | 237.0 | <1.0 |
| 172A | 1.0% | Local Type I | Mountable | 47.9 # | 212.0 | <1.0 |
| 172B | 5.0% | Local Type I | Mountable | 37.2 | 190.0 | <1.0 |
| 172C | 1.0% | Local Type I | Mountable | 47.9 # | 212.0 | <1.0 |
| 173A | 2.5% | Local Type II | Mountable | 3.9 | 221.0 | <1.0 |
| 173B | 1.0% | Local Type I | Mountable | 17.6 | 212.0 | <1.0 |
| 173C | 1.0% | Local Type I | Mountable | 7.7 | 212.0 | <1.0 |
| 173D | 1.0% | Local Type I | Mountable | 30.6 | 212.0 | <1.0 |
| 181A | 0.5% | Collector | Vertical | 11.9 | 143.0 | <1.0 |
| 181B | 0.5% | Collector | Vertical | 27.1 | 143.0 | <1.0 |
| 182 | 1.0% | Collector | Vertical | 30.4 | 202.0 | <1.0 |

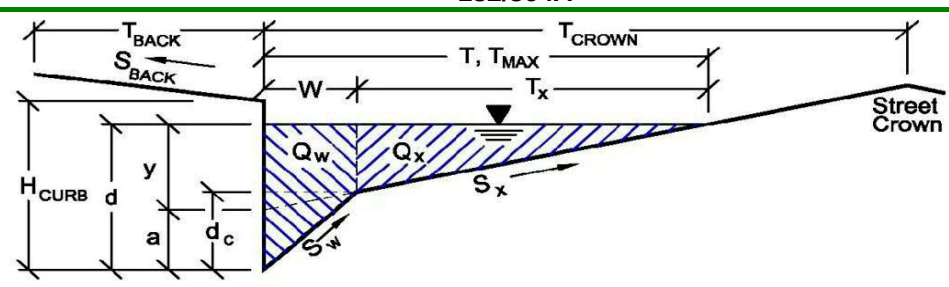
# When two design points are located adjacently in a sump, on opposite sides of a local street, the sum of the flows to the sump was used for the full street flow.

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** High Plains Country Club Filing No. 3

**Inlet ID:** 182/364A




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 14.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 42.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 42.0 | 42.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 12.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

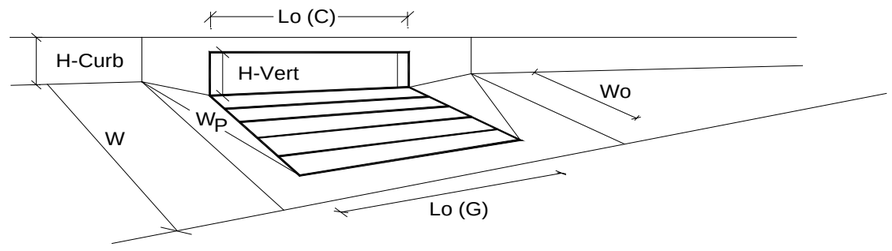
**Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

**Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

# INLET IN A SUMP OR SAG LOCATION

**Project =** High Plains Country Club Filing No. 3

**Inlet ID =** 182/364A



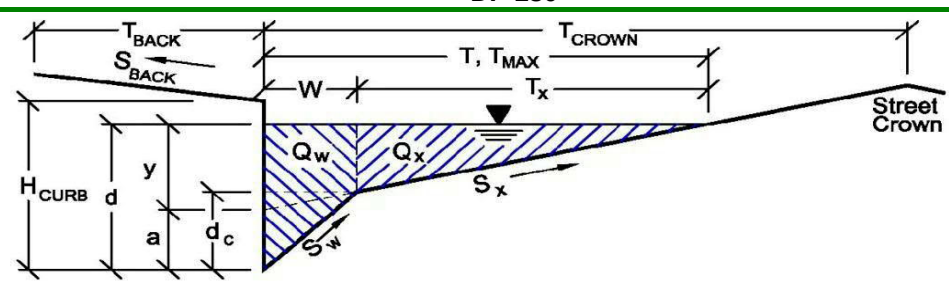

| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Inlet Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow') | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 6.0 | 11.6 | inches |
| | | | | ☑ Override Depths |
| **Grate Information** | | MINOR | MAJOR | |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 30.00 | 30.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.20 | 0.20 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **17.6** | **74.1** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 9.6 | 30.4 | cfs |

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** High Plains Country Club Filing No. 3

**Inlet ID:** DP 180




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 14.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 29.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.040 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 18.5 | 23.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 12.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

**MINOR STORM Allowable Capacity is based on Depth Criterion**

**MAJOR STORM Allowable Capacity is based on Spread Criterion**

| | Minor Storm | Major Storm | |
|---|---|---|---|
| $Q_{allow}$ = | **16.3** | **47.0** | **cfs** |

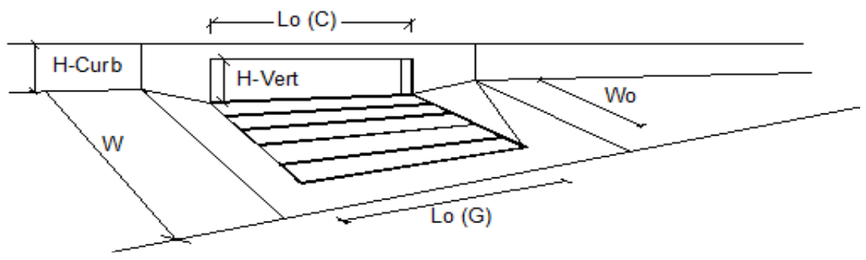
**Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

**Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

# INLET ON A CONTINUOUS GRADE

**Project:** High Plains Country Club Filing No. 3

**Inlet ID:** DP 180




| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 15.00 | 15.00 | ft |
| Width of a Unit Grate (cannot be greater than W from Q-Allow) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Warning 1 Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.20 | 0.20 | |

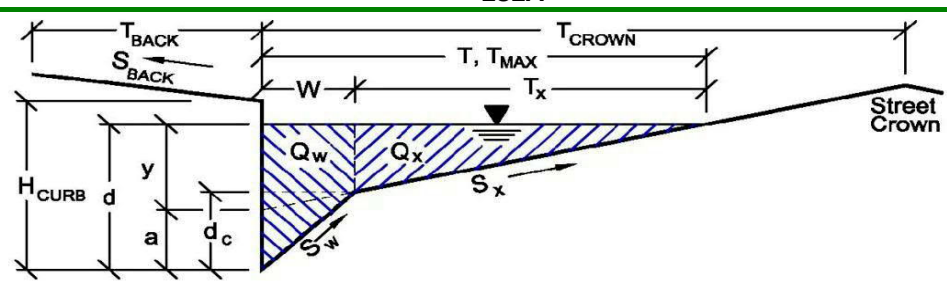
| Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow' | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **7.77** | **15.83** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.2** | **11.3** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **97** | **58** | **%** |

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** High Plains Country Club Filing No. 3

**Inlet ID:** 181A




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 14.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 31.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.035 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 18.5 | 23.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 12.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

**MINOR STORM Allowable Capacity is based on Depth Criterion**

**MAJOR STORM Allowable Capacity is based on Spread Criterion**

| | Minor Storm | Major Storm | |
|---|---|---|---|
| $Q_{allow}$ = | **17.0** | **43.9** | **cfs** |

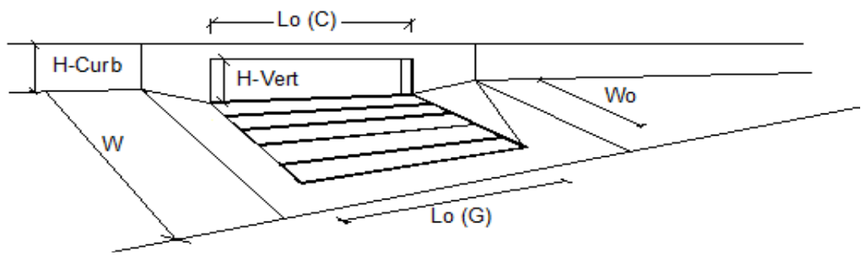
**Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

**Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

# INLET ON A CONTINUOUS GRADE

**Project:** High Plains Country Club Filing No. 3

**Inlet ID:** 181A




| Design Information (Input) | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 15.00 | 15.00 | ft |
| Width of a Unit Grate (cannot be greater than W from Q-Allow) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Warning 1 Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.20 | 0.20 | |

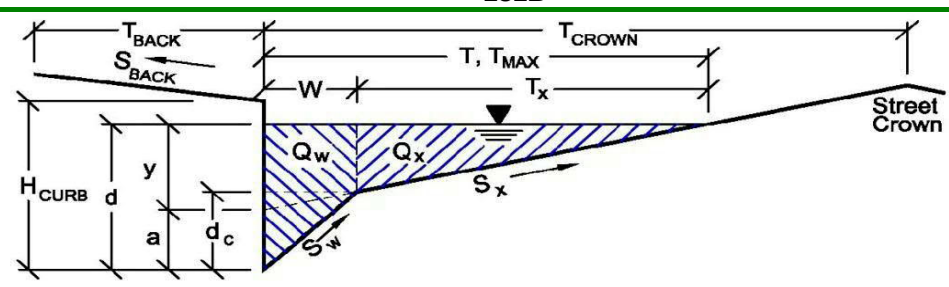
| Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow' | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **3.30** | **10.20** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **1.7** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **86** | **%** |

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** High Plains Country Club Filing No. 3

**Inlet ID:** 181B




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 14.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.020 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 31.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 18.5 | 23.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 12.0 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

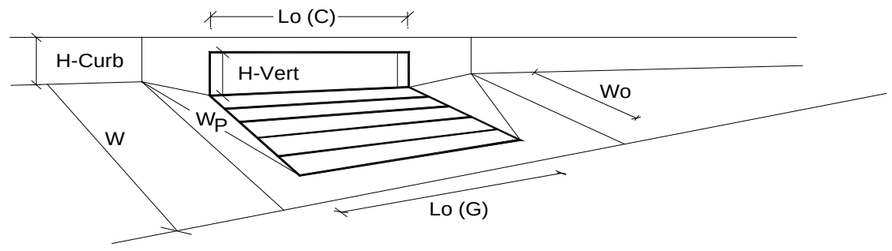
**Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

**Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'**

# INLET IN A SUMP OR SAG LOCATION

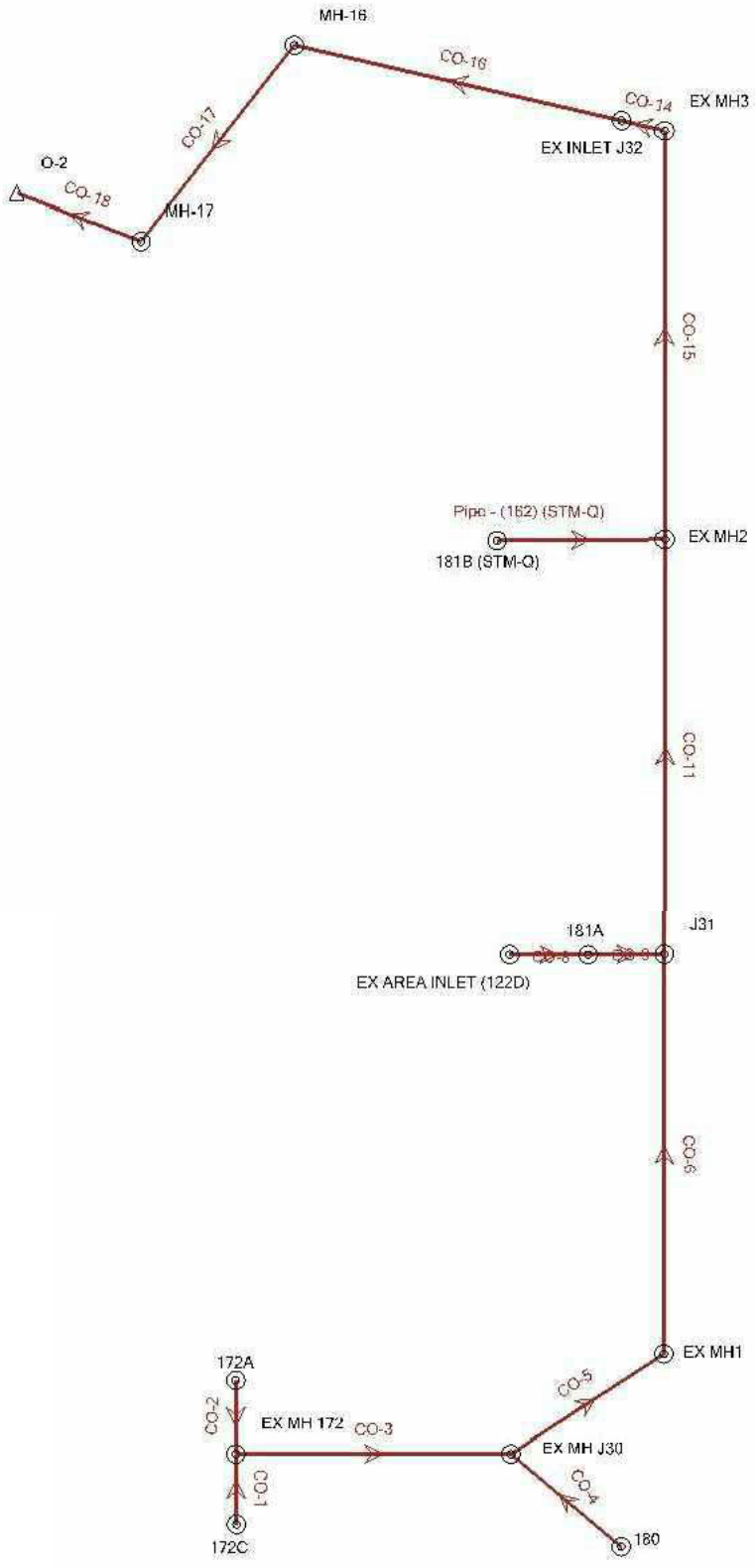
**Project =** High Plains Country Club Filing No. 3

**Inlet ID =** 181B




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Inlet Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow') | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 6.0 | 7.8 | inches |
| **Grate Information** | | MINOR | MAJOR | |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 15.00 | 15.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.20 | 0.20 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **19.0** | **38.1** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 7.1 | 27.1 | cfs |

☑ Override Depths

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Fax: (303) 674-3263
www.bowmanconsulting.com

