Winsome Filing No 1
17480 Meridian Road North
Colorado Springs, Colorado 80924

Final Drainage Report

OCTOBER 2, 2020

PREPARED FOR:
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VERTEX Project: 49388
PCD File No. SF203

Jason Priddy
Project Engineer

Lance VanDemark, P.E.
Project Manager

Engineer's Certification

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO LICENSED
LANCE PATRICK VANDEMARK
43911
PROFESSIONAL ENGINEER

10/06/2020

Lance VanDemark, P.E.
Registered Professional Engineer
State of Colorado No. 43911

Owner Certification

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

✓ *Joseph W. DesJardin* — *10/5/2020*

Joseph DesJardin
Director of Entitlements
Winsome, LLC

Date

El Paso County

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

Jennifer Irvine, P.E.
County Engineer / ECM Administrator

Date

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ATTACHMENTS

1.0 GENERAL LOCATION AND DESCRIPTION

The following report provides detailed drainage information for existing and proposed conditions for the Winsome Filing No 1 project. Filing No 1 is a portion of the overall development studied last year for Preliminary Plan approval. The intent of this report is to show the routing of minor and major storms through the proposed site in accordance with El Paso County Standards. For this site, a minor flow is defined as the 5-year frequency storm and a major flow as the 100-year frequency storm. The information given in this report is intended to provide a detailed analysis of on-site drainage areas and receiving facilities. This development will consist of large-lot single family residential lots, access roads, and the required infrastructure to serve them.

GENERAL LOCATION

The site is located at 17480 Meridian Road North or, more generally, at the northwest corner of Hodgen Road and Meridian Road North in unincorporated El Paso County, latitude 39°04’38” N and longitude 104°36’47” W. The subject property is undeveloped and situated in Section 24, Township 11 South, Range 65 West of the 6th P.M., County of El Paso, State of Colorado.

The site is bounded to the south by Hodgen Road, to the east by Meridian Road North, and to the north and west by several parcels zoned primarily as Agricultural and Residential use with some Forest Land. On the east side of Median Road is Forest Green Subdivision, a low-density single-family development. On the south side of Hodgen Road is Bison Meadows Subdivision which is also a low-density single family residential subdivision. The remainder of properties surrounding the site have not yet been formally platted. The site has not been included in any previous drainage study. West Kiowa Creek flows approximately through the center of the property from the southwest corner to the northeast corner, upstream to the west and southwest of the property lie 3 Kiowa Creek Watershed Reservoirs notated as 1-N-10, 1-P-10, and 1-P-20. There are no irrigation ditches on the property.

DESCRIPTION OF PROPERTY

The existing site contains 767 acres of agricultural grazing land and dry farm land. Ground cover consists mainly of native grasses, shrubs, and several stands of evergreen trees along its northern and southern boundary. Existing wetlands are present along West Kiowa Creek and its tributaries, wetland boundaries are located roughly 50 feet to either side of the thalweg of West Kiowa Creek and the drainageway way to the south of the creek on the property. There are no existing irrigation canals or ditches on the project site nor are there any major geologic features. The property generally slopes in a northeasterly direction with slopes ranging between 1-16%. Soils consist of Alamosa loam, Brussett loam, Cruckton sandy loam, Elbeth sandy loam, Holderness loam, Kettle gravelly loamy sands, Peyton sandy loam, Peyton-Pring complex, Pring course sandy loam, Tomah-Crowford loamy sands and Tomah-Crowfoot complex. Most of the site has soils classified in Hydrologic Soil Group B; however, the property also contains a small mixture of soils from Hydrologic Soils Groups C and D located in the areas in and adjacent to West Kiowa Creek and its tributaries. A soils map prepared by Natural Resources Conservation Service is included in the Appendix.

The development of this property will consist of 143 2.5 to 10-acre single family residential lots and the requisite public roads and stormwater infrastructure to serve them. Filing 1 of this project is covered in this drainage report and consists of 47 of the total lots with the rest of the site remaining in existing condition. Anticipated construction activities include earthwork and paving associated with the public road development, as well as the installation of culverts and stormwater detention ponds to convey and treat stormwater on the site. As previously discussed, West Kiowa Creek bisects the property, flowing from southwest to northeast. In addition, a major tributary of West Kiowa Creek flows north from a point halfway along the southern property boundary and intersects West Kiowa Creek in the middle of the property. The primary access for the site will be from 3 points along Hodgen Road and 1 entry point along Meridian Road. Filing 1 of the project will construct the first 2 entries off Hodgen. The shaded area in the exhibit below denotes the Filing 1 area.

2.0 DRAINAGE BASINS AND SUB-BASINS

MAJOR BASIN DESCRIPTION

The site resides within the West Kiowa Creek Drainage Basin (KIKI0200) which is located near the northern boundary of El Paso County, approximately 14.5 miles east of downtown Monument, CO. This watershed begins approximately 5 miles southwest of the Winsome property and continues another 10 miles to the northeast where it outfalls into Kiowa Creek which eventually discharges into the South Platte River near Fort Morgan, CO.

DRAINAGE STUDIES, OUTFALL SYSTEM PLANS, & SITE CONSTRAINTS

There are no major drainage studies (DBPS or MDDP) for this area on record and no base flood elevations for this reach of West Kiowa Creek that have been established. In conjunction with the previous Preliminary Plan, a floodplain study has been performed on the section of West Kiowa

Creek located within the property. A Conditional Letter of Map Revision (CLOMR) has been submitted and approved by FEMA to establish the floodplain boundary on-site. A plan showing the new proposed 100-year floodplain line is included in the appendix along with supporting documentation. The site is shown on FEMA flood map 08041C0350G with an effective date of 12/7/2018 which indicates that the site is in Zone X – an area outside of the 0.2% annual chance of flood (see the accompanying exhibits in the Appendix). The areas immediately adjacent to West Kiowa Creek are designated as Zone A, which is a 100-year Flood Hazard Area in which no base flood elevations have been determined. No portion of Filing 1 comes in contact with the effective or proposed floodplain. There are no known irrigation facilities located on the property at the current time.

EXISTING SUB-BASIN DESCRIPTION

Historically, the runoff from the property flows into West Kiowa Creek, which bisects the site flowing from the southwest corner of the property to the northeast corner. There are 10 on-site sub-basins and 6 off-site sub-basin that contribute flows to West Kiowa Creek. The 10 on-site sub-basins correspond to the largest defined natural drainage channels that occur on site, while the 6 off-site basins are defined by the entire West Kiowa Creek watershed that is upstream from the subject property.

As previously discussed, the site is currently undeveloped, containing mainly native grasses and shrubs, with limited forested areas along the northern and southern boundary of the site. The existing topography of the site slopes generally in a northerly direction with grades varying from 1-16%. There are no existing irrigation canals or ditches on the project site nor are there any major geologic features. The existing site can be described as 12 sub-basins as follows:

Sub-Basin A is the 915.4-acre watershed of the western tributary to West Kiowa Creek. This sub-basin contains the West Kiowa Creek 1-N-10 Reservoir which is located about a quarter-mile

upstream of the property to the west. The sub-basin generates peak runoff of 87.1cfs in the 5-year event and peak runoff of 585.6cfs in the 100-year event. Stormwater generated within the basin flows east from Southwood Drive to the subject property and discharges into West Kiowa Creek immediately to the east of the western property boundary.

Consisting of the entire West Kiowa Creek watershed that is south of Hodgen Road, Sub-Basin Ba encompasses 3836.7 acres and generates peak runoff of 271.5cfs in the 5-year event and peak runoff of 1448.6cfs in the 100-year event. This sub-basin contains 2 Kiowa Creek Watershed Reservoirs noted as 1-P-10 and 1-P-20 located upstream of the property to the southwest. The largest of these reservoirs is evaluated later in the report for risk hazard. Sub-Basin Ba begins approximately 5 miles to the southwest of the Winsome property near Black Forest, CO. Stormwater generated within the basin flows from southwest to northeast passing under a bridge on Hogden Road into sub-basin Bb.

Stormwater generated within the 100.6-acre sub-basin Bb has a peak runoff of 19.2cfs in the 5-year event and peak runoff of 127.7cfs in the 100-year event. Sub-Basin Bb is located at the southwest corner of the property and consists of the land immediately tributary to West Kiowa Creek on the north side of Hodgen Road. Flows from this sub-basin travel to the northeast discharging into the Creek.

Sub-Basin Ca consists of an off-site area located near the southwest corner of the property. This sub-basin has an area of 162.7-acres and generates peak runoff of 20.7cfs in the 5-year event and peak runoff of 127.8cfs in the 100-year event. This sub-basin discharges into a 30” CMP culvert under Hodgen Road flowing into sub-basin Cb.

Sub-Basin Cb located in the southwest corner of the property. This sub-basin has an area of 70-acres and generates peak runoff of 9.9cfs in the 5-year event and peak runoff of 88.1cfs in the

100-year event. This sub-basin consists of the land tributary to a minor drainage channel that discharges into sub-basin H.

Sub-Basin Da is the 161.3-acre watershed of the southern tributary to West Kiowa Creek. The sub-basin generates peak runoff of 20.6cfs in the 5-year event and peak runoff of 127.3cfs in the 100-year event. Stormwater generated within the basin flows north from Pole Pine Point to the subject property and discharges into a 72” CMP culvert under Hodgen Road into sub-basin Dc.

Sub-Basin Db is the 49.9-acre watershed of the southern tributary to West Kiowa Creek. The sub-basin generates peak runoff of 5.7cfs in the 5-year event and peak runoff of 34.1cfs in the 100-year event. Stormwater generated within the basin flows north from Pole Pine Point to the subject property and discharges into a 30” CMP culvert under Hodgen Road into sub-basin Dc.

Sub-Basin Dc is the 249.7-acre watershed of the southern tributary to West Kiowa Creek. This sub-basin contains a significant fraction of the southern half of the Winsome property. The sub-basin generates peak runoff of 28.1cfs in the 5-year event and peak runoff of 275.7cfs in the 100-year event. Stormwater generated within the basin flows north discharges into West Kiowa Creek immediately near the center of the project site.

Sub-Basin Ea consists of an off-site area located near the southeast corner of the property. This sub-basin has an area of 37.9-acres and generates peak runoff of 5.4cfs in the 5-year event and peak runoff of 34.8cfs in the 100-year event. This sub-basin discharges into a 30” RCP culvert under Hodgen Road flowing into sub-basin Eb.

Sub-Basin Eb located in the southeast corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek at the eastern property line. This sub-basin has an area of 74.6-acres and generates peak runoff of 4.0cfs in the 5-year event and peak runoff of 85.8cfs in

the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Sub-Basin F located in the southeast corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek to the east of the property. This sub-basin has an area of 44.5-acres and generates peak runoff of 6.6cfs in the 5-year event and peak runoff of 56.6cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Sub-Basin G located on the western side of the property and consists of an on-site watershed of a minor natural drainage channel that flows from west to east and discharges into West Kiowa Creek near the west of the property. This sub-basin has an area of 107.6 acres and generates peak runoff of 45.3cfs in the 5-year event and peak runoff of 199.0cfs in the 100-year event.

Sub-Basin H located in the northern side corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek on the north side of the property. This sub-basin has an area of 121.8 acres and generates peak runoff of 34.8cfs in the 5-year event and peak runoff of 197.2cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of West Kiowa Creek on the western side of the site.

Sub-Basin I located in the northeast corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek to the east of the property. This sub-basin has an area of 37.5-acres and generates peak runoff of 26.4cfs in the 5-year event and peak runoff of 88.4cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of West Kiowa Creek on the eastern side of the site.

Sub-Basin J located in the northeast corner of the property and consists of an on-site watershed that discharges to the north of the property in existing natural drainage channels. This sub-basin

has an area of 10.1-acres and generates peak runoff of 3.4cfs in the 5-year event and peak runoff of 19.9cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Sub-Basin K located in the northeast corner of the property and consists of an on-site watershed that discharges to the north of the property in existing natural drainage channels. This sub-basin has an area of 17.8-acres and generates peak runoff of 12.9cfs in the 5-year event and peak runoff of 45.1cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Flow rate numbers were generated using NRCS Curve Number Methodology with HEC-HMS modeling software. Colorado Springs Stormwater Manual criteria was used for identifying curve numbers of the type B, C, and D NRCS Hydrologic Soil Groups as they applied to the various sub-basins. A summary of the results of calculations for the existing conditions can be found in the Appendix.

PROPOSED SUB-BASIN DESCRIPTION

In the proposed condition, stormwater runoff will generally flow from southwest to northeast as it does in the existing condition. The main difference between the existing and proposed conditions is the flow paths of West Kiowa Creek and the various tributary drainageways will intersect the proposed public roads that access the residential lots. All existing drainage patterns will be maintained throughout the site to the extent possible. To calculate the design flows for each of the proposed culverts that will convey runoff across the proposed roads, the existing basins were subdivided to create design points at each of the proposed crossing locations. As a result, Filing 1 has 16 on-site sub-basins and 6 off-site sub-basins in the proposed condition.

In accordance with the above-mentioned drainage patterns, the proposed project will be divided into 22 sub-basins that are described as follows:

Sub-Basin A is a 915.4 sub-basin to the west and northwest of West Kiowa Creek, at the west side of the property. The sub-basin consists of agricultural land and native grasslands and contains 1-N-10 Reservoir. The curve number for Sub-Basin A is 61.8. The basin will generate 87.1cfs and 585.6cfc in the minor and major storms, respectively. Stormwater from Sub-Basin A will be conveyed by natural drainageways and then collect into West Kiowa Creek, and flow northeast. In a future submittal, portions of Sub-Basin A will consist of residential lots. For the purposes of Filing 1, the existing conditions of Sub-Basin A were analyzed as it will not be disturbed.

Sub-Basin B1 consists of the West Kiowa Creek watershed to the south of Hodgen Road. This sub-basin has an area of 3836.70 acres. The curve number for Sub-Basin B1 is 60.34. The basin will generate runoff of 271.5cfs and 1448.6cfs in the minor and major storms, respectively. Flows from this sub-basin will pass under Hodgen Road and then conveyed by a natural drainage channel through Sub-Basin B3 via West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin B2 consists of 4 large residential lots at the southwest corner of the project. This sub-basin has an area of 13.10 acres. The curve number for Sub-Basin B2 is 64.00. The basin will generate runoff of 3.3cfs and 19.9cfs in the minor and major storms, respectively. Flows from this basin will travel across the lots from south to north where they will be intercepted by a culvert in Clove Hitch Ct. From the culvert, flows will be conveyed by a natural drainage channel to water quality pond B (WQ-B). WQ-B outlets to Sub-Basin B4 continuing through natural channels to West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin B3 is an off-site sub-basin to the west of the site near the southwest corner of the property. This sub-basin has an area of 54.90 acres. The curve number for Sub-Basin B3 is 65.10.

The basin will generate runoff of 6.7cfs and 57.9cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed by a natural drainage channel through Sub-Basin B4 to West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin B4 consists of 6 large residential lots and West Kiowa Creek at the southwest corner of the property. This sub-basin has an area of 41.48 acres. The curve number for Sub-Basin B4 is 68.50. The basin will generate runoff of 8.8cfs and 53.1cfs in the minor and major storms, respectively. Flows from this basin will flow north to northeast and will be conveyed by a natural drainage channel through Sub-Basin B4 to West Kiowa Creek, which will convey flows off the site to the northeast. Stormwater flowing off the west half of Winsome Way will travel north in the roadside ditch to pond WQ-C for treatment.

Sub-Basin C1 is an off-site sub-basin to the south of Hodgen Road. This sub-basin has an area of 162.70 acres. The curve number for Sub-Basin C1 is 60.00. The basin will generate runoff of 20.7cfs and 127.8cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed north by a natural drainage channel to Hodgen Road or through an existing 30” CMP culvert that will convey flows under Hodgen Road into Sub-Basin C2.

Sub-Basin C2 consists of 7 large residential lots along the southern boundary of the property. This sub-basin has an area of 22.40 acres. The curve number for Sub-Basin C2 is 64.00. The basin will generate runoff of 3.1cfs and 23.7cfs in the minor and major storms, respectively. Stormwater from this basin will flow north across the lots to a culvert under Mosey Trail. The culvert flows will then be conveyed into Sub-Basin C3.

Sub-Basin C3 consists of 5 large residential lots in southern half of the property, just south of Alamar Way. This sub-basin has an area of 16.10 acres. The curve number for Sub-Basin C3 is 64.00. The basin will generate runoff of 3.7cfs and 22.1cfs in the minor and major storms, respectively. Runoff from this basin will flow to the northwest across the lots to a culvert under

Winsome Way. From the culvert runoff will enter pond WQ-C for treatment. Pond outfalls convey across Sub-Basin B4 and will be discharged into West Kiowa Creek.

Sub-Basin C4 will contain two residential lots in a future filing and a portion of West Kiowa Creek. It is located north of the southern loop of Alamar Way. This sub-basin has an area of 23.80 acres. The curve number for Sub-Basin C4 is 65.00. The basin will generate runoff of 1.8cfs and 22.9cfs in the minor and major storms, respectively. Stormwater from this sub-basin will flow north to West Kiowa Creek.

Sub-Basin D1.1 is an off-site sub-basin to the south of Hodgen Road consisting of agricultural land and large residential lots. This sub-basin has an area of 161.30 acres. The curve number for Sub-Basin D1.1 is 60.00. The basin will generate runoff of 20.6cfs and 127.3cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed north by a natural drainage channel to an existing 72” CMP culvert that will convey flows under Hodgen Road into Sub-Basin D2.

Sub-Basin D1.2 is an off-site sub-basin to the south of Hodgen Road consisting of agricultural land and large residential lots. This sub-basin has an area of 49.90 acres. The curve number for Sub-Basin D1.2 is 60.00. The basin will generate runoff of 5.7cfs and 34.1cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed north by a natural drainage channel to a 30” CMP culvert that will convey flows under Hodgen Road into Sub-Basin D3.