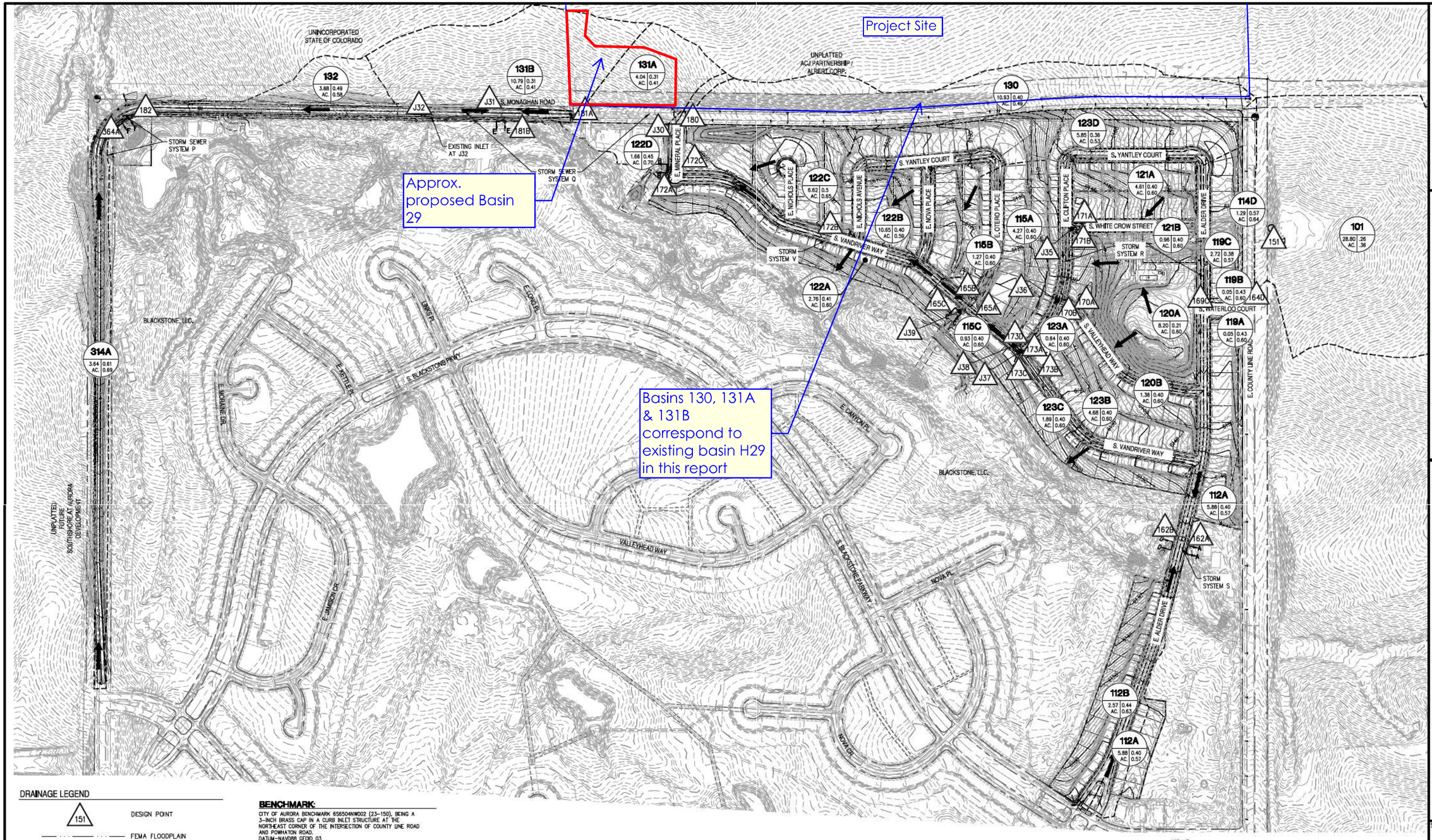
STORM SCHEMATIC - SYSTEM Q

HPCC FILING 3 (BLACKSTONE)
AURORA, CO

Cad file name: P:\020067 – Blackstone\020067-01-001 (ENG) – Filing 3\Engineering\Work\JL-Storm\Storm Schematic.dwg

| 2-yr Scenario - Storm System Q | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Label | Start Node | Stop Node | Invert (Start) (ft) | Invert (Stop) (ft) | Length (User Defined) (ft) | Slope (Calculated) (ft/ft) | Slope (Calculated) (%) | Diameter (in) | Manning's n | Flow (cfs) | Velocity (ft/s) | Capacity (Full Flow) (cfs) | Depth (Normal) (ft) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
| 35 | Pipe - (162) (STM-Q) | 181B (STM-Q) | EX MH2 | 6054.4 | 6053.83 | 28.7 | 0.02 | 2 | 24 | 0.013 | 7.1 | 8.17 | 31.88 | 0.64 | 6055.35 | 6054.52 |
| 50 | CO-1 | 172C | EX MH 172 | 6079.24 | 6079 | 13.8 | 0.017 | 1.7 | 30 | 0.013 | 7.2 | 7.66 | 54.17 | 0.62 | 6080.13 | 6079.7 |
| 51 | CO-2 | 172A | EX MH 172 | 6080.45 | 6079 | 21.4 | 0.068 | 6.8 | 18 | 0.013 | 2.4 | 9.52 | 27.33 | 0.3 | 6081.04 | 6079.88 |
| 52 | CO-3 | EX MH 172 | EX MH J30 | 6078.9 | 6074.2 | 162.8 | 0.029 | 2.9 | 36 | 0.013 | 9.6 | 9.76 | 113.32 | 0.59 | 6079.88 | 6074.79 |
| 53 | CO-4 | 180 | EX MH J30 | 6081.84 | 6075.9 | 82 | 0.072 | 7.2 | 18 | 0.013 | 7.8 | 13.67 | 28.27 | 0.54 | 6082.92 | 6076.44 |
| 55 | CO-5 | EX MH J30 | EX MH1 | 6073.4 | 6070.66 | 115.2 | 0.024 | 2.4 | 36 | 0.013 | 15.6 | 10.5 | 102.88 | 0.79 | 6074.66 | 6071.45 |
| 59 | CO-6 | EX MH1 | J31 | 6070.26 | 6060.73 | 398 | 0.024 | 2.4 | 36 | 0.013 | 15.6 | 10.53 | 103.2 | 0.79 | 6071.52 | 6061.52 |
| 61 | CO-8 | AREA INLET (122 | 181A | 6062.9 | 6062.45 | 32.3 | 0.014 | 1.4 | 24 | 0.013 | 2.1 | 5.07 | 26.72 | 0.38 | 6063.4 | 6063.27 |
| 62 | CO-9 | 181A | J31 | 6062.45 | 6060.73 | 27.1 | 0.063 | 6.3 | 24 | 0.013 | 5.4 | 11.42 | 56.99 | 0.42 | 6063.27 | 6061.92 |
| 66 | CO-11 | J31 | EX MH2 | 6060.53 | 6052.83 | 317 | 0.024 | 2.4 | 36 | 0.013 | 18.7 | 11.14 | 103.95 | 0.86 | 6061.92 | 6054.37 |
| 72 | CO-14 | EX MH3 | EX INLET J32 | 6045.85 | 6045.5 | 22.4 | 0.016 | 1.6 | 36 | 0.013 | 25.8 | 10.4 | 83.37 | 1.15 | 6047.49 | 6046.81 |
| 73 | CO-15 | EX MH2 | EX MH3 | 6052.73 | 6045.95 | 303.2 | 0.022 | 2.2 | 36 | 0.013 | 25.8 | 11.84 | 99.73 | 1.04 | 6054.37 | 6046.99 |
| 78 | CO-16 | EX INLET J32 | MH-16 | 6045.5 | 6032.59 | 203.4 | 0.063 | 6.3 | 36 | 0.013 | 23.8 | 16.82 | 168.03 | 0.76 | 6047.07 | 6033.35 |
| 79 | CO-17 | MH-16 | MH-17 | 6032.49 | 6030.61 | 90.4 | 0.021 | 2.1 | 36 | 0.013 | 23.8 | 11.28 | 96.16 | 1.02 | 6034.06 | 6031.66 |
| 80 | CO-18 | MH-17 | O-2 | 6030.34 | 6029.68 | 30.3 | 0.022 | 2.2 | 36 | 0.013 | 23.8 | 11.46 | 98.38 | 1 | 6031.91 | 6030.83 |