Sub-Basin D2 consists of 17 large residential lots and the southern tributary to West Kiowa Creek. This sub-basin has an area of 68.70 acres. The curve number for Sub-Basin D2 is 64.75. The basin will generate runoff of 11.7cfs and 81.2cfs in the minor and major storms, respectively. A culvert will convey flows across Alamar Way into pond WQ-D.

Sub-Basin D3.4.6 consists of 29 large residential lots and has an area of 167.00 acres. Sub-Basin D3.4.6 is located at the center of Winsome Way, Alamar Way, Bison Meadows Court, and Hodgen Road. The curve number for Sub-Basin D3.4.6 is 66.4. The basin will generate runoff for 5.9cfs and 175.3cfs in the minor and major storms, respectively. Stormwater from this sub-basin will flow north through a culvert, natural channels, and across residential lots to the 7.1 ac-ft stormwater detention pond, Pond 3, which will discharge to West Kiowa Creek. Flows in the creek pass under Alamar Way through a double box culvert.

All other proposed sub-basins fall outside of the Filing 1 boundary and will be included in the drainage reports associated with future filings. See the approved Preliminary Drainage Report for Winsome Subdivision, dated May 10, 2019 prepared by The Vertex Companies for narrative description and preliminary analysis for the proposed sub-basins outside of the Filing 1 boundary.

3.0 DRAINAGE DESIGN CRITERIA

REGULATIONS

The hydrologic calculations in this report comply with the El Paso County Drainage Criteria Manuals. There are no previous drainage studies that cover this property beyond the preliminary report for this project.

DESIGN CRITERA

Consideration has been given to the Four-Step Process outlined in the El Paso County Engineering Criteria Manual for BMP selection as noted below:

<u>Step 1: Employ Runoff Reduction Practices</u>

This project is a low density residential development with lots varying between 2.5 acres and 5 acres in size. The development is designed to have a minimal impact and maintain

the rural nature of the existing area. Relative to the size of the site, a small amount of paving is proposed as residential roadways. For roadways traveling across the grade (Hodgen Road, Clove Hitch Court, Mosey Trail, and Alamar Way) runoff reduction has been employed by removing the ditch on the downhill side of the road and sending stormwater that contacts the road across a receiving pervious area (RPA). Roadside ditches help to control water velocity and effectively reduce runoff peaks. Full Spectrum Detention Basins will be used to capture stormwater and maintain flows off the site at below historic levels.

Step 2: Stabilize Drainageways

Stabilizing the flow paths within the development will be addressed by roadside ditch designs, flow controls, and swales. Roadside ditch slopes will be designed to control flow rates, and erosion control blankets will be used in areas of steeper slopes to slow storm runoff. Low sloping swales are proposed to direct water from adjacent basins to the full spectrum detention ponds. The swales will be graded to reduce the velocity of the water before it enters the ponds. By controlling stormwater along flow paths we anticipate minimal erosion. The natural channels have been analyzed for width and velocity during the 100Y storm. Erosion control blanket has been specified in areas and easements are proposed to accommodate the full width of a major storm event.

Step 3: Provide Water Quality Capture Volumes (WQCV)

This filing proposes 1 full spectrum detention basin and 3 water quality only ponds to capture stormwater runoff. These ponds have all been sized using UD-Detention and will provide full spectrum detention. Water quality measures are being used for all stormwater that contacts roadways.

Step 4: Consider Need for Industrial and Commercial BMP’s

NA

HYDROLOGICAL CRITERIA

Since this project contains both sub-basins over 100 acres and sub-basins less than 100 acres, times of concentration and peak runoff values were calculated for the 5-year and 100-year storm events using the NRCS Curve Number Method as required by the City of Colorado Springs/El Paso County Drainage Criteria Manuals. The model utilizes the NRCS Type II 24-hr rainfall distribution, the cumulative depth for the 5-year storm is 2.7 inches and cumulative depth of the 100-year storm is 4.6 inches. Per the Drainage Criteria Manual, both Frontal Storms and Thunder Storms were evaluated to determine the higher design flow. The comparative analysis of these storms show that the Frontal Storm produces significantly higher flow rates, so this storm type was used for drainage design. The table below outlines the rain gage data used for the comparison.

Frontal Storm Rainfall Depths		
	1 H	24 H
5 Year	1.5	2.7
100 Year	2.52	4.6

Thunder Storm 2H Rainfall Depths			
Minutes	Fraction of 1 H	5Y	100Y
5	0.01	0.02	0.04
10	0.05	0.07	0.12
15	0.08	0.12	0.20
20	0.12	0.18	0.30
25	0.18	0.27	0.45
30	0.26	0.39	0.65
35	0.42	0.63	1.06
40	0.71	1.07	1.79
45	0.82	1.24	2.08
50	0.89	1.34	2.25
55	0.94	1.40	2.36
60	0.97	1.46	2.45
65	1.00	1.51	2.53
70	1.02	1.53	2.57
75	1.03	1.55	2.60
80	1.04	1.56	2.62
85	1.05	1.58	2.65
90	1.06	1.59	2.68

95	1.07	1.61	2.70
100	1.08	1.62	2.73
105	1.09	1.64	2.75
110	1.10	1.65	2.77
115	1.11	1.66	2.79
120	1.12	1.68	2.82

The peak outfall results for each storm type were reviewed and the frontal storm was identified to have over a 200% greater peak.

NRCS TR-55 CURVE NUMBER SELECTION

Basin runoff curve numbers were generated using the runoff curve tables and methods presented in the Colorado Springs/El Paso County Stormwater Criteria Manual.

With curve values for a developed condition only listed up to a 2-acre lot size, some conservative interpolation was necessary. Taking into account that the curve numbers are not linear as the lot sizes increase, the following table was extrapolated for this study.

LOT SIZE	IMPERVIOUS %	SOIL GROUP A	SOIL GROUP B	SOIL GROUP C	SOIL GROUP D
2 ½ ACRE	11%	NA	64	76	81
5 ACRE	7%	NA	60	72	77

Impervious areas were referenced from the county Engineering Criteria Manual (Appendix L Table 3-1) in the table shown below.

Table 3-1
Typical Values of Percent Impervious

Type of Development	Percent Impervious
Commercial	95%
Industrial	85%
Multi-Family	65%
Single Family - 0.1377 acre lots (6,000 SF)	53%
Single-Family – 0.20 acre lots	43%
Single-Family – 0.25 acre lots	40%
Single-Family – 0.33 acre lots	30%
Single-Family – 0.5 acre lots	25%
Single-Family – 1.0 acre lots	20%
Single-Family – 2.5 acre lots	11%
Single-Family – 5 acre lots	7%

HYDRAULIC CRITERIA

Routing of stormwater runoff and modelling of drainageways on the site, was done using the NRCS Curve Number Method as required by the City of Colorado Springs. However, ultimate culvert and full spectrum detention pond sizing is be based on Rational Method peak flows and will utilize FHA HY-8 & UD-Detention calculations.

Time of Concentration

Assumptions were made for channelized flows through basins to calculate Time of Concentration values. To recognize that larger basins produce more runoff, we structured the hydrology model with 2 channelized flow profiles for basin over and under 100 acres. The table below outlines these assumptions:

	Shape	Side Slopes	Depth	Wetted Perimeter	Cross Sectional Area
> 100 Acre Basin Channels	Trapezoidal	4:1	4’	32.98’	64 sqft
< 100 Acre Basin Channels	Triangular	4:1	3’	24.74’	36 sqft

Conveyance Flow Paths

For conveyance flow paths between basins and the main channel where basins converge, 3 flow profiles were used. Triangular profiles were used for a majority of the conveyances, larger branching tributaries were trapezoidal with an 8’ bottom, and the main channel was modeled as trapezoidal with a 20’ bottom. A full HEC-RAS section analysis was completed that modeled the shape of the main floodplain drainage way. The 20’ bottom is a conservative average.

4.0 DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

This project is a low density residential development with lots varying between 2.5 acres and 10 acres in size. Adjoining properties and drainage facilities downstream from the site will not be affected. In order to maintain historic runoff levels for this site, 1 full spectrum detention pond and 3 water quality only ponds are being proposed as part of Filing No 1, that will capture and control the flows from roads and residential lots. The runoff from road surfaces will be treated for water quality before releasing it into West Kiowa Creek, or on to the downstream properties at historic discharge points. HEC-HMS analysis identified that the proposed development had a minimal impact on the historic flow for this area, and detention was used to address the minimal increase. Due to far reaching basins upstream from this project, stormwater needed to be detained for a significant amount of time for the delayed peak to pass through the adjacent area of West Kiowa Creek. By over detaining stormwater at pond P3 and releasing it at a slow and controlled rate, the proposed Q100 was reduced below historic levels. Design point 1 represents the stormwater outfall on the east edge of the project, the historic Q100 = 2469.7 CFS and the proposed Q100 = 2294.1 CFS. Full details from the HEC-HMS model can be found in the appendix.

Pond P3 is designed to work in conjunction with future detention ponds in the project outside of Filing No 1, to keep proposed flows below historic at full build out. For Filing 1, Pond P3 is over detaining more than required for this individual phase.

UD Detention was used to determine water quality characteristics and size the outlet structures of ponds on the project. Due to area limitations within UD Detention, when the large tributary areas were entered, flows entering the ponds were higher than what the HEC-HMS model had generated. Calibrating the models to show similar Q100 flows entering the ponds was decided to be most efficient and the following steps were performed:

1. A unique UD Detention sheet was generated for each of the ponds to identify the required water quality volume. This was based on using the tributary area of asphalt runoff for each pond (the required water quality area less any associated runoff reduction).
2. A second UD Detention sheet was then generated for each pond with an adjusted tributary area entered in UD Detention to achieve a peak Q100 inflow matching what was generated in the HEC-HMS model. All other parameters, such as length, slope, imperviousness, and soil group were held constant and are representative of proposed conditions.
3. After doing this "calibration" the calculated runoff volume was compared between the two models. In all cases, UD Detention showed a larger total storm volume validating this as a conservative approach.
4. The calculated water quality volume required from step 1 was then manually entered into the second UD Detention sheet where outlet structure characteristics were generated.
5. The pond outflow values from UD Detention were then entered back into HEC-HMS to match the outflow hydrograph between the two models.

POND	TRIBUTARY AREA (ACRES)	UD DETENTION AREA VALUE (ACRES)	HEC-HMS IN-FLOW (Q100 CFS)	UD DETENTION IN-FLOW (Q100 CFS)	HEC-HMS IN-FLOW (AC-FT)	UD DETENTION IN-FLOW (AC-FT)
B	13.1	11.0	19.9	20.0	1.0	1.3
C	201.2	136.5	165.8	166.9	11.1	14.7
D	230.0	127.0	203.5	203.9	13.4	14.2
3	156.0	101.0	116.3	116.5	8.6	11.3

Supporting outputs from HEC-HMS and UD Detention can be found in the appendix. This process was discussed with the County and agreed as being reasonable.

Forebay structures for each of the ponds were designed using MHFD design criteria as outlined in the table below:

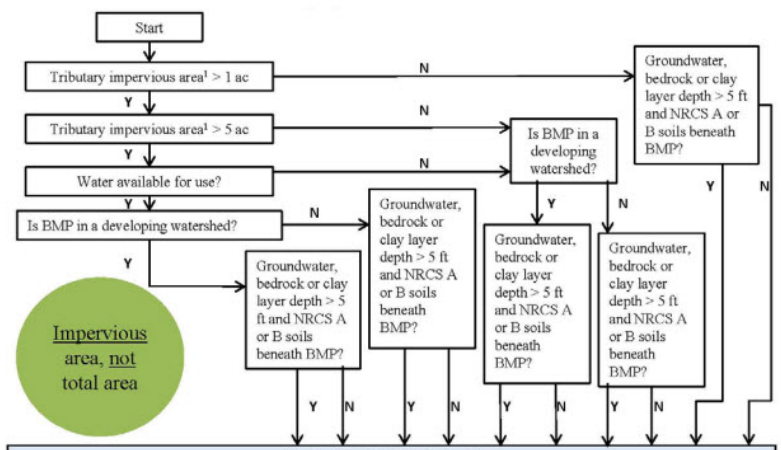
Erosion Protection Types	UDFCD Manual Chapter	Use For	Do Not Use For
1. Riprap Lining (Section 4.1)	Major Drainage, Volume 1	▪ Receiving channel on same line and grade ▪ Storm sewer and culvert outlets ▪ In-line culvert outlets ▪ Velocities < 15 ft/sec ▪ High tailwater ▪ Fish passage	▪ Velocities > 15 ft/sec ▪ Wetland channels
2. Low Tailwater Stilling Basin (Section 4.2)	Hydraulic Structures, Volume 2	▪ Storm sewer and culvert outlets ▪ Velocities < 15 ft/sec ▪ Low tailwater	▪ Velocities > 15 ft/sec ▪ Confined receiving area ▪ Major drainageways ▪ Areas where standing water is unacceptable
3. Concrete Impact Stilling Basin (Section 4.3)	Hydraulic Structures, Volume 2	▪ Storm sewer outlets ▪ Velocities > 15 ft/sec ▪ Low tailwater	▪ In-line culvert outlets ▪ High visibility areas
4. Concrete Baffle Chute (Section 4.4)	Hydraulic Structures, Volume 2	▪ Storm sewer outlets ▪ Velocities > 15 ft/sec ▪ Low tailwater ▪ Degrading channel	▪ In-line culvert outlets ▪ High debris potential ▪ High visibility areas
5. Drop Structures	Hydraulic Structures, Volume 2	▪ Wetland channels ▪ Low rise box culverts or small diameter pipes where plugging is possible ▪ In-line culvert outlets	▪ Confined receiving area ▪ Fish passage

Flows entering the forebays are all below 15 FPS placing them in the Low Tailwater Stilling Basin category. Pond C and D do have significant peak flows entering the pond, but with a 12” forebay wall qualify as a low tailwater condition where the 12” wall < pipe diameter/3. UD BMP for extended detention basins was used for sizing the slot on each of the forebays and the supporting sheets are included in the appendix.

As this is a phased project, additional detention ponds will be installed to maintain flow rates below historic levels at each phase of the project. To achieve this, some ponds will be built and put online that are outside of the boundary area for a given phase.

SPECIFIC DETAILS

In the existing condition, the subject property is undeveloped land consisting mostly of grassland with a few forested areas near the northern and southern boundaries. Runoff from the site is collected by natural swales and channels that convey flows to West Kiowa Creek, which carries water from the site. The proposed development does not aim to change these natural drainage patterns, but rather to preserve them to the extent possible. With this philosophy in mind, culverts were added to the design to convey water under proposed roads as it flows through the site. The Urban Drainage BMP Decision Tree was used to evaluate various options for water quality and detention as shown below:



Step 1—Runoff Reduction Practices										
Grass Swale	●	●	●	●	●	●	●	●	●	●
Grass Buffer	●	●	●	●	●	●	●	●	●	●
Constructed Wetland Channel[2]	●[2]	●[2]	●[2]	●[2]						
Permeable Pavement—Full Infiltration[5]			●[6]				●[6]		●	
Permeable Pavement—No or Partial Infiltration[5]				●[6]				●[6]		●
Green Roof	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3]	●[3]
Step 2—Provide WQCV with Slow Release										
Permeable Pavement — Full Infiltration[5]			●[6]				●[6]		●	
Permeable Pavement – No or Partial Infiltration[5]				●[6]				●[6]		●
Bioretention—Full Infiltration[5]			●[6]				●[6]		●	
Bioretention—No or Partial Infiltration[5]				●[6]				●[6]		●
Extended Dry Detention Basin	●		●		●		●			
Constructed Wetland Basin[2]	●	●	●	●						
Retention Pond	●	●	●	●						
Sand Filter Extended Detention--Full Infiltration[5]			●				●		●	
Sand Filter Extended Detention--No or Partial Infiltration[5]				●				●		●
Green Roof	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3,6]	●[3]	●[3]
Regional Water Quality Treatment	●[4]	●[4]	●[4]	●[4]	●[4]	●[4]	●[4]	●[4]	●[4]	●[4]

Notes: [1] "Tributary impervious area" refers to the impervious area draining to the BMP, **not** the total area of the project site.
[2] For a successful wetland channel or basin, a water source (groundwater or baseflow) will be required.
[3] In the Front Range of Colorado, irrigation, at least periodically in dry times, will be required to sustain a green roof.
[4] If a regional facility will be used to provide the WQCV, some degree of onsite treatment/MDCIA will still likely be required.
[5] No Infiltration = underdrain and liner, Partial Infiltration = underdrain and no liner, Full Infiltration = no underdrain and no liner.
[6] Consider this BMP for a portion of your site. It's best suited for impervious tributary areas of approximately one acre or less.

Figure 2-2. BMP Decision Tree for Conventional Development Sites

Extended detention basins were identified as the most appropriate method to address stormwater for this project and were used accordingly.

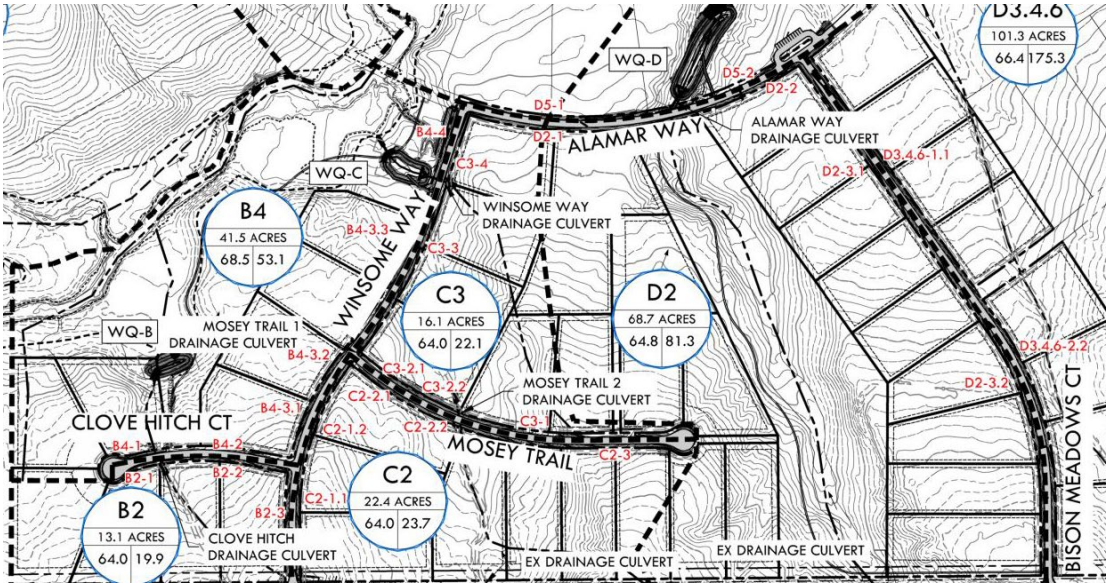
RUNOFF REDUCTION

Runoff reduction has been used at select areas in the project. For roads that travel perpendicular to grade (Hodgen Road, Clove Hitch Court, Mosey Trail, Alamar Way, and a portion of Winsome Way), the ditch has been removed on the downhill side of the road. Using the Mile High Flood District Runoff Reduction BMP table, these areas were calculated using the length of road x the asphalt area for the UIA, and then the same road length x the distance to the property setback for the RPA. This effort yielded a 100% runoff reduction for all of the areas examined to support removal of the ditch. A copy of the table can be found in the appendix along with a map key showing the ditch section designators.

ROADSIDE DITCH DESIGN

The roadside ditch designs proposed in the project are taken from the El Paso County Engineering Criteria Manual. Proposed road lengths/ditch areas have been broken into portions as shown in the following figure (see the red designators). Each portion has been analyzed for velocity and sheer to identify where controls will be needed to address erosion potential. Erosion Control Blanket will be lined in ditch bottoms where velocities are greater than 4 fps.

The table on the next page was created to document this analysis:



ROADSIDE DITCH Q 100Y VALUES

DITCH SECTION DESIGNATOR	START STATION	END STATION	LENGTH	GRADE	WATER SHED FROM ROAD	FRACTION OF BASIN FLOW	BASIN DESIGNATOR	BASIN 100Y Q	DITCH RECEIVING FRACTION OF Q	DITCH 100Y Q FROM BASIN	ROAD WATERSHED 100Y Q	CONNECTING DITCH 100Y Q	TOTAL 100Y Q IN DITCH SECTION	AVERAGE VELCITY
	(FT)	(FT)	(FT)	%				(CFS)	%	(CFS)	(CFS)	(CFS)	(CFS)	(FPS)
WINSOME WAY														
B2-3	+32	5+14	482'	4.83%	X		B2			-	0.00		0.00	3.00
B4-3.1	5+14	6+60	146'	3.85%			B4			-	0.00		0.00	3.52
B4-3.2	6+60	9+50	290'	7.89%			B5			-	0.00	0.00	0.00	3.51
B4-3.3	9+50	18+00	850'	3.22%			B6			-	0.00	0.00	0.00	3.29
B4-4	18+00	20+96	296'	1.00%	X		B4			-	0.00		0.00	1.47
C2-1.1	+32	6+10	578'	3.85%	X		C2			-	0.00		0.00	2.65
C2-1.2	6+10	10+17	407'	7.89%	X		C2			-	0.00	0.00	0.00	4.30
C3-3	10+17	18+00	783'	3.22%	X		C3			-	0.00	1.19	1.19	3.93
C3-4	18+00	20+96	296'	1.00%	X		C4			-	0.00		0.00	1.47
ALAMAR WAY														
D2-1	70+52	78+93	841'	1.43%	X	X	C3	22.1	10%	2.21	0.00		2.21	2.42
D2-2	78+93	84+31	538'	3.72%	X	X	D2	81.3	2%	1.63	0.00		1.63	3.39
D5-1	70+52	78+93	841'	1.43%	X		-			-	0.00		0.00	2.21
D5-2	78+93	84+31	538'	3.72%	X		-			-	0.00		0.00	2.79
BISON MEADOWS COURT														
D2-3.1	+8	6+00	592'	1.37%	X	X		81.3	1%	0.81	0.00	0.81	1.63	2.92
D2-3.2	5+50	24+02	1852'	3.47%	X	X		81.3	1%	0.81	0.00		0.81	3.82
D3.4.6-1.1	5+50	24+02	1852'	3.47%	X					-	0.00		0.00	3.71
D3.4.6-2.2	+8	6+00	592'	1.37%	X					-	0.00	0.00	0.00	2.79
CLOVE HITCH COURT														
B2-1	+14	5+80	566'	5.34%	X	X	B2	19.9	10%	1.99	0.00		1.99	3.85
B2-2	5+80	7+82	202'	1.13%	X	X	B2	19.9	20%	3.98	0.00		3.98	2.37
B4-1	5+80	7+82	202'	1.13%			B4	53.1		-	0.00		0.00	1.48
B4-2	+14	5+80	566'	5.34%			B4	53.1		-	0.00		0.00	3.24
MOSEY TRAIL														
C2-2.1	+14	2+74	260'	1.43%	X	X	C2	23.7	5%	1.19	0.00		1.19	2.00
C2-2.2	2+74	5+25	251'	1.03%	X	X	C2	23.7	10%	2.37	0.00		2.37	2.16
C2-3	5+25	14+54	929'	7.03%	X	X	C2	23.7	40%	9.48	0.00		9.48	5.72
C3-1	5+25	14+54	929'	7.03%			C3	22.1		-	0.00		0.00	2.38
C3-2.1	2+74	5+25	251'	1.03%			C3	22.1		-	0.00		0.00	1.56
C3-2.2	+14	2+74	260'	1.43%			C3	22.1		-	0.00		0.00	2.26

Q PER FOOT FOR 1' X 20' (HALF OF ROAD SECTION TO DITCH X 1' WIDE) = 0.003 CFS

Using the rational method, a Q value was identified for a 1' wide section the standard asphalt road area (1' x 14'). This value was then used to determine the Q contribution from the road surface. Separately, contribution from basin flow and connecting ditches was included. This analysis identified 2 areas that require ditch lining which has been incorporated into the design. A copy of this table and the supporting calculations from the FHA Hydraulic Toolbox can be found in the appendix.

DRIVEWAY CULVERTS

To facilitate the sizing of culverts required at driveway crossings, each ditch length has been analyzed relative to the required culvert size for a driveway crossing. Design assumptions were made that culvert slopes would be flattened out to 2% max, and rip rap would be used to protect drop locations at culvert exit points where velocities are greater than 7 fps. All lots show as being adequately supported with the County minimum 18" culvert. The results can be found in the appendix, summarized in a table along with all the supporting calculations from FHS HY-8. Analysis of the natural swales across the project was also done with supporting documentation in the appendix.

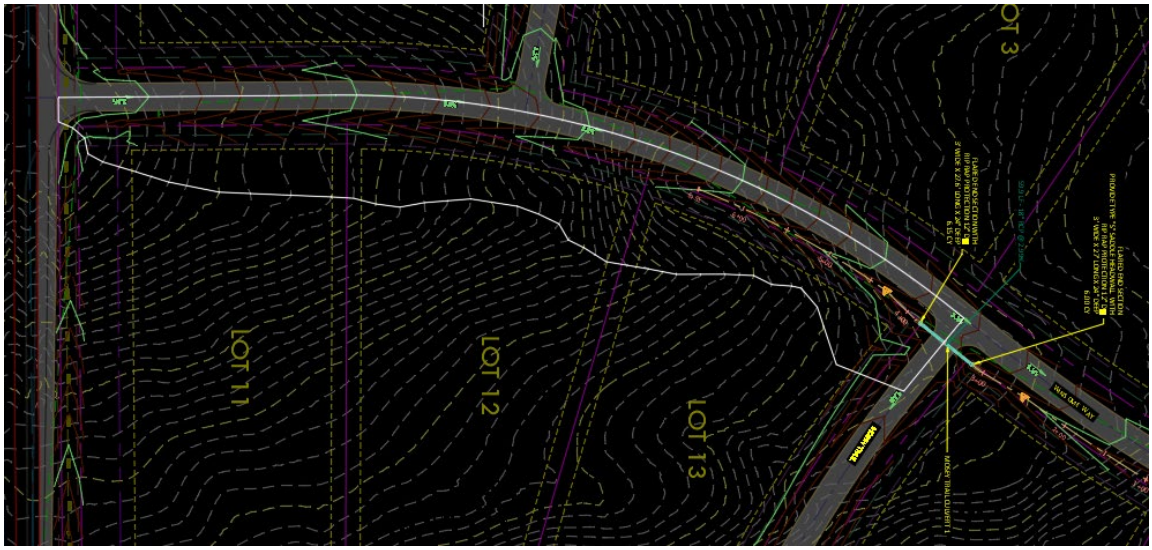
ROAD CROSSING CULVERTS

A total of five (5) road crossing culverts are proposed and sized to accommodate 100% of the 100-year storm through the pipe. A summary of the culverts is shown in the table below with additional details in the appendix.

Location (HMS Designation)	Reach Model	100Y Peak (CFS)	Proposed Culvert Size (IN)
Clove Hitch (Culv B2)	Basin B2	19.9	24

Mosey Trail 1 (not used in HMS)	9.5% OF Basin C2	2.25	18
Mosey Trail 2 (Culv C2)	C1+C2-Mosey Trail 1	147.6	48
Winsome Way (Culv C3)	C1+C2+C3	166.0	54
Alamar Way (Culv D2)	D1.1+D2	203.7	60

Four of the five culverts are present in the HEC-HMS model where flow data was obtained. For the culvert along Winsome Way at the intersection of Mosey Trail, an area was calculated in the image below showing the tributary sub-basin amounted to 9.5% of the C2 basin. Culverts were all sized using the Federal Highway Administration HY-8 software. A full HY-8 report can be found in the appendix.



DETENTION AND WATER QUALITY POND SUMMARY

A summary is shown in the table below and full details are included in the appendix. A total of 4 ponds are proposed, 3 providing only water quality and 1 providing full spectrum over-detention. This combination of ponds, along with runoff reduction strategies, work together to provide water quality for all stormwater that flows from the roads. The detention at pond 3 achieves a

lower proposed flow at the main outfall relative to historic levels. Ownership and maintenance of the ponds will be through an established metro district. An overview of the pond characteristics is shown in the table below:

	Proposed Volume	Q100 HEC-HMS Flow Entering Pond (CFS)	Q100 UD Detention Flow Exiting Pond (CFS)	Q100 Flow Ratio (Developed vs Historic)
Pond B	0.186 ac-ft	19.9	na	na
Pond C	0.531 ac-ft	166.0	na	na
Pond D	1.432 ac-ft	203.7	na	na
Pond 3	6.887 ac-ft	116.3	52.0	0.6

Ponds B, C, and D are designed to only address water quality with the outlet structures releasing the water volumes at a controlled rate.

As discussed previously, UD Detention was “calibrated” the match the flows coming from HEC-HMS. The following steps were performed to achieve this:

1. A unique UD Detention sheet was generated for each of the ponds to identify the required water quality volume. This was based on using the tributary area of asphalt runoff for each pond (the required water quality area less any associated runoff reduction).
2. A second UD Detention sheet was then generated for each pond with the tributary area (acres) entered in UD Detention adjusted to achieve a peak Q100 inflow matching what was generated in HEC-HMS. After doing this the total stormwater volume was compared between the two models showing UD Detention with a larger volume and validating a conservative approach.
3. The calculated required water quality volume from step 1 was manually entered into the second UD Detention sheet where outlet structure characteristics were generated.

Water Quality Pond B

Water Quality Pond B is located north of the low point on Clove Hitch Ct. This pond provides water quality only and is sized to treat the stormwater runoff coming from Clove Hitch and runoff from the west side of Winsome Way between Clove Hitch and Hodgen. Water flows to the pond via a roadside ditch and culvert, entering the pond via a rip rap protected rundown and concrete forebay. The forebay is sized to effectively dissipate the energy of water entering the pond. A trickle channel conveys water to a concrete lined micropool and outlet structure. The outlet structure provides water quality via an orifice plate allowing the pond to drain over an extended period of time. The full 100Y storm volume exits through the outlet structure via a proposed 18" concrete pipe. The spillway is sized to convey the full 100Y flow in less than 1' of flow depth. A full 1' of freeboard is proposed at the spillway, giving a full 2' of freeboard around the rest of the pond. A 15' wide access road is proposed from the right of way to the top of pond. This pond is designed to accommodate the final buildout of the project without any additional grading/volume adjustment.

Water Quality Pond C

Water Quality Pond C is located at a low point near the intersection of Winsome Way and Alamar Way within Filing 1. This pond provides water quality only. Water flows to the pond via a roadside ditch and culvert, entering the pond via a concrete forebay. The forebay is sized to effectively dissipate the energy of water entering the pond. A trickle channel then conveys water to a concrete lined micropool and outlet structure. The outlet structure provides water quality via an orifice plate allowing the pond to drain over an extended period of time. The full 100Y storm volume exits through the outlet structure via a proposed 54" concrete pipe. The spillway is sized to convey the full 100Y flow in less than 1' of flow depth. A full 1' of freeboard is proposed at the spillway, giving a full 2' of freeboard around the rest of the pond. A 15' wide access road is proposed from the right of way to the bottom of the pond for servicing requirements. This pond is designed to accommodate the final buildout of the project without any additional grading/volume adjustment.

Water Quality Pond D

Water Quality Pond D is located at a low point along Alamar Way within Filing 1. This pond provides water quality only. Water flows to the pond via a roadside ditch and culvert, entering the pond via a concrete forebay. The forebay is sized to effectively dissipate the energy of water entering the pond. A trickle channel then conveys water to a concrete lined micropool and outlet structure. The outlet structure provides water quality via an orifice plate allowing the pond to drain over an extended period of time. The full 100Y storm volume exits through the outlet structure via a proposed 54" concrete pipe. The spillway is sized to convey the full 100Y flow in less than 1' of flow depth. A full 1' of freeboard is proposed at the spillway, giving a full 2' of freeboard around the rest of the pond. A 15' wide access road is proposed from the right of way to the bottom of the pond for servicing requirements. This pond is designed to accommodate the final buildout of the project without any additional grading/volume adjustment.

Detention Pond 3

Pond 3 is located to the north and outside of Filing 1. This pond provides water quality and over-detention for the project. The pond reduces proposed flow at the main outfall below historic levels relative to the impact of Filing 1. Water flows into Pond 3 through natural channels entering the pond via a concrete forebay. The forebay is sized to effectively dissipate the energy of water entering the pond. A combination of trickle channels convey the water to a concrete lined micropool and outlet structure providing full spectrum characteristics. The outlet structure provides water quality via an orifice plate allowing the pond to drain over an extended period of time. The full 100Y storm volume exits through the outlet structure via a proposed 30" concrete pipe. An emergency spillway is proposed that will convey the full 100Y flow in less than 1' of flow depth. A full 1' of freeboard is proposed at the spillway, giving a full 2' of freeboard around the rest of the pond. A 15' wide access road is proposed from the future right of way to the bottom of the pond for servicing requirements. As described previously, by over detaining stormwater at pond P3 and releasing it at a slow and controlled rate, the proposed Q100 was reduced below

historic levels. Pond P3 is designed to work in conjunction with the other detention ponds in the project to keep proposed flows below historic at full build out. For Filing 1, Pond P3 is over detaining more than required for this individual phase. This pond is designed to accommodate the final buildout of the project without any additional grading/volume adjustment.

EXISTING MINOR DRAINAGE CHANNELS

Existing drainage channels within Filing 1 were evaluated for both top width to identify easement requirements, and velocity for erosion potential. All of the existing channels are fully vegetated and will remain undisturbed outside of the construction boundaries. Per Mile High Flood District guidance of a maximum allowable 7 FPS velocity, all channels are below this level and in stable condition. Based on our analysis no further stabilization should be required. A copy of the graphical analysis and calculations can be found in the appendix.

KIOWA CREEK DRAINAGE CHANNEL

The Kiowa Creek drainage channel receives flows from this project and ultimately conveys stormwater off the site. The channel area is outside the boundaries of Filing 1 but will be examined in detail in the future. Hydraulic analysis will be performed to examine channel improvements and bank stability with future filings.

CONSTRUCTION PHASING

Due to the size and scope of this project, the development has been broken into phases that will be built one at a time. This drainage report covers Filing 1 only.

RISK ASSESSMENT

The site has been further evaluated for future flooding risk with respect to three documented reservoirs upstream from the project. The reservoirs are listed as 1-N-10, 1-P-10, and 1-P-20 in the Kiowa Creek Watershed. The reservoirs were installed as part of jurisdictional flood control

and are documented by the state. The Colorado State Dam Safety Engineering office has been contacted. With input criteria from John Hunyadi who oversees jurisdictional dams in this area, the largest of the 3 dams in question has been modeled and results have been provided back to the state. A breaching "sunny day" flow rate of 9500cfs is the largest of the 3 dams and results in a small portion of (two lots) of the project. Easements have been added so that no building will occur in these areas and the current low risk level associated with the dams will remain unchanged. An exhibit of the floodplain area associated with the dam failure, and an approval letter from the Colorado Dam Safety Engineering Office is included in the appendix.

DRAINAGE BASIN FEE

Currently, there are no drainage and bridge fees for Winsome Filing No 1. The West Kiowa Creek Drainage Basin is not part of the El Paso County Drainage Basin Fee Program.

CONCLUSIONS

This report has been prepared in accordance with El Paso County stormwater criteria. It outlines the routing of the 5-Year and 100-year storm events through the project's drainage system. The proposed drainage facilities were designed to convey and treat stormwater flows in accordance with the requirements presented by El Paso County and the Colorado Springs Drainage Criteria Manual. These proposed improvements provide adequate protection to this site without adverse impacts on adjoining upstream and downstream properties.

Consideration has been given to the Four-Step Process outlined in the El Paso County Engineering Criteria Manual for BMP selection as noted below:

<u>Step 1: Employ Runoff Reduction Practices</u>

For roadways traveling across the grade (Hodgen Road, Clove Hitch Court, Mosey Trail, and Alamar Way) runoff reduction has been employed by removing the ditch on the

downhill side of the road and sending stormwater that contacts the road across a receiving pervious area (RPA). A 100% water quality reduction was successfully achieved in all cases.