| 100-yr Scenario - Storm System Q | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Label | Start Node | Stop Node | Invert (Start) (ft) | Invert (Stop) (ft) | Length (User Defined) (ft) | Slope (Calculated) (ft/ft) | Slope (Calculated) (%) | Diameter (in) | Manning's n | Flow (cfs) | Velocity (ft/s) | Capacity (Full Flow) (cfs) | Depth (Normal) (ft) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
| 35 | Pipe - (162) (STM-Q) | 181B (STM-Q) | EX MH2 | 6054.4 | 6053.83 | 28.7 | 0.02 | 2 | 24 | 0.013 | 27.1 | 8.63 | 31.88 | 1.42 | 6057.53 | 6057.12 |
| 50 | CO-1 | 172C | EX MH 172 | 6079.24 | 6079 | 13.8 | 0.017 | 1.7 | 30 | 0.013 | 46.9 | 12.42 | 54.17 | 1.8 | 6081.5 | 6081.33 |
| 51 | CO-2 | 172A | EX MH 172 | 6080.45 | 6079 | 21.4 | 0.068 | 6.8 | 18 | 0.013 | 9.5 | 14.07 | 27.33 | 0.61 | 6081.64 | 6081.33 |
| 52 | CO-3 | EX MH 172 | EX MH J30 | 6078.9 | 6074.2 | 162.8 | 0.029 | 2.9 | 36 | 0.013 | 56.4 | 16.01 | 113.32 | 1.5 | 6081.33 | 6075.74 |
| 53 | CO-4 | 180 | EX MH J30 | 6081.84 | 6075.9 | 82 | 0.072 | 7.2 | 18 | 0.013 | 15.8 | 16.44 | 28.27 | 0.8 | 6083.26 | 6076.73 |
| 55 | CO-5 | EX MH J30 | EX MH1 | 6073.4 | 6070.66 | 115.2 | 0.024 | 2.4 | 36 | 0.013 | 70.1 | 15.66 | 102.88 | 1.82 | 6076.06 | 6072.58 |
| 59 | CO-6 | EX MH1 | J31 | 6070.26 | 6060.73 | 398 | 0.024 | 2.4 | 36 | 0.013 | 70.1 | 15.69 | 103.2 | 1.81 | 6072.92 | 6062.54 |
| 61 | CO-8 | AREA INLET (122 | 181A | 6062.9 | 6062.45 | 32.3 | 0.014 | 1.4 | 24 | 0.013 | 8.9 | 7.65 | 26.72 | 0.79 | 6063.96 | 6064.02 |
| 62 | CO-9 | 181A | J31 | 6062.45 | 6060.73 | 27.1 | 0.063 | 6.3 | 24 | 0.013 | 19.1 | 16.34 | 56.99 | 0.8 | 6064.02 | 6063.31 |
| 66 | CO-11 | J31 | EX MH2 | 6060.53 | 6052.83 | 317 | 0.024 | 2.4 | 36 | 0.013 | 81.6 | 16.28 | 103.95 | 2 | 6063.31 | 6057.12 |
| 72 | CO-14 | EX MH3 | EX INLET J32 | 6045.85 | 6045.5 | 22.4 | 0.016 | 1.6 | 36 | 0.013 | 108.7 | 15.38 | 83.37 | (N/A) | 6049.06 | 6048.42 |
| 73 | CO-15 | EX MH2 | EX MH3 | 6052.73 | 6045.95 | 303.2 | 0.022 | 2.2 | 36 | 0.013 | 108.7 | 15.38 | 99.73 | (N/A) | 6057.12 | 6049.06 |
| 78 | CO-16 | EX INLET J32 | MH-16 | 6045.5 | 6032.59 | 203.4 | 0.063 | 6.3 | 36 | 0.013 | 102.9 | 24.96 | 168.03 | 1.7 | 6048.41 | 6034.35 |
| 79 | CO-17 | MH-16 | MH-17 | 6032.49 | 6030.61 | 90.4 | 0.021 | 2.1 | 36 | 0.013 | 102.9 | 15.24 | 96.16 | 2.73 | 6035.22 | 6033.34 |
| 80 | CO-18 | MH-17 | O-2 | 6030.34 | 6029.68 | 30.3 | 0.022 | 2.2 | 36 | 0.013 | 102.9 | 15.78 | 98.38 | 2.61 | 6033.25 | 6032.47 |