Step 2: Stabilize Drainageways

Stabilizing the flow paths within the development will be addressed by roadside ditch designs, flow controls, and swales. Roadside ditch slopes will be designed to control flow rates, and erosion control blankets will be used in areas of steeper slopes to slow storm runoff.

All existing drainage swales are vegetated and full stabilized. They will not be disturbed from this existing state. Recognizing that the Prudent Line Method is no longer an acceptable option, drainageway stabilization along the main channel of West Kiowa Creek will be examined as part of future project filing. The Kiowa Creek area is outside of the boundaries for Filing 1 and is not being studied at this time.

Step 3: Provide Water Quality Capture Volumes (WQCV)

This filing proposes 1 full spectrum detention basin and 3 water quality only ponds to capture stormwater runoff. These ponds have all been sized using UD-Detention and will provide full spectrum detention. Water quality measures are being used for all stormwater that contacts roadways.

Step 4: Consider Need for Industrial and Commercial BMP's

Industrial and Commercial BMP's were not applicable to this filing.

5.0 REFERENCES

1. Urban Storm Drainage Criteria Manuals (Volumes 1, 2, and 3) Urban Drainage & Flood Control District.

2. El Paso County Drainage Criteria Manual, Volumes 1 & 2, Stormwater Quality Policies, Procedures and Best Management Practices (BMPs), Dates May 2014 & June 2019.

3. Federal Emergency Management Agency, Flood Insurance Rate Map Index 08041C0350G, dated December 7, 2018.

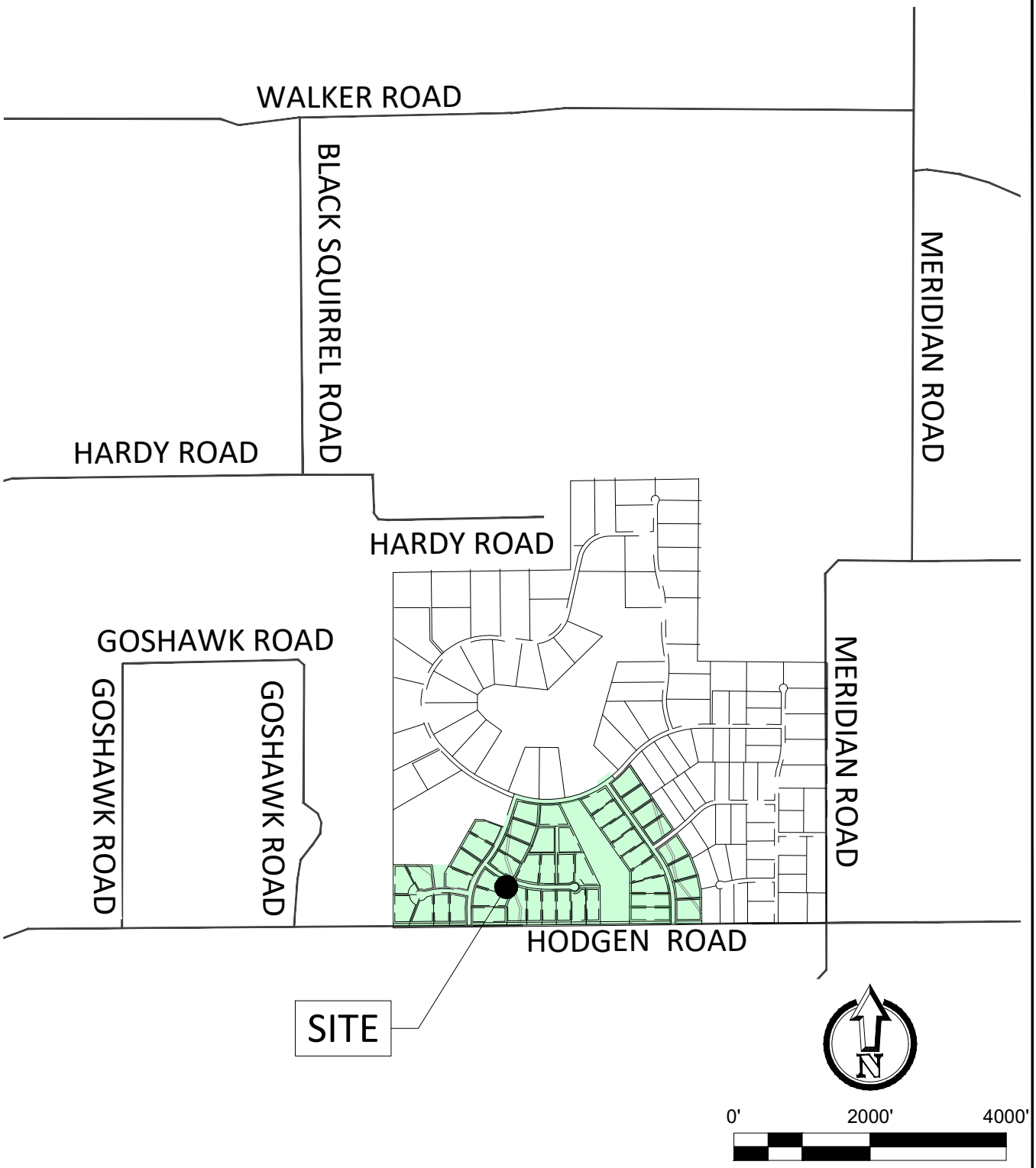
4. Winsome Subdivision Preliminary Drainage Report, dated May 10, 2019.

5. Natural Resources Conservation Service, Web Soil Survey, dated October 10, 2017.

6. Entech Engineering Geotechnical Report, Dated October 2, 2018.

1.0 VICINITY MAP

VICINITY MAP

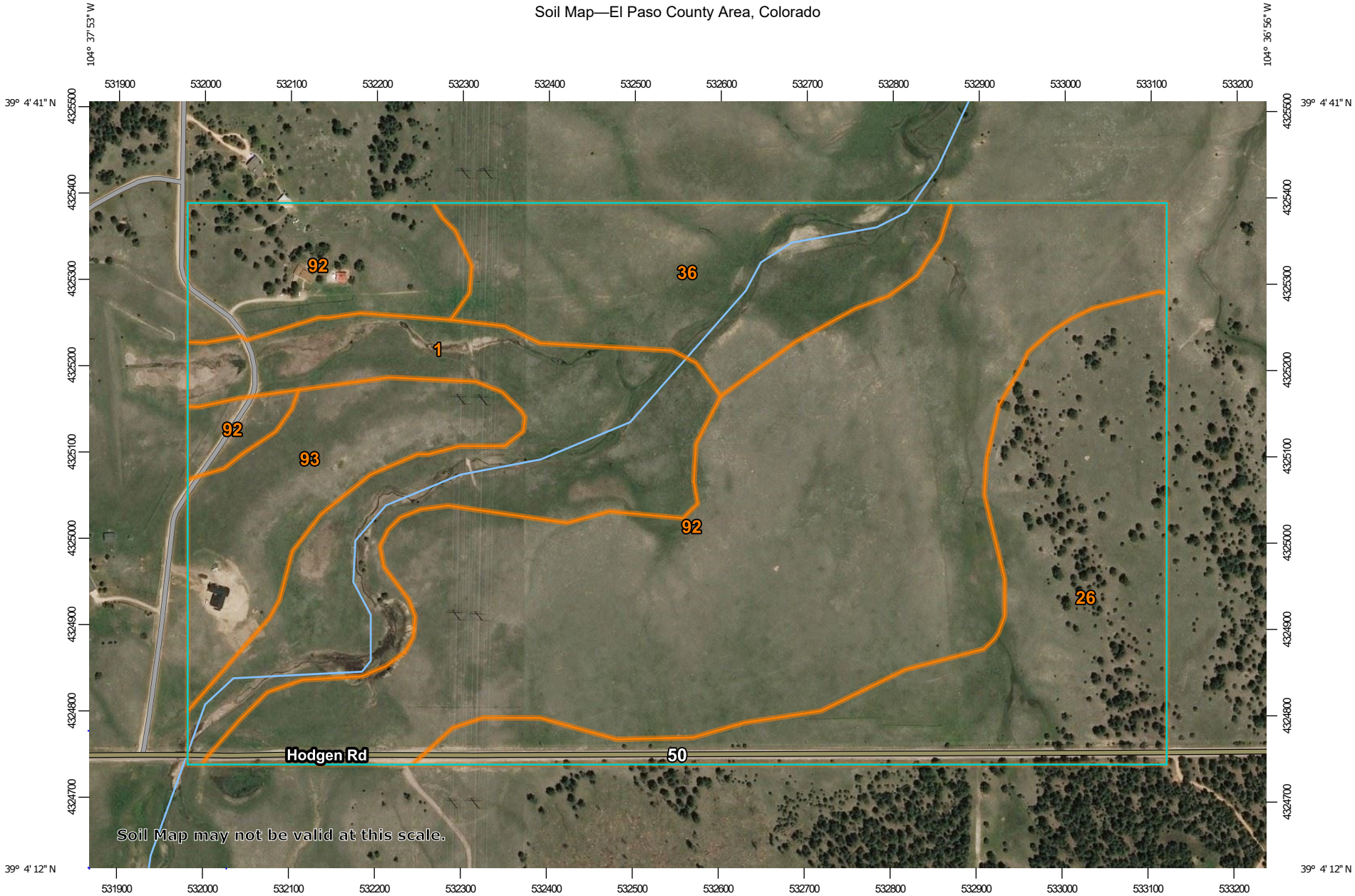


VICINITY MAP			
WINSOME SUBDIVISION FILING 1 17480 MERIDIAN ROAD ELBERT, COLORADO	File No.: Date: 01/21/20 Drawn: JCP Checked: LPV Job No.: 49388	FIGURE 1	VERTEX ®

Z:\Shared\Projects\49000-49999\49300-49399\49388.McCune Ranch\06-Engineering\Vertex Drawings\Exhibits\49388_EXH_VinMap.dwg
Tuesday, January 21, 2020 2:05:49 PM

2.0 HYDROLOGIC SOILS MAP

Soil Map—El Paso County Area, Colorado



Map Scale: 1:6,260 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

N

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 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: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	28.7	15.6%
26	Elbeth sandy loam, 8 to 15 percent slopes	35.5	19.3%
36	Holderness loam, 8 to 15 percent slopes	21.4	11.6%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	84.7	46.1%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	13.5	7.4%
Totals for Area of Interest		**183.9**	**100.0%**

3.0 FEMA FIRM MAP

NOTES TO USERS

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

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

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

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

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

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

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

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

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

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

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

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

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

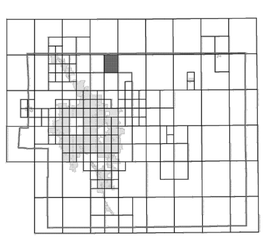
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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

El Paso County Vertical Datum Offset Table

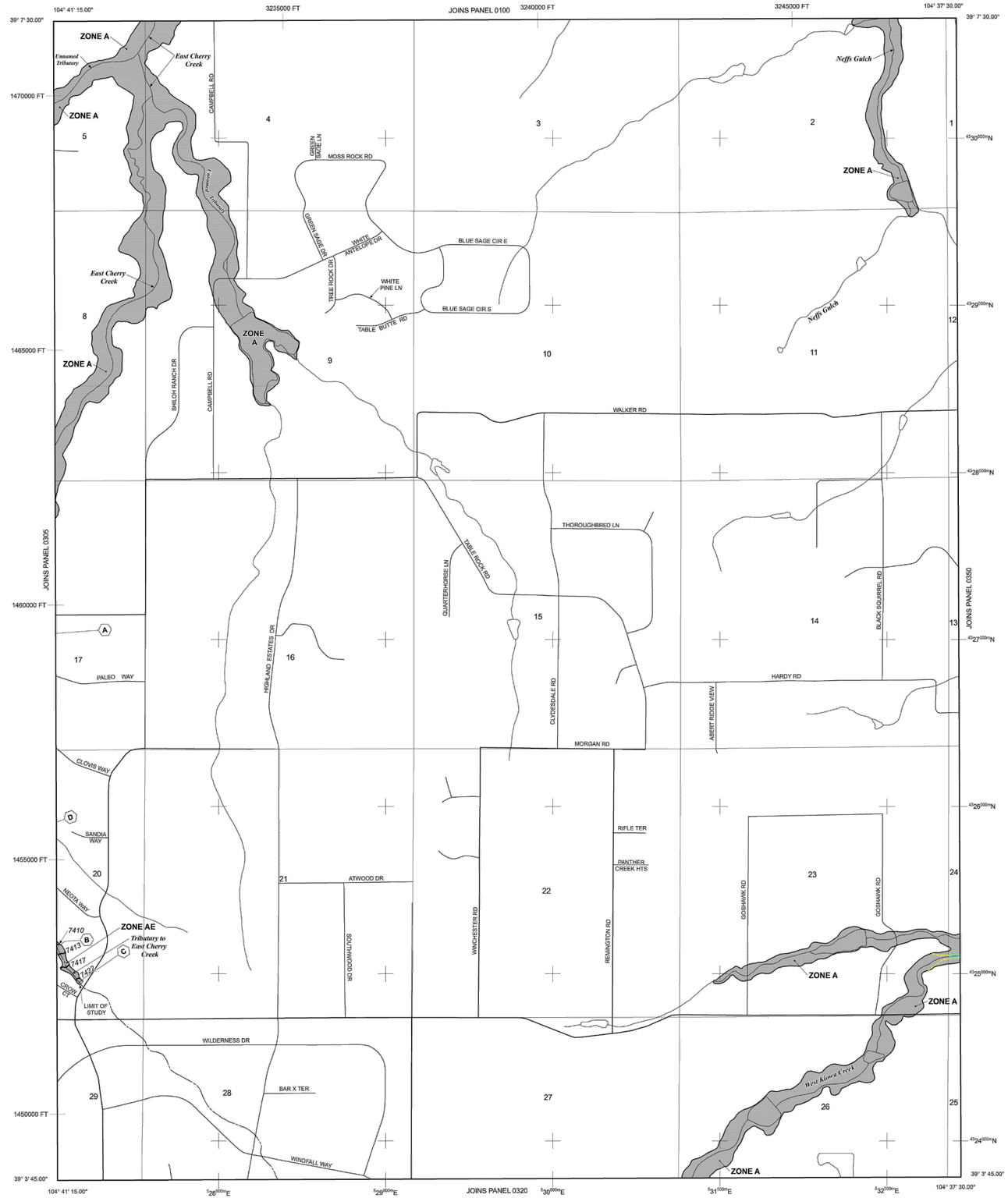
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



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

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A	Cross section line
23 - - - - - 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
475000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0310G

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

PANEL 310 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0310	G

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

MAP NUMBER
08041C0310G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

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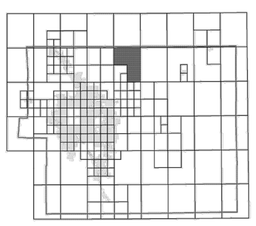
Panel Location Map



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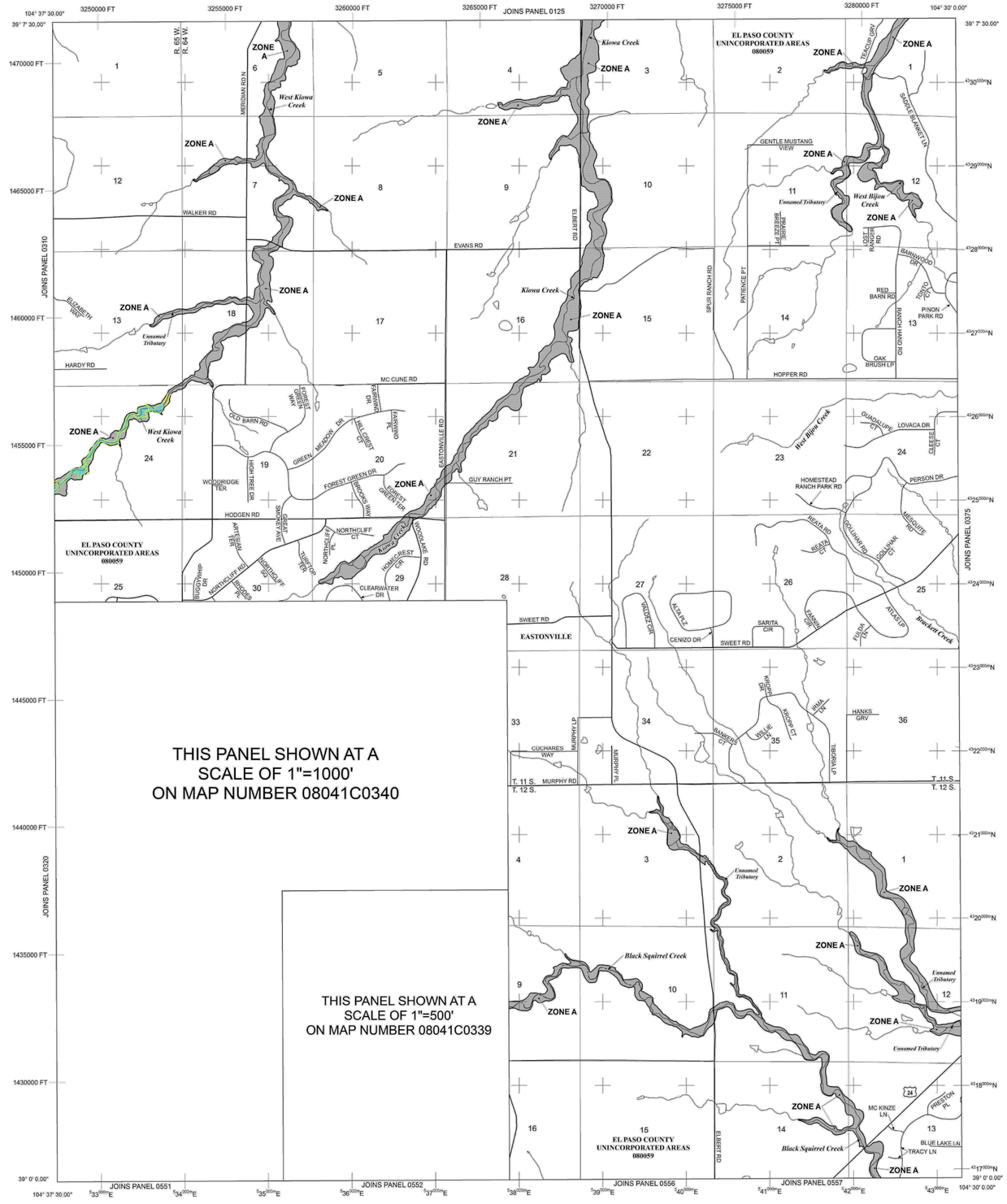