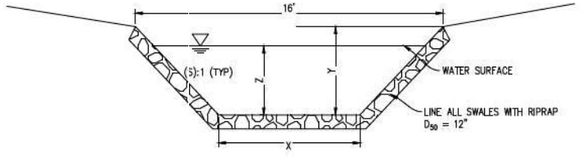

## DRAINAGE LEGEND

- 151 — DESIGN POINT
- FEMA FLOODPLAIN
- PROPOSED BASIN BOUNDARY
- 350 — EXISTING GROUND MAJOR CONTOUR
- 349 — EXISTING GROUND MINOR CONTOUR
- 350 — PROPOSED GRADE MAJOR CONTOUR
- 349 — PROPOSED GRADE MINOR CONTOUR
- FLOW DIRECTION
- BASIN DESIGNATION 101 / 32.14 AC. .26 .36 / BASIN AREA — DRAINAGE BASIN
- 2-YEAR COEFFICIENT / 100-YEAR COEFFICIENT

**BENCHMARK:**

CITY OF AURORA BENCHMARK 6S6504NW002 (23-150), BEING A 3-INCH BRASS CAP IN A CURB INLET STRUCTURE AT THE NORTH-EAST CORNER OF THE INTERSECTION OF COUNTY LINE ROAD AND POWHATON ROAD.
DATUM=NAVD88 GEOID 03
ELEVATION=6168.39

| CHANNEL DIMENSIONS | | | | | | |
|---|---|---|---|---|---|---|
| SECTION ID | S | X | Y | Z | Channel slope (%) | Q100 (CFS) |
| A-A | 4 | 8 | 1 | 1 | 1.5 | 44.7 |
| B-B | 4 | 8 | 1 | 0.87 | 12.5 | 99.6 |
| C-C | 3 | 8 | 2.5 | 1.03 | 10 | 114.2 |
| D-D | 4 | 8 | 1 | 0.77 | 4 | 44.7 |
| E-E | 4 | 8 | 1 | 0.52 | 10 | 46.6 |
| F-F | 4 | 8 | 1 | 0.34 | 33.3 | 30.4 |




NOTES:

1. REFERENCE THE OFF-SITE CONSTRUCTION PLANS FOR THE PROPOSED STORM SEWER IMPROVEMENTS LOCATED IN SMOKY HILL PARKWAY AND MONAGHAN ROAD.

Know what's below. Call before you dig. 811

HLINON

GRAPHIC SCALE
200 0 100 200 400 800
( IN FEET )
1 inch = 200 ft.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Fax: (303) 674-8383
www.bowmanconsulting.com


| REVISIONS | | |
|---|---|---|
| REVISION | DESCRIPTION | DATE |
| 2 | 2ND. CD SUBMITTAL | 11/23/16 |
| 3 | SIGNATURE SUBMISSION | 1/30/17 |
| 4 | SIGNATURE RESUBMISSION | 2/20/17 |

# OVERALL DRAINAGE MAP

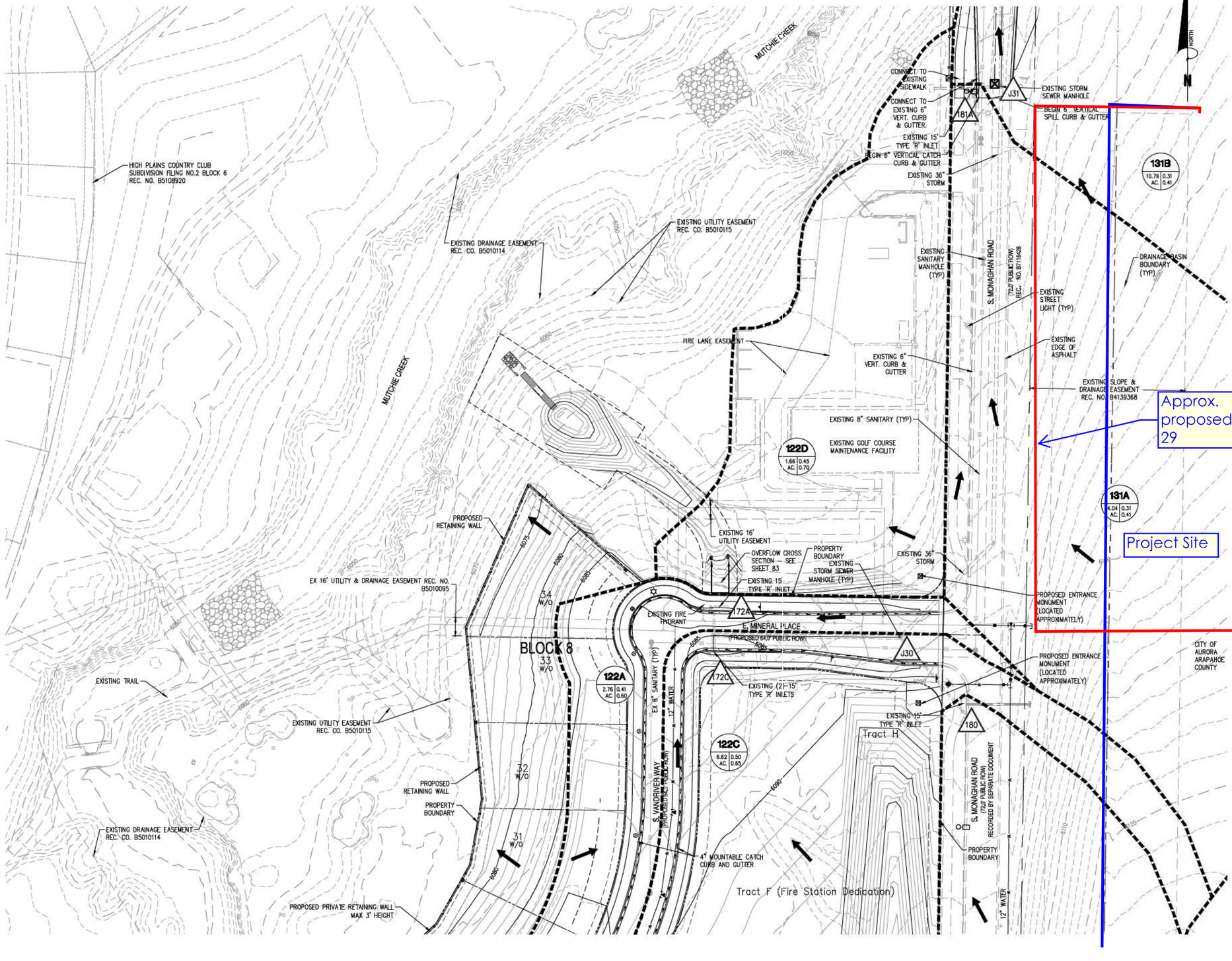
HIGH PLAINS (BLACKSTONE) COUNTRY CLUB FILING 3
CONSTRUCTION DOCUMENTS
CITY OF AURORA / ARAPAHOE COUNTY COLORADO