LEGEND

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

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ZONE A	No Base Flood Elevations determined.
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ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

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ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
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OTHERWISE PROTECTED AREAS (OPAs)

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Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

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

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

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

A — A	Cross section line
23 - - - - - 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

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

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

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MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0350G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 350 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0350	G

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

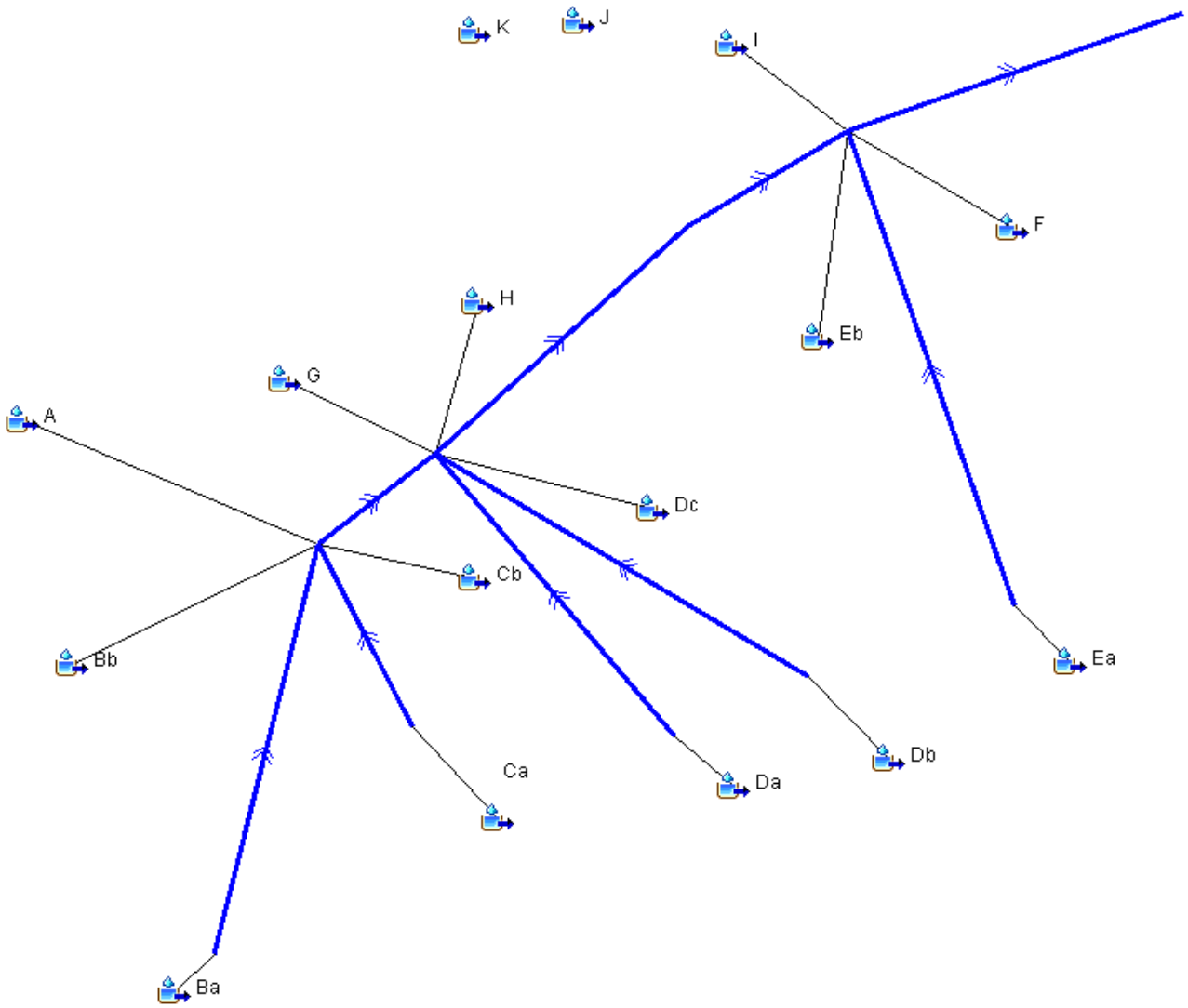
MAP NUMBER
08041C0350G

MAP REVISED
DECEMBER 7, 2018

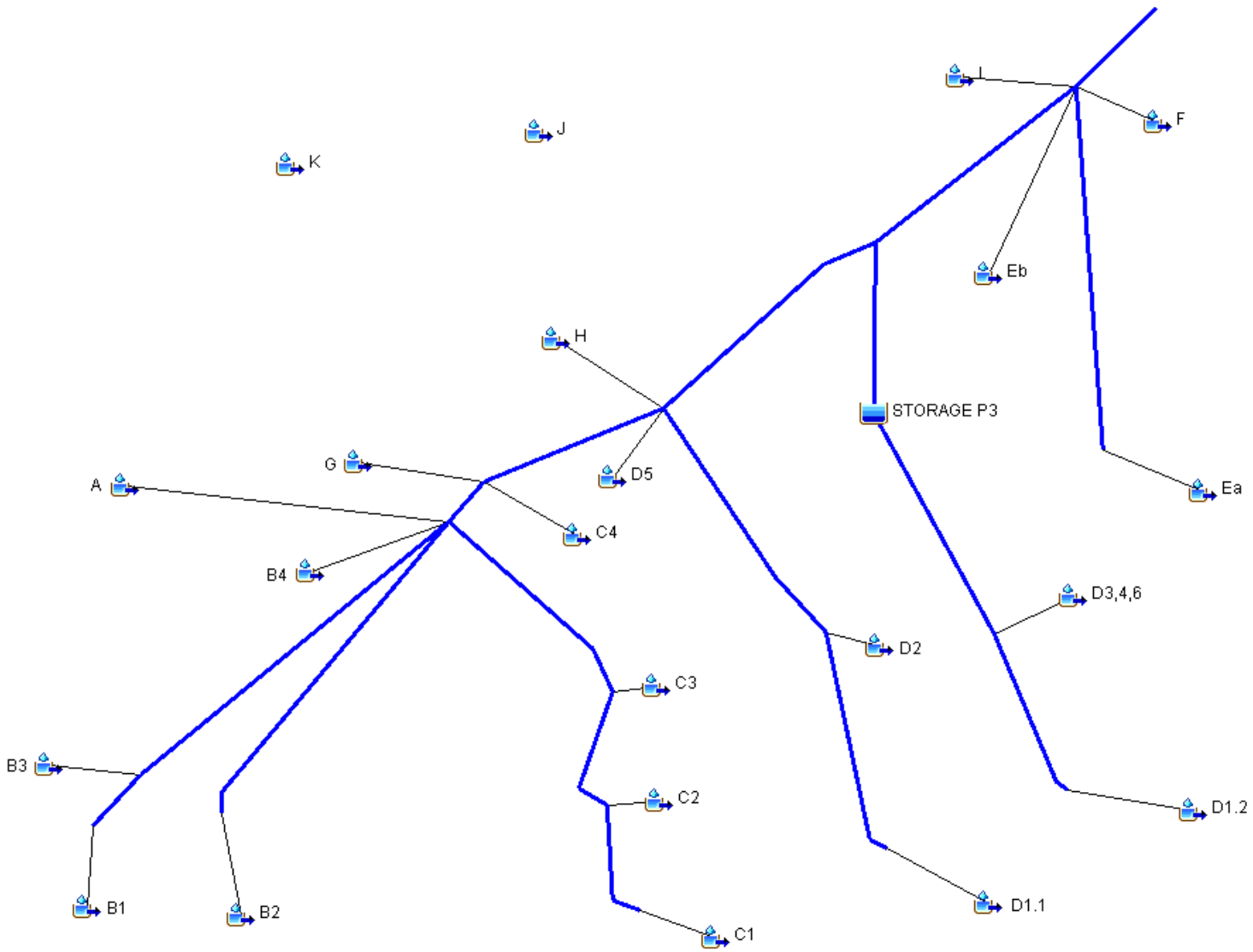
Federal Emergency Management Agency

4.1 MODEL SCHEMATICS

EXISTING CONDITION
MODEL SCHEMATIC



FILING 1 CONDITION
MODEL SCHEMATIC



4.2 FRONTAL STORM RAIN GAGE DATA

Frontal Storm Rain Gage

Time	5Y Values	100Y Values	Time	5Y Values	100Y Values
0:00	0	0	12:00	1.7901	3.0498
0:06	0.00273	0.00465	12:06	1.84129	3.13702
0:12	0.00545	0.00929	12:12	1.88633	3.21374
0:18	0.00824	0.01403	12:18	1.92521	3.27998
0:24	0.01102	0.01877	12:24	1.95793	3.33574
0:30	0.01385	0.0236	12:30	1.9845	3.381
0:36	0.01669	0.02843	12:36	2.00729	3.41982
0:42	0.01958	0.03335	12:42	2.02867	3.45626
0:48	0.02246	0.03827	12:48	2.04865	3.4903
0:54	0.02541	0.04329	12:54	2.06723	3.52194
1:00	0.02835	0.0483	13:00	2.0844	3.5512
1:06	0.03135	0.05341	13:06	2.10049	3.57862
1:12	0.03434	0.05851	13:12	2.11583	3.60474
1:18	0.0374	0.06371	13:18	2.13041	3.62958
1:24	0.04045	0.06891	13:24	2.14423	3.65314
1:30	0.04355	0.0742	13:30	2.1573	3.6754
1:36	0.04666	0.07949	13:36	2.16972	3.69656
1:42	0.04982	0.08487	13:42	2.1816	3.7168
1:48	0.05297	0.09025	13:48	2.19294	3.73612
1:54	0.05619	0.09573	13:54	2.20374	3.75452
2:00	0.0594	0.1012	14:00	2.214	3.772
2:06	0.06267	0.10677	14:06	2.22391	3.78888
2:12	0.06593	0.11233	14:12	2.2336	3.8054
2:18	0.06926	0.11799	14:18	2.24313	3.82163
2:24	0.07258	0.12365	14:24	2.25245	3.8375
2:30	0.07595	0.1294	14:30	2.2616	3.8531
2:36	0.07933	0.13515	14:36	2.27054	3.86832
2:42	0.08276	0.14099	14:42	2.27931	3.88327
2:48	0.08618	0.14683	14:48	2.28787	3.89786
2:54	0.08967	0.15277	14:54	2.29627	3.91216
3:00	0.09315	0.1587	15:00	2.30445	3.9261
3:06	0.09669	0.16473	15:06	2.31247	3.93976
3:12	0.10022	0.17075	15:12	2.32027	3.95306
3:18	0.10381	0.17687	15:18	2.32791	3.96607
3:24	0.10741	0.18299	15:24	2.33534	3.97872
3:30	0.11105	0.1892	15:30	2.3426	3.9911
3:36	0.1147	0.19541	15:36	2.34965	4.0031
3:42	0.1184	0.20171	15:42	2.35653	4.01483
3:48	0.12209	0.20801	15:48	2.3632	4.0262
3:54	0.12585	0.21441	15:54	2.36971	4.03728
4:00	0.1296	0.2208	16:00	2.376	4.048
4:06	0.13341	0.22729	16:06	2.38218	4.05853
4:12	0.13727	0.23386	16:12	2.38828	4.06893
4:18	0.14118	0.24053	16:18	2.39433	4.07923
4:24	0.14515	0.2473	16:24	2.4003	4.0894
4:30	0.14918	0.25415	16:30	2.40621	4.09947
4:36	0.15325	0.2611	16:36	2.41205	4.10941
4:42	0.15738	0.26813	16:42	2.41782	4.11925
4:48	0.16157	0.27526	16:48	2.42352	4.12896
4:54	0.16581	0.28249	16:54	2.42916	4.13857
5:00	0.1701	0.2898	17:00	2.43473	4.14805
5:06	0.17445	0.29721	17:06	2.44023	4.15743
5:12	0.17885	0.3047	17:12	2.44566	4.16668
5:18	0.1833	0.31229	17:18	2.45103	4.17583
5:24	0.18781	0.31998	17:24	2.45632	4.18485
5:30	0.19238	0.32775	17:30	2.46156	4.19377
5:36	0.19699	0.33562	17:36	2.46672	4.20256
5:42	0.20166	0.34357	17:42	2.47182	4.21125
5:48	0.20639	0.35162	17:48	2.47685	4.21981
5:54	0.21117	0.35977	17:54	2.48181	4.22827
6:00	0.216	0.368	18:00	2.4867	4.2366
6:06	0.22089	0.37633	18:06	2.49153	4.24483
6:12	0.22583	0.38474	18:12	2.49629	4.25293
6:18	0.23082	0.39325	18:18	2.50098	4.26093
6:24	0.23587	0.40186	18:24	2.5056	4.2688
6:30	0.24098	0.41055	18:30	2.51016	4.27657
6:36	0.24613	0.41934	18:36	2.51465	4.28421
6:42	0.25134	0.42821	18:42	2.51907	4.29175
6:48	0.25661	0.43718	18:48	2.52342	4.29916
6:54	0.26193	0.44625	18:54	2.52771	4.30647
7:00	0.2673	0.4554	19:00	2.53192	4.31365
7:06	0.27273	0.46465	19:06	2.53608	4.32073
7:12	0.27821	0.47398	19:12	2.54016	4.32768
7:18	0.28374	0.48341	19:18	2.54418	4.33453
7:24	0.28933	0.49294	19:24	2.54812	4.34125
7:30	0.29498	0.50255	19:30	2.55201	4.34787
7:36	0.30067	0.51226	19:36	2.55582	4.35436
7:42	0.30642	0.52205	19:42	2.55957	4.36075
7:48	0.31223	0.53194	19:48	2.56325	4.36701
7:54	0.31809	0.54193	19:54	2.56686	4.37317
8:00	0.324	0.552	20:00	2.5704	4.3792
8:06	0.33008	0.56235	20:06	2.57391	4.38518
8:12	0.33642	0.57316	20:12	2.57739	4.39111
8:18	0.34304	0.58443	20:18	2.58088	4.39705
8:24	0.34992	0.59616	20:24	2.58433	4.40294
8:30	0.35708	0.60835	20:30	2.58779	4.40882
8:36	0.3645	0.621	20:36	2.59122	4.41467
8:42	0.3722	0.63411	20:42	2.59465	4.42051
8:48	0.38016	0.64768	20:48	2.59805	4.4263
8:54	0.3884	0.66171	20:54	2.60145	4.4321
9:00	0.3969	0.6762	21:00	2.60483	4.43785
9:06	0.40554	0.69092	21:06	2.6082	4.4436
9:12	0.41418	0.70564	21:12	2.61155	4.4493
9:18	0.42282	0.72036	21:18	2.6149	4.45501
9:24	0.43146	0.73508	21:24	2.61822	4.46067
9:30	0.4401	0.7498	21:30	2.62154	4.46632
9:36	0.44896	0.76489	21:36	2.62483	4.47194
9:42	0.45824	0.78071	21:42	2.62813	4.47755
9:48	0.46796	0.79727	21:48	2.63139	4.48311
9:54	0.47812	0.81457	21:54	2.63466	4.48868
10:00	0.4887	0.8326	22:00	2.6379	4.4942
10:06	0.49982	0.85155	22:06	2.64114	4.49972
10:12	0.5116	0.87161	22:12	2.64435	4.50519
10:18	0.52402	0.89277	22:18	2.64757	4.51067
10:24	0.53708	0.91503	22:24	2.65075	4.5161
10:30	0.5508	0.9384	22:30	2.65394	4.52152
10:36	0.56538	0.96324	22:36	2.6571	4.52691
10:42	0.58104	0.98992	22:42	2.66026	4.53229
10:48	0.59778	1.01844	22:48	2.66339	4.53762
10:54	0.6156	1.0488	22:54	2.66652	4.54296
11:00	0.6345	1.081	23:00	2.66963	4.54825
11:06	0.65524	1.11633	23:06	2.67273	4.55354
11:12	0.67856	1.15607	23:12	2.67581	4.55878
11:18	0.70448	1.20023	23:18	2.67889	4.56403
11:24	0.733	1.24881	23:24	2.68194	4.56923
11:30	0.7641	1.3018	23:30	2.68499	4.57442
11:36	0.82847	1.41146	23:36	2.68801	4.57958
11:42	0.95677	1.63006	23:42	2.69104	4.58473
11:48	1.16313	1.98163	23:48	2.69403	4.58983
11:54	1.53322	2.61216	23:54	2.69703	4.59494
			24:00:00	2.7	4.6

4.3 TIME OF CONCENTRATION CALCULATIONS

Project Description

File Name	WinsomeSubdivisionExistingCondition (24) - Copy.SPF
Description	
	McCune Ranch Basins

Project Options

Flow Units	CFS
Elevation Type	Depth
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Mar 09, 2018	00:00:00
End Analysis On	Mar 10, 2018	00:00:00
Start Reporting On	Mar 09, 2018	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	16
Nodes	17
Junctions	12
Outfalls	1
Flow Diversions	4
Inlets	0
Storage Nodes	0
Links	18
Channels	14
Pipes	4
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	TS-01	Cumulative	inches	Colorado	El Paso	100	4.60	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A	915.40	61.83	4.60	1.19	1086.58	565.84	0 00:53:00
2	Ba	3836.70	60.34	4.60	1.10	4201.19	1443.11	0 01:29:33
3	Bb	100.60	69.79	4.60	1.73	173.94	122.13	0 00:40:00
4	Ca	162.70	60.00	4.60	1.07	174.74	113.04	0 00:37:12
5	Cb	70.00	68.70	4.60	1.65	115.50	84.46	0 00:37:25
6	Da	161.30	60.00	4.60	1.07	173.24	112.52	0 00:36:59
7	Db	49.90	60.00	4.60	1.07	53.59	30.63	0 00:44:12
8	Dc	249.70	67.70	4.60	1.58	394.28	267.69	0 00:40:56
9	Ea	37.90	60.00	4.60	1.07	40.70	30.18	0 00:30:30
10	Eb	74.60	67.20	4.60	1.54	115.18	81.57	0 00:38:15
11	F	44.50	69.00	4.60	1.67	74.40	54.18	0 00:37:43
12	G	107.60	74.50	4.60	2.09	224.78	181.44	0 00:33:55
13	H	121.80	71.76	4.60	1.88	228.50	182.91	0 00:33:39
14	I	37.50	79.00	4.60	2.46	92.29	78.32	0 00:31:48
15	J	10.10	69.50	4.60	1.71	17.25	17.21	0 00:22:55
16	K	17.80	76.00	4.60	2.21	39.34	39.26	0 00:24:06

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 915.40
Weighted Curve Number 61.83
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	823.86	B	60.00
Pasture, grassland, or range, Fair	9.15	D	84.00
Pasture, grassland, or range, Fair	64.08	C	79.00
Pasture, grassland, or range, Fair	9.15	B	69.00
5 Acre Lots, 7% Impervious	9.15	D	77.00
Composite Area & Weighted CN	915.39		61.83

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	10.62	0.00	0.00

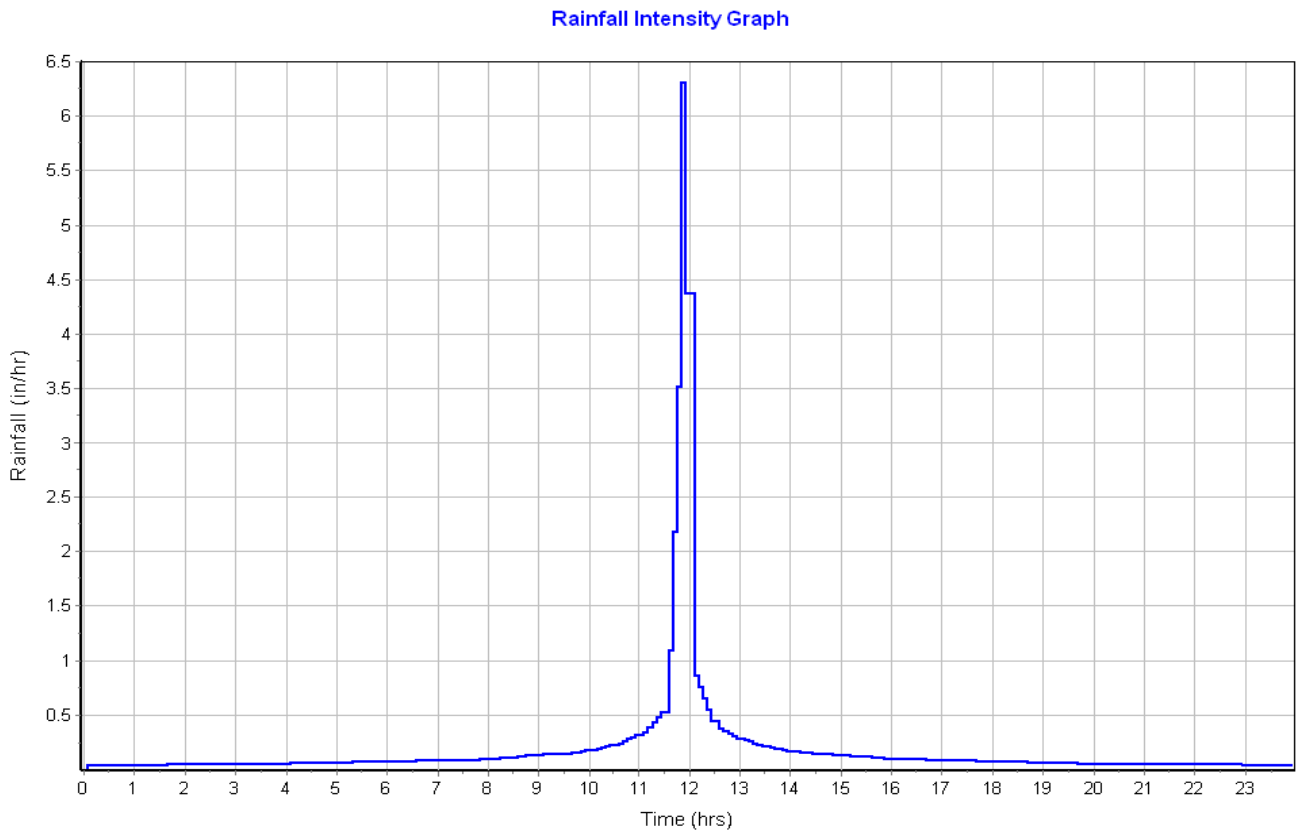
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	10494	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft²) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	8.20	0.00	0.00
Computed Flow Time (min) :	21.34	0.00	0.00

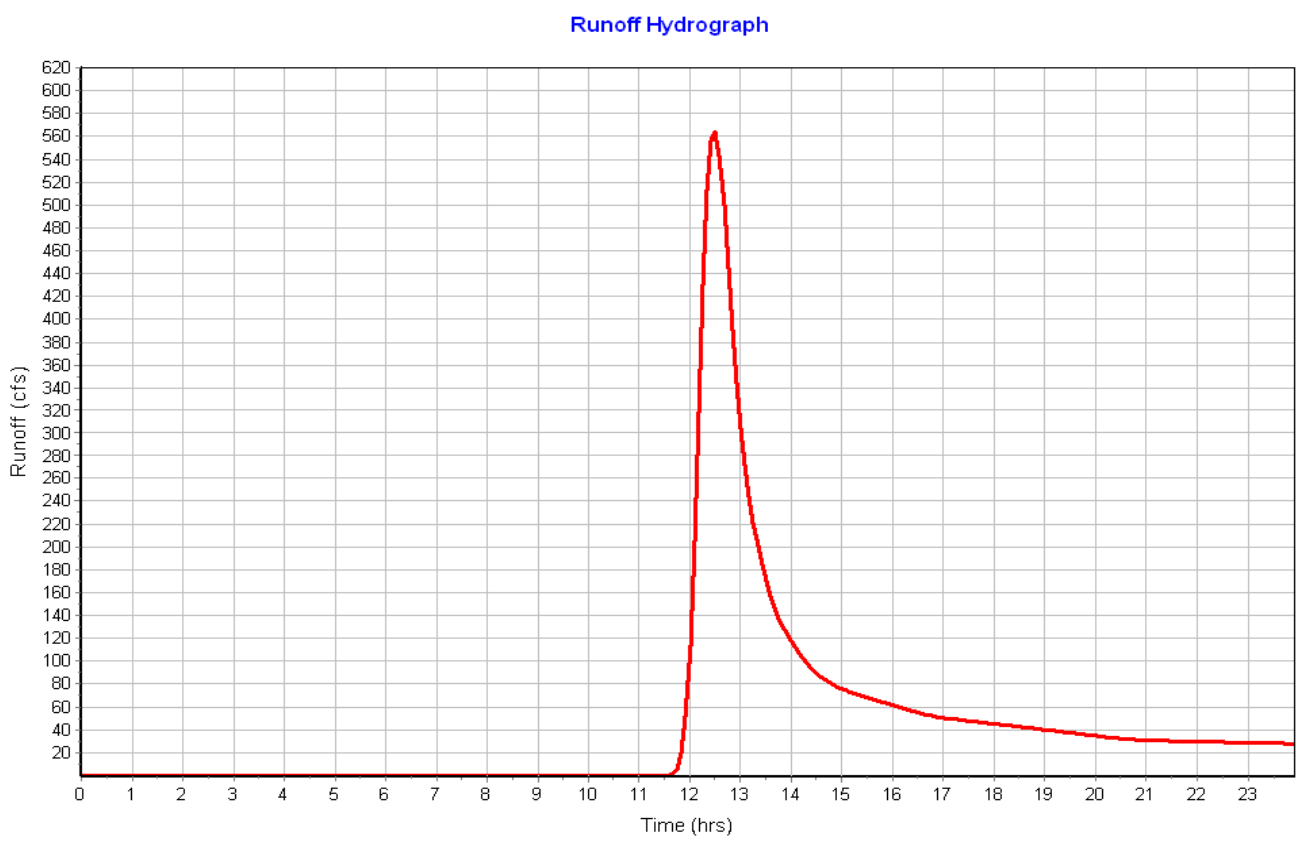
Total TOC (min) 53.01

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.19
Peak Runoff (cfs) 565.84
Weighted Curve Number 61.83
Time of Concentration (days hh:mm:ss) 0 00:53:01

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Ba

Input Data

Area (ac) 3836.70
Weighted Curve Number 60.34
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	3759.97	B	60.00
5 Acre Lots, 7% Impervious	76.73	D	77.00
Composite Area & Weighted CN	3836.70		60.34

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.40	0.00	0.00
Computed Flow Time (min) :	11.90	0.00	0.00

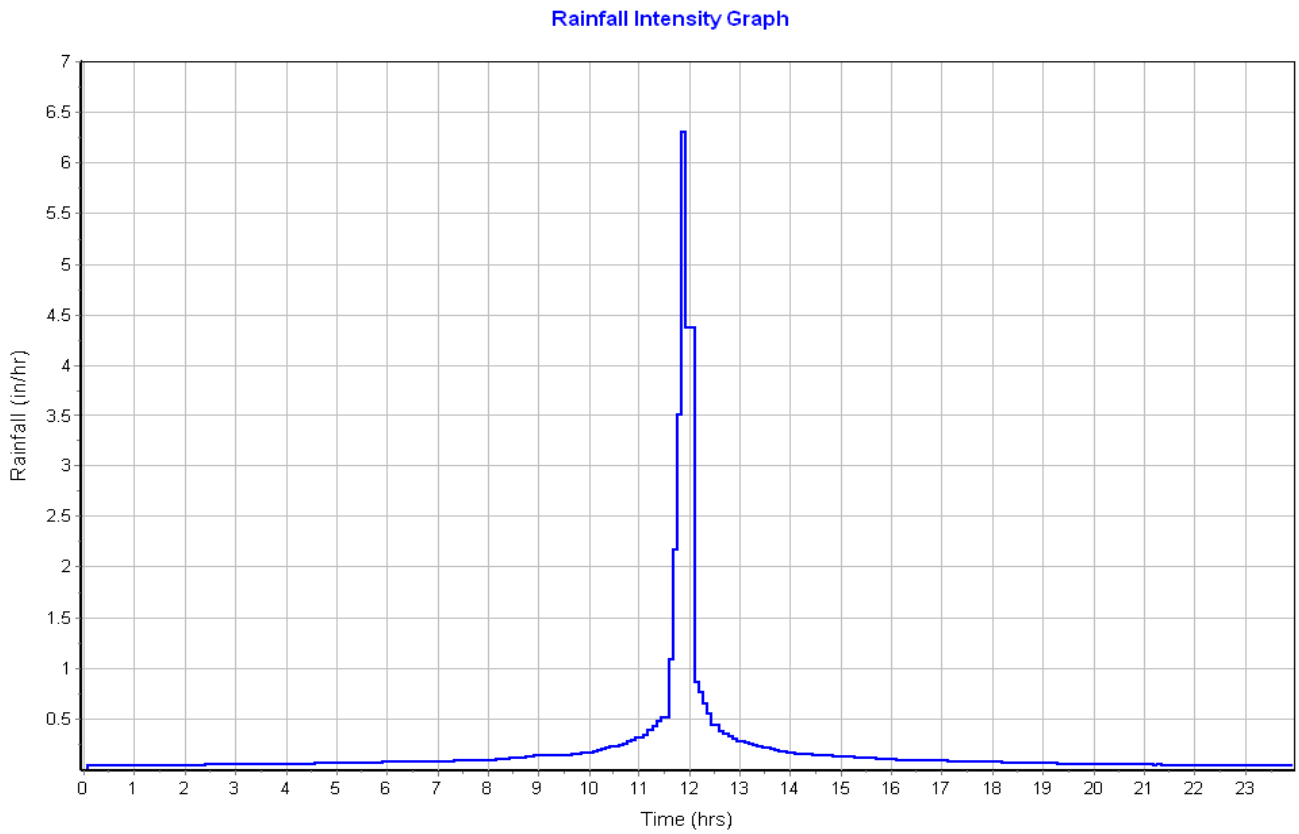
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	23284	0.00	0.00
Channel Slope (%) :	1.4	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	6.86	0.00	0.00
Computed Flow Time (min) :	56.59	0.00	0.00

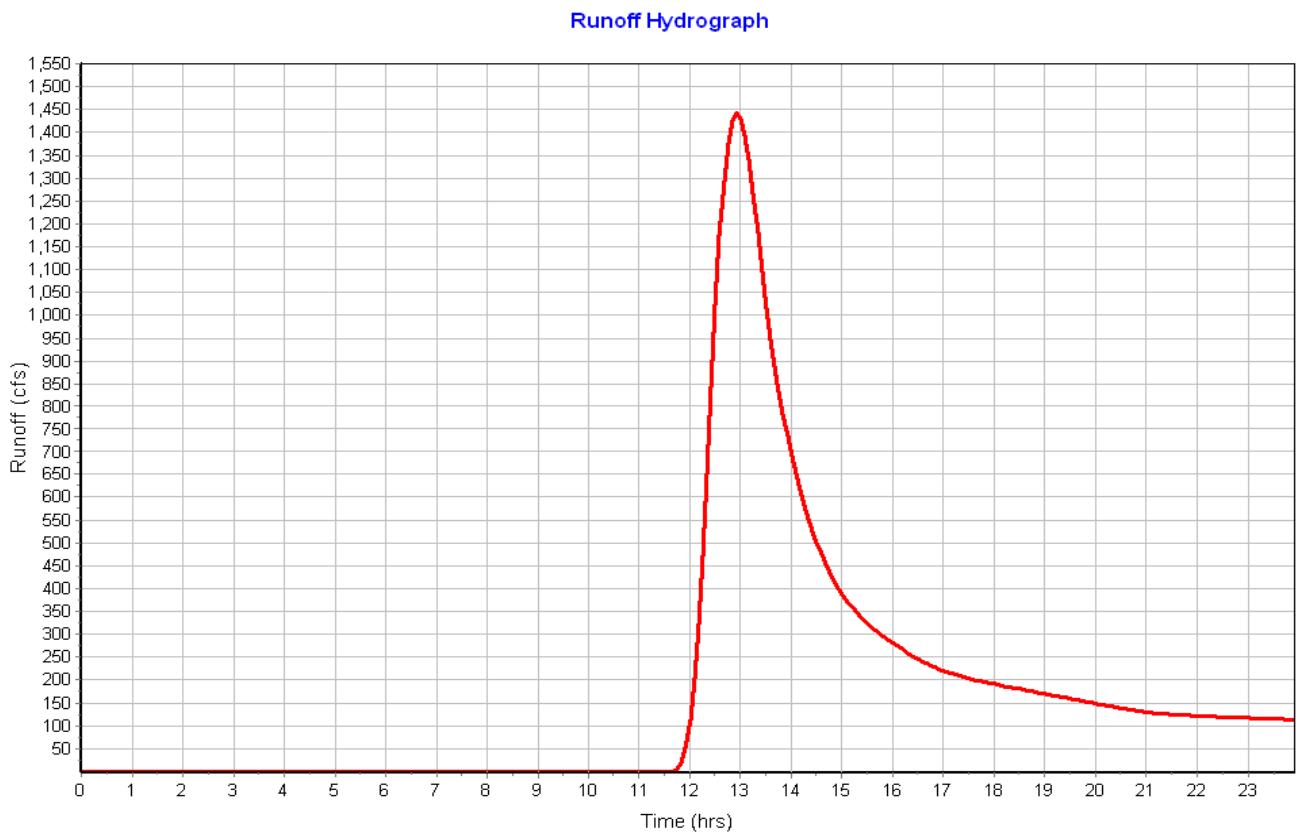
Total TOC (min) 89.56

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.10
Peak Runoff (cfs) 1443.11
Weighted Curve Number 60.34
Time of Concentration (days hh:mm:ss) 0 01:29:34

Subbasin : Ba


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Bb

Input Data

Area (ac) 100.60
Weighted Curve Number 69.79
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	90.54	B	69.00
Pasture, grassland, or range, Fair	5.03	D	84.00
Composite Area & Weighted CN	95.57		69.79

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.48	0.00	0.00
Computed Flow Time (min) :	11.26	0.00	0.00