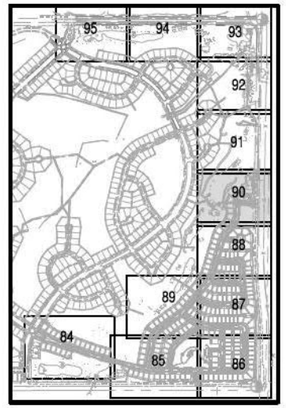
SEAL
COLORADO LICENSED
CLIFTON DAYTON
48189
2-20-17
PROFESSIONAL ENGINEER

| DESIGN | DRAWN | CHKD |
|---|---|---|
| CO / TWW | TWW | CO |

SCALE: H: 1" = 200' V: N/A
JOB No. 020067-01-001
DATE : 2/20/2017
SHEET 83

Cad file name : P:\020067 - Blackstone\020067-01-001 (ENG) - Filing 3\Engineering\Engineering Plans\CONSTRUCTION DOCS\020067-0-DR-001-DDM-OVERALL.dwg




KEY MAP
SCALE: 1" = 1000'

GRAPHIC SCALE

40 0 20 40 80 160

( IN FEET )
1 inch = 40 ft.

NOTES:
1. CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
2. THE STORM SEWER IS PUBUC & SIZED FOR THE 100-YEAR EVENT UNLESS NOTED.

LEGEND

- 151 — DESIGN POINT
- FEMA FLOODPLAIN
- PROPOSED BASIN BOUNDARY
- 350 — EXISTING GROUND MAJOR CONTOUR
- 349 — EXISTING GROUND MINOR CONTOUR
- 350 — PROPOSED GRADE MAJOR CONTOUR
- 349 — PROPOSED GRADE MINOR CONTOUR
- FLOW DIRECTION
- BASIN DESIGNATION / BASIN AREA — 101 — 32.14 AC. | .26 | .36 — DRAINAGE BASIN
- 2-YEAR COEFFICIENT
- 100-YEAR COEFFICIENT

**BENCHMARK:**
CITY OF AURORA BENCHMARK 6S6504NW002 (23-150), BEING A 3-INCH BRASS CAP IN A CURB INLET STRUCTURE AT THE NORTHEAST CORNER OF THE INTERSECTION OF COUNTY LINE ROAD AND POMATON ROAD.
DATUM-NAVD88 GEOID 03
ELEVATION-6168.39

**BASIS OF BEARING:**
BASIS OF BEARINGS IS THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 33, TOWNSHIP 5 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, BEARING NORTH 00°26'27" EAST, AS MONUMENTED BY THE SOUTHWEST CORNER OF SAID SECTION 33, BEING A 3-1/4 INCH ALUMINUM CAP STAMPED "RLS 10377", AND BY THE WEST QUARTER CORNER OF SAID SECTION 33, BEING AN ILLEGIBLE ALUMINUM CAP IN RANGE BOX, AS SHOWN HEREON AND MONUMENTED.

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| REVISIONS | | |
|---|---|---|
| REVISION | DESCRIPTION | DATE |
| 2 | 2ND CD SUBMITTAL | 11/23/16 |
| 3 | SIGNATURE SUBMISSION | 1/30/17 |
| 4 | SIGNATURE RESUBMISSION | 2/20/17 |

# PROPOSED DRAINAGE MAP - VIEW 7

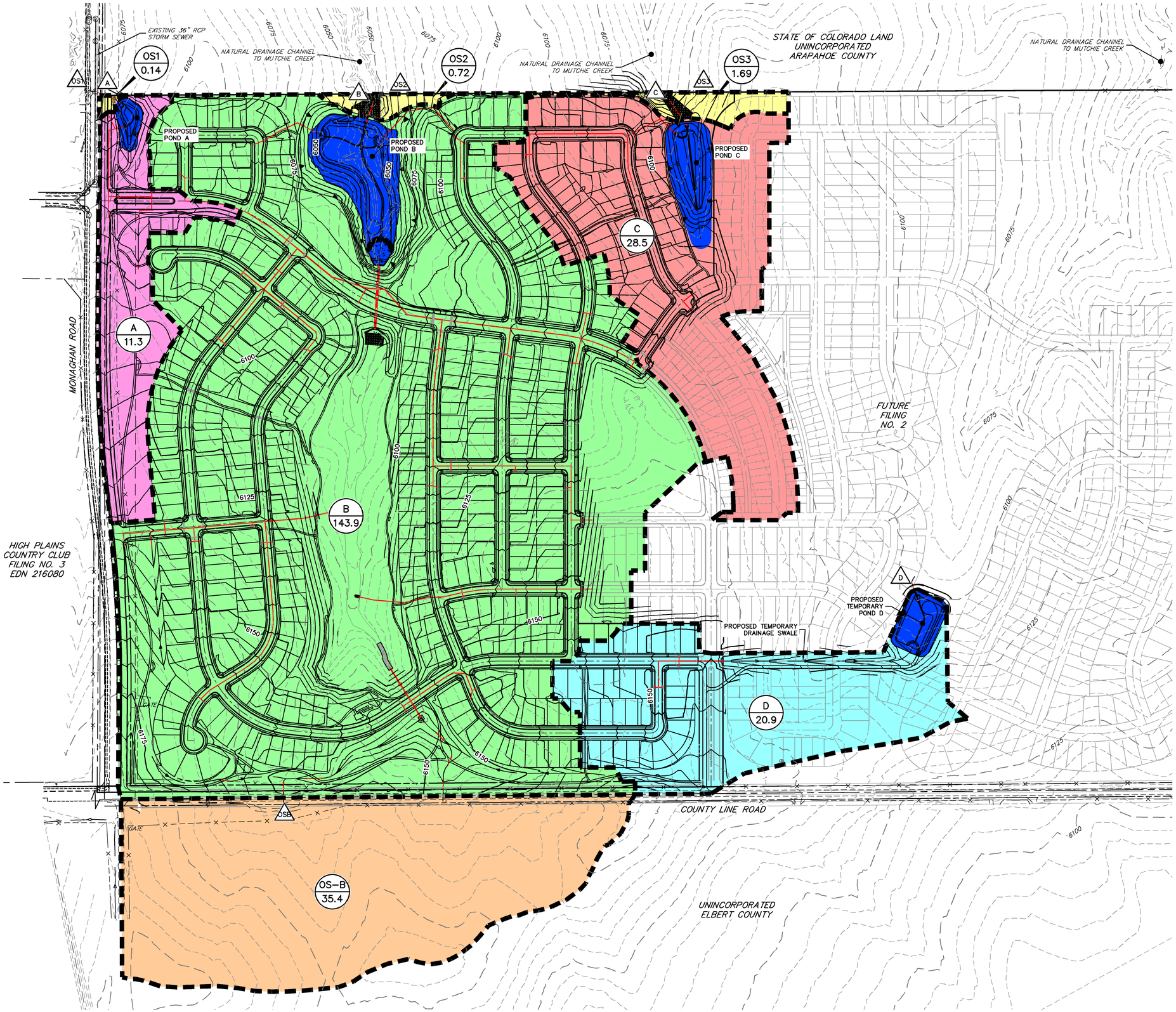
HIGH PLAINS (BLACKSTONE) COUNTRY CLUB FILING 3
CONSTRUCTION DOCUMENTS
CITY OF AURORA / ARAPAHOE COUNTY COLORADO

SEAL
COLORADO LICENSED
CLIFTON DAYTON
48189
2-20-17
PROFESSIONAL ENGINEER

| DESIGN | DRAWN | CHKD |
|---|---|---|
| CO/TWW | TWW | CO |
| SCALE | H: 1" = 40' V: N/A | |
| JOB No. | 020067-01-001 | |
| DATE : | 2/20/2017 | |
| SHEET | 90 | |

Cad file name : P:\020067 - Blackstone\020067-01-001 (ENG) - Filing 3\Engineering\Engineering Plans\CONSTRUCTION DOCS\020067-0-DP-001-DDM.dwg

# APPENDIX F
# DRAINAGE MAP




| POND ID | AREA SERVICED (AC) | IMPERVIOUS % |
|---|---|---|
| POND A | 11.28 | 31.2% |
| POND B | 143.92 | 43.0% |
| POND C | 28.53 | 52.4% |
| POND D | 20.91 | 28.8% |
| TOTAL | 204.64 | |

## LEGEND:

- PROPOSED STORM SEWER
- 6100 — PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 6100 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- BASIN TRIBUTARY TO POND A
- BASIN TRIBUTARY TO POND B
- BASIN TRIBUTARY TO POND C
- BASIN TRIBUTARY TO POND D
- OFFSITE BASIN TRIBUTARY TO POND B
- OFFSITE BASIN
- PROPOSED POND

A = BASIN DESIGNATION
B = AREA IN ACRES

1 DESIGN OUTLET

200 100 0 200 400
ORIGINAL SCALE: 1" = 200'

OVERALL DRAINAGE PLAN
TRAILS AT OVERLAND RANCH
JOB NO. 16118.00
10/27/22
SHEET 1 OF 1

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Fort Collins 970-491-9888 • www.jrengineering.com