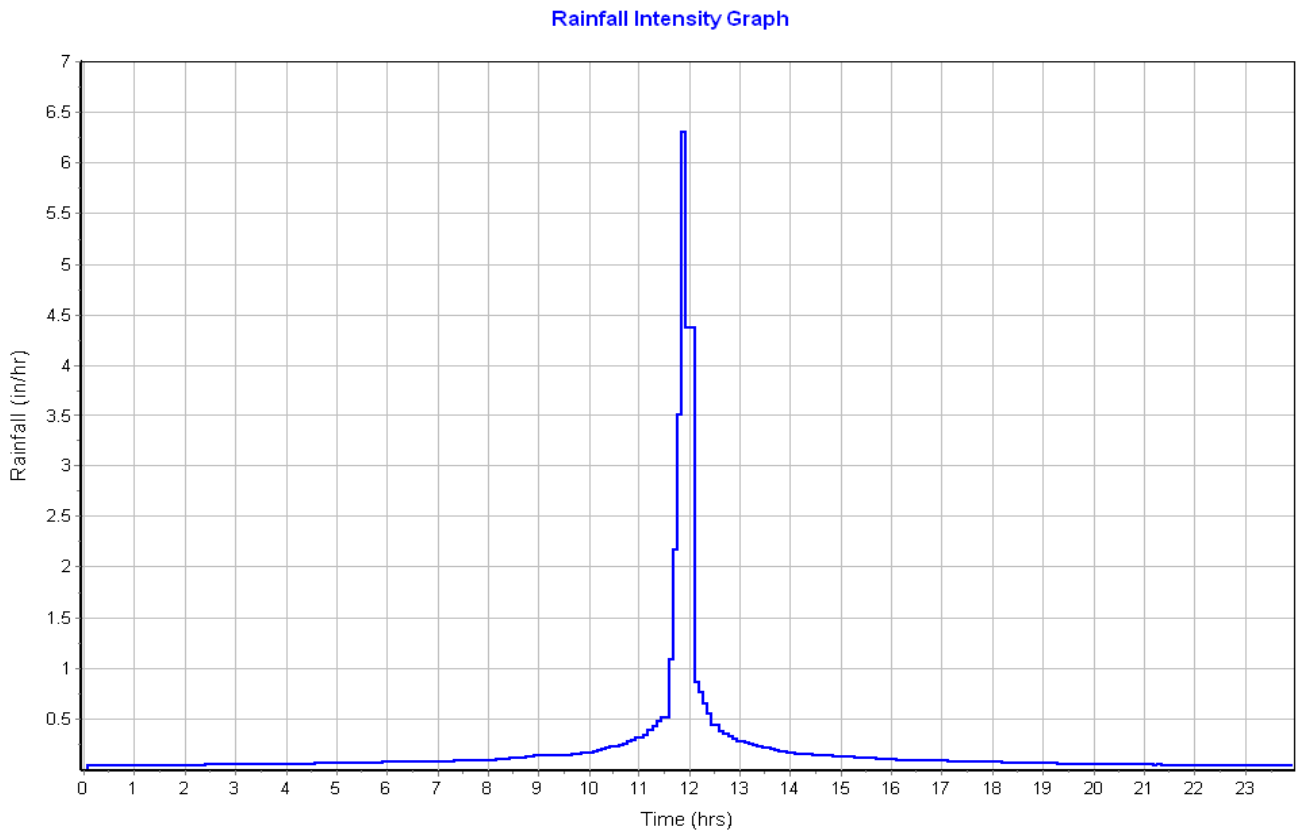
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	4140	0.00	0.00
Channel Slope (%) :	2.4	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	8.98	0.00	0.00
Computed Flow Time (min) :	7.69	0.00	0.00

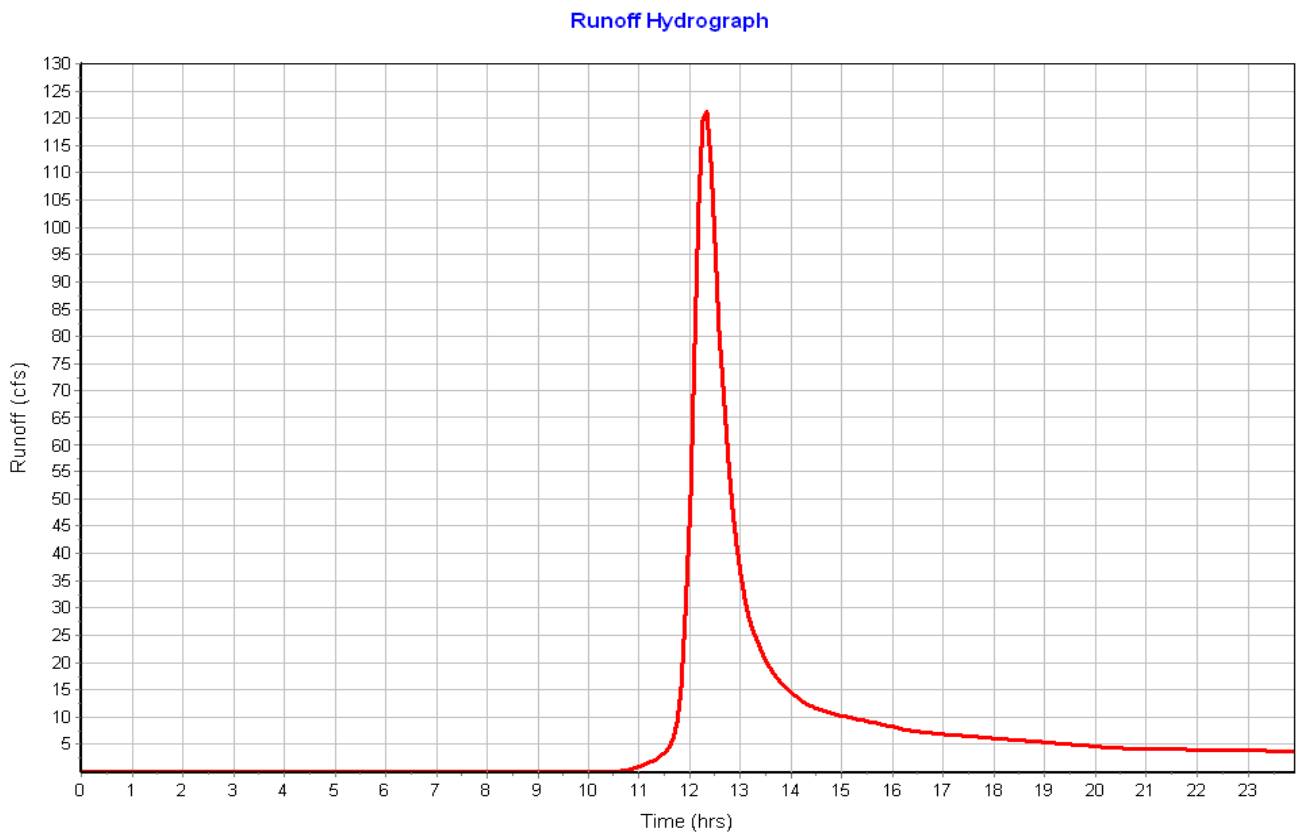
Total TOC (min) 40.00

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.73
Peak Runoff (cfs) 122.13
Weighted Curve Number 69.79
Time of Concentration (days hh:mm:ss) 0 00:40:00

Subbasin : Bb


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Ca

Input Data

Area (ac) 162.70
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	162.70	B	60.00
Composite Area & Weighted CN	162.70		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.42	0.00	0.00
Computed Flow Time (min) :	11.74	0.00	0.00

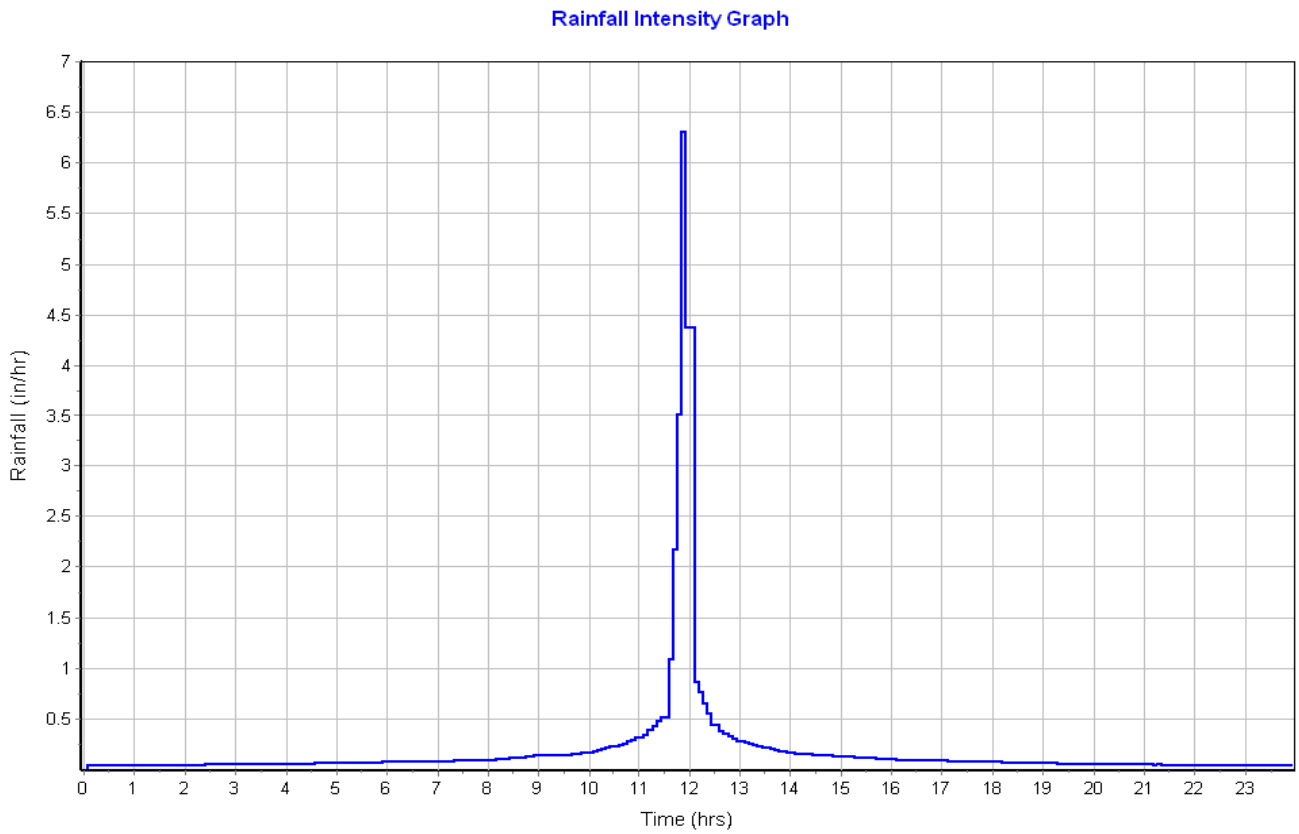
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	3099	0.00	0.00
Channel Slope (%) :	4.1	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	11.73	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

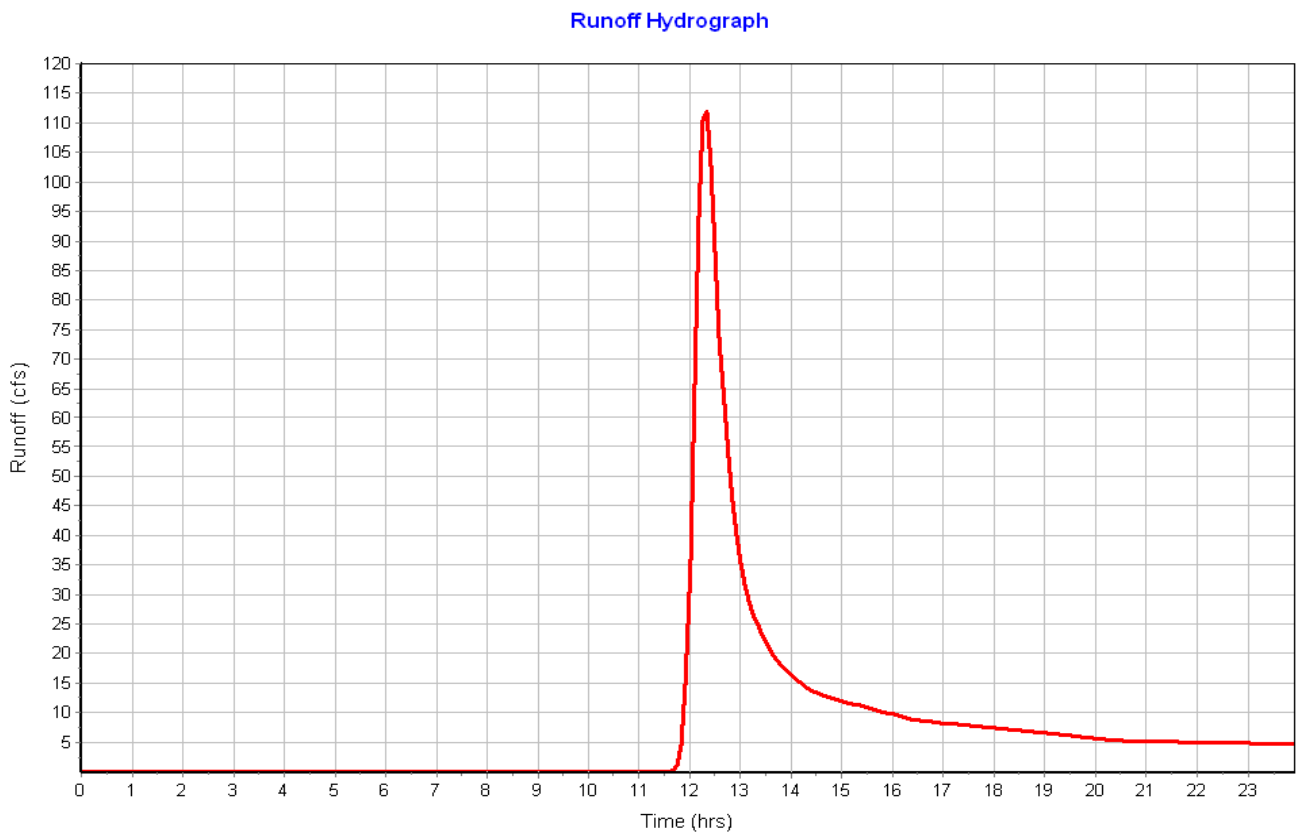
Total TOC (min) 37.20

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 113.04
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:37:12

Subbasin : Ca


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Cb

Input Data

Area (ac) 70.00
Weighted Curve Number 68.70
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	10.50	B	65.00
Pasture, grassland, or range, Fair	2.10	C	79.00
Pasture, grassland, or range, Fair	57.40	B	69.00
Composite Area & Weighted CN	70.00		68.70

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.6	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.33	0.00	0.00
Computed Flow Time (min) :	12.53	0.00	0.00

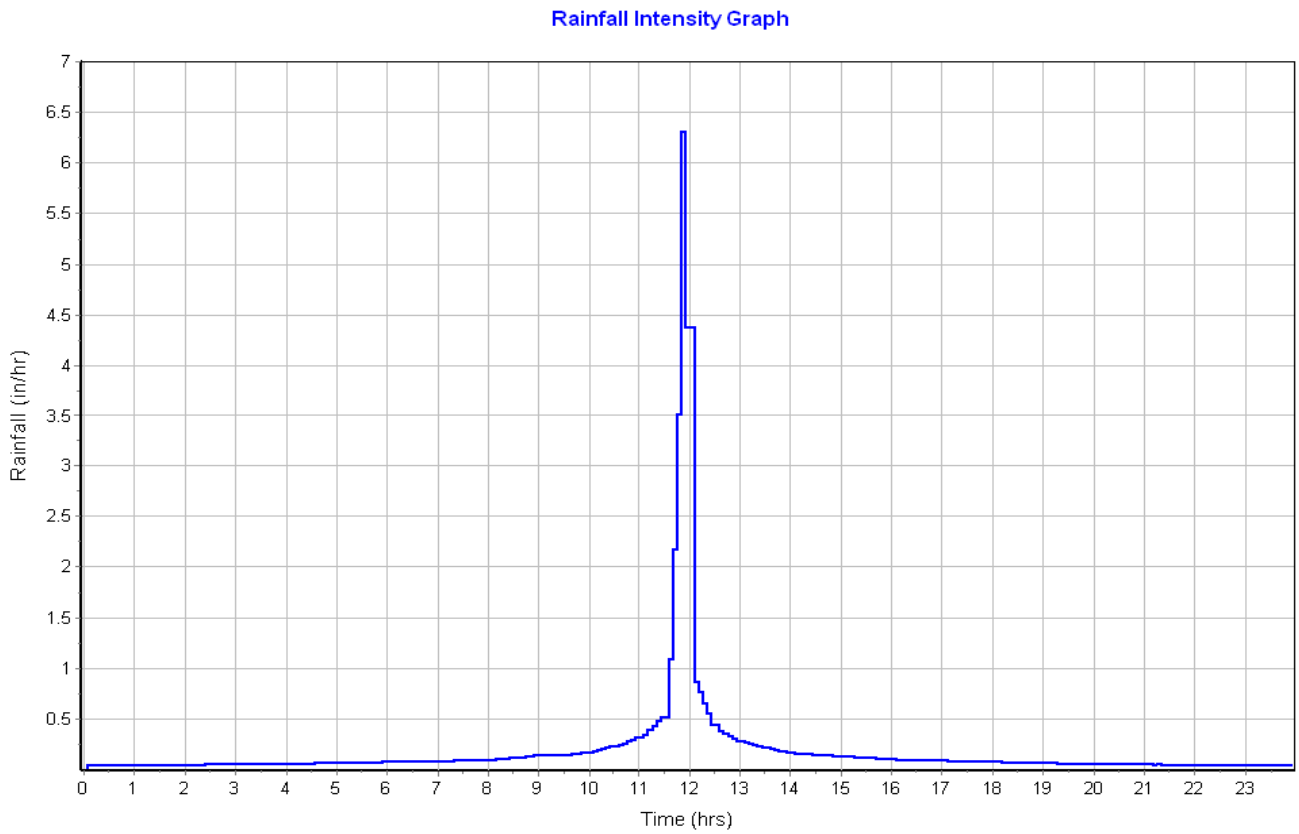
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	2084	0.00	0.00
Channel Slope (%) :	3.6	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.08	0.00	0.00
Computed Flow Time (min) :	3.83	0.00	0.00

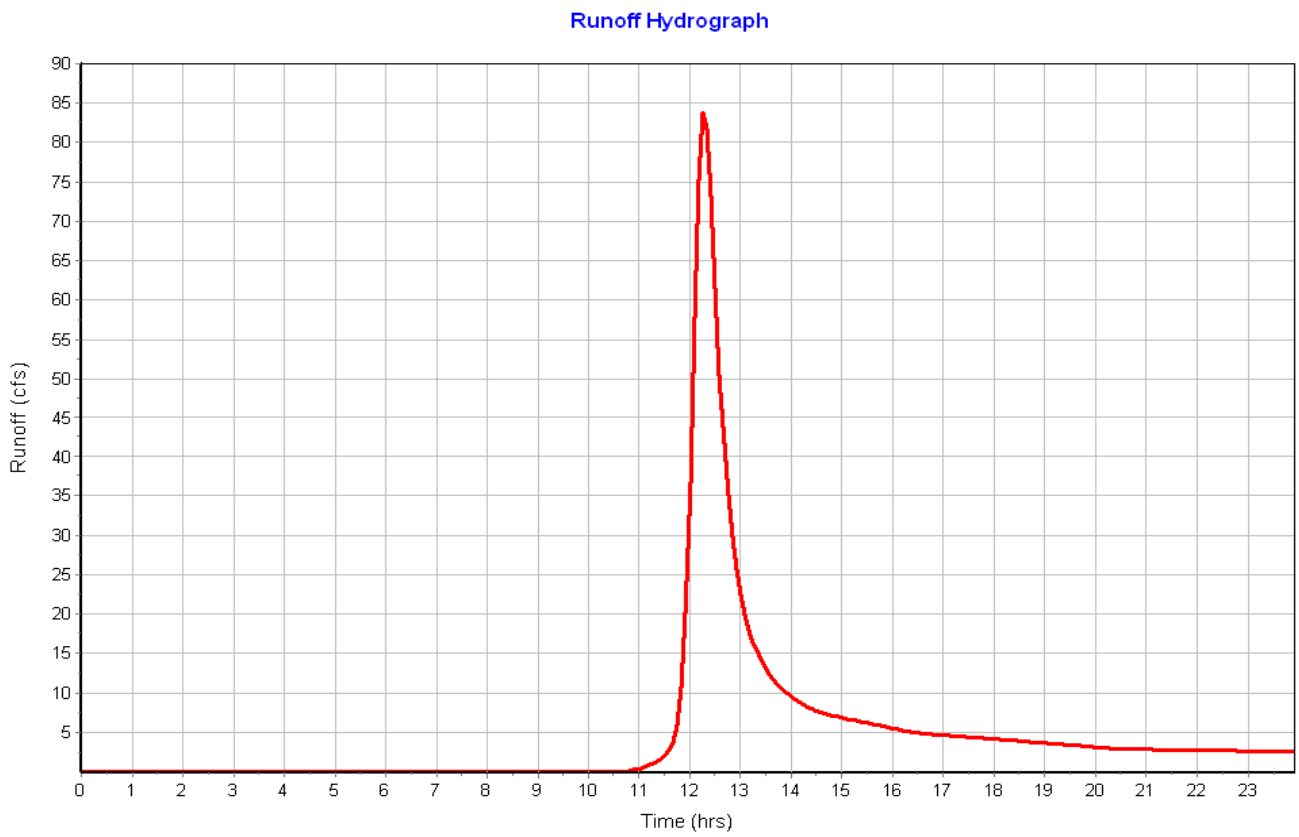
Total TOC (min) 37.42

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.65
Peak Runoff (cfs) 84.46
Weighted Curve Number 68.70
Time of Concentration (days hh:mm:ss) 0 00:37:25

Subbasin : Cb


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Da

Input Data

Area (ac) 161.30
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	161.30	B	60.00
Composite Area & Weighted CN	161.30		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.19	0.00	0.00
Computed Flow Time (min) :	14.01	0.00	0.00

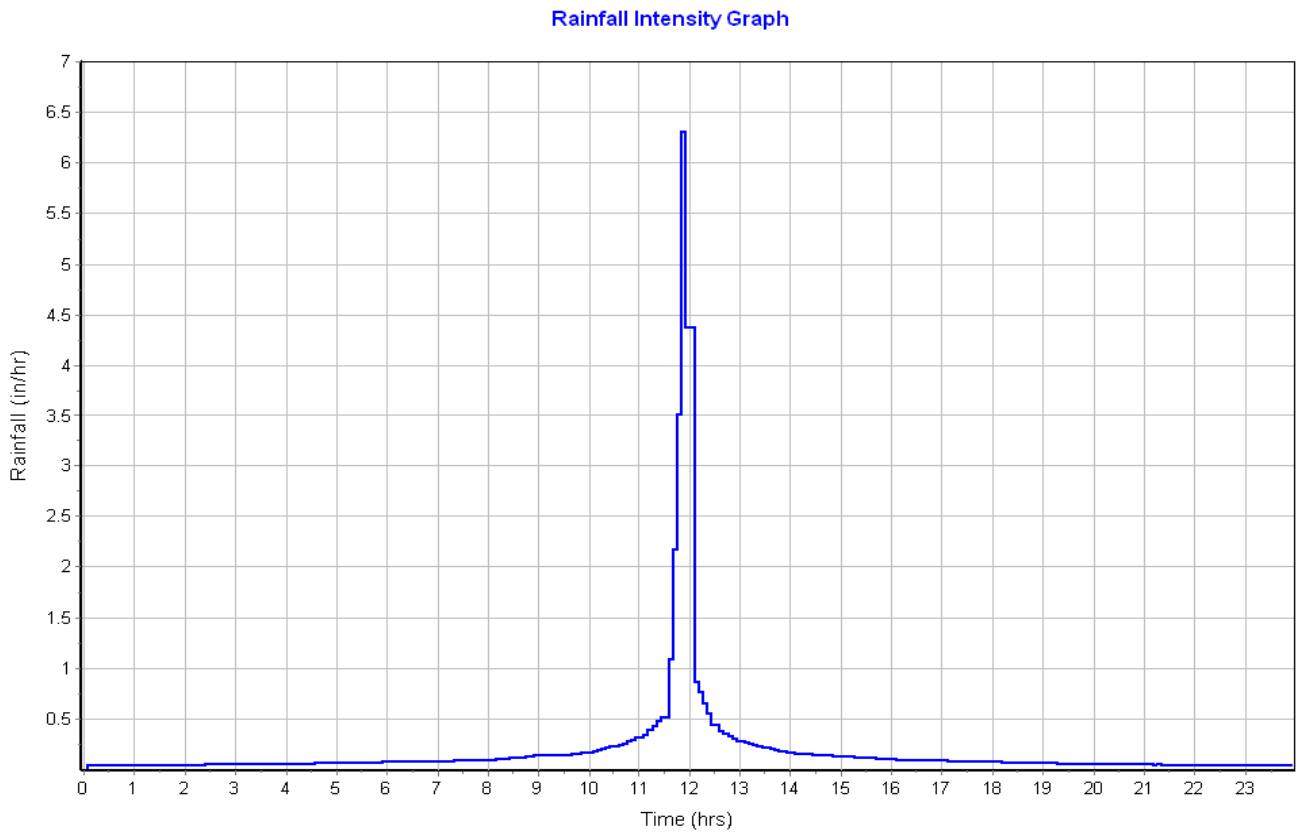
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1601	0.00	0.00
Channel Slope (%) :	5.7	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	13.84	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00

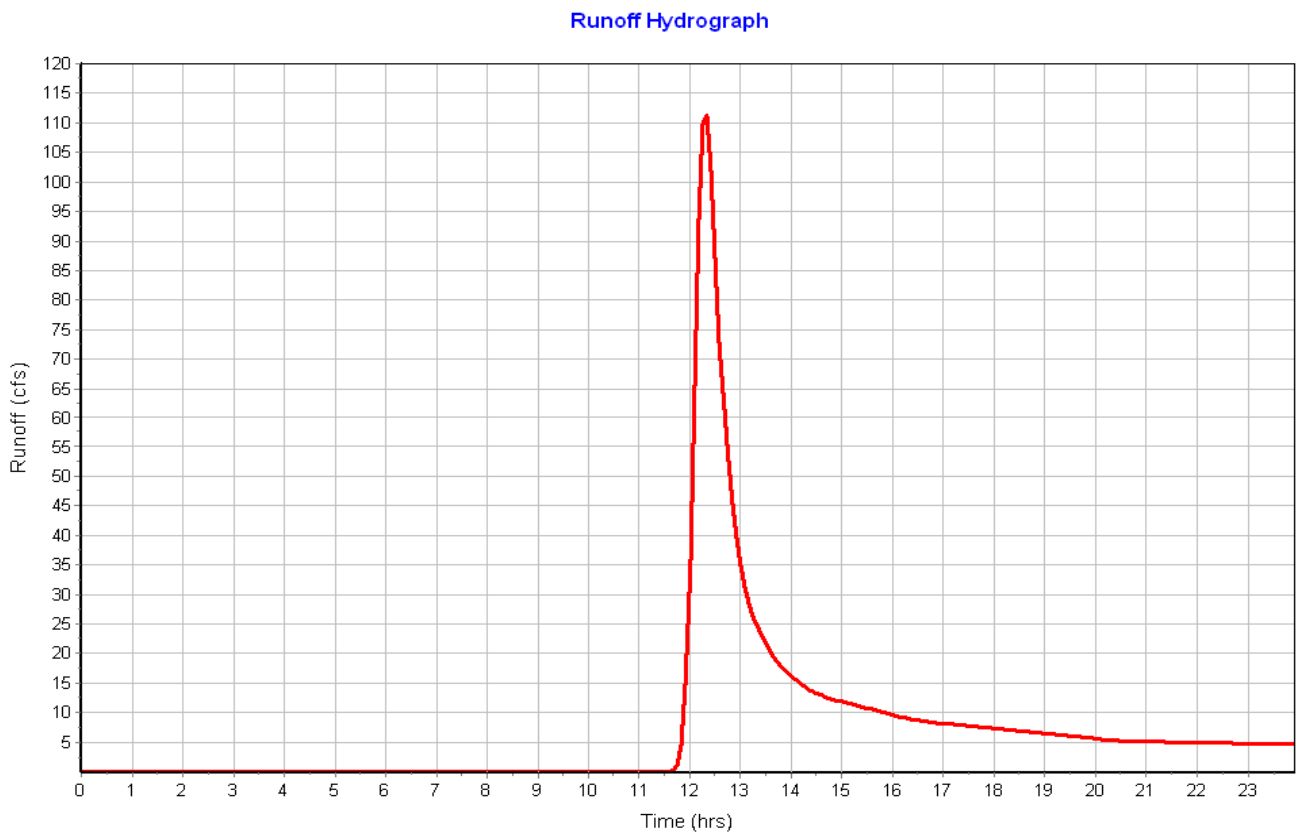
Total TOC (min) 36.99

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 112.52
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:36:59

Subbasin : Da


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Db

Input Data

Area (ac) 49.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	49.90	B	60.00
Composite Area & Weighted CN	49.90		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.48	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.79	0.00	0.00
Computed Flow Time (min) :	21.10	0.00	0.00

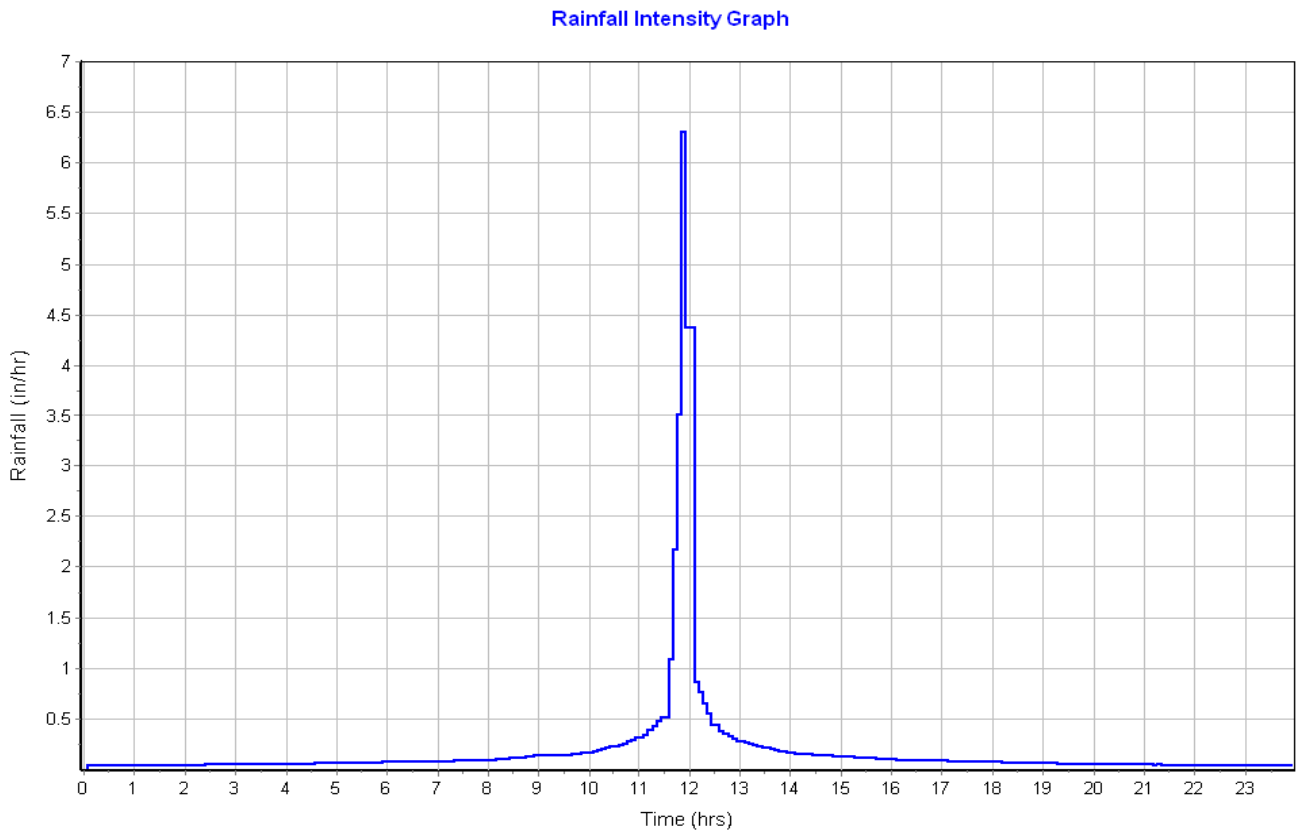
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	922	0.00	0.00
Channel Slope (%) :	2.48	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.53	0.00	0.00
Computed Flow Time (min) :	2.04	0.00	0.00

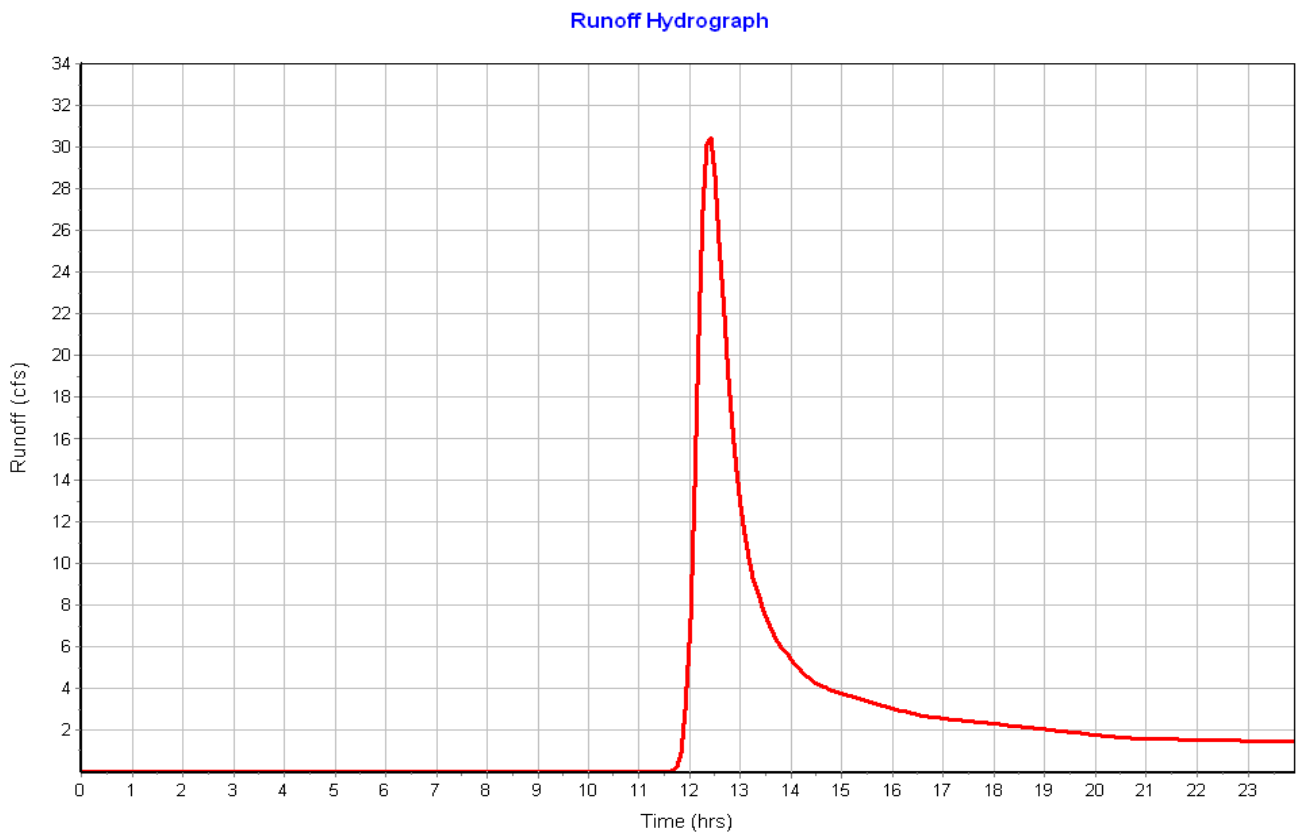
Total TOC (min) 44.20

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 30.63
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:44:12

Subbasin : Db


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Dc

Input Data

Area (ac) 249.70
Weighted Curve Number 67.70
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	83.80	B	65.00
Pasture, grassland, or range, Fair	4.19	D	84.00
Pasture, grassland, or range, Fair	121.51	B	69.00
Composite Area & Weighted CN	209.50		67.70

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.21	0.00	0.00
Computed Flow Time (min) :	13.77	0.00	0.00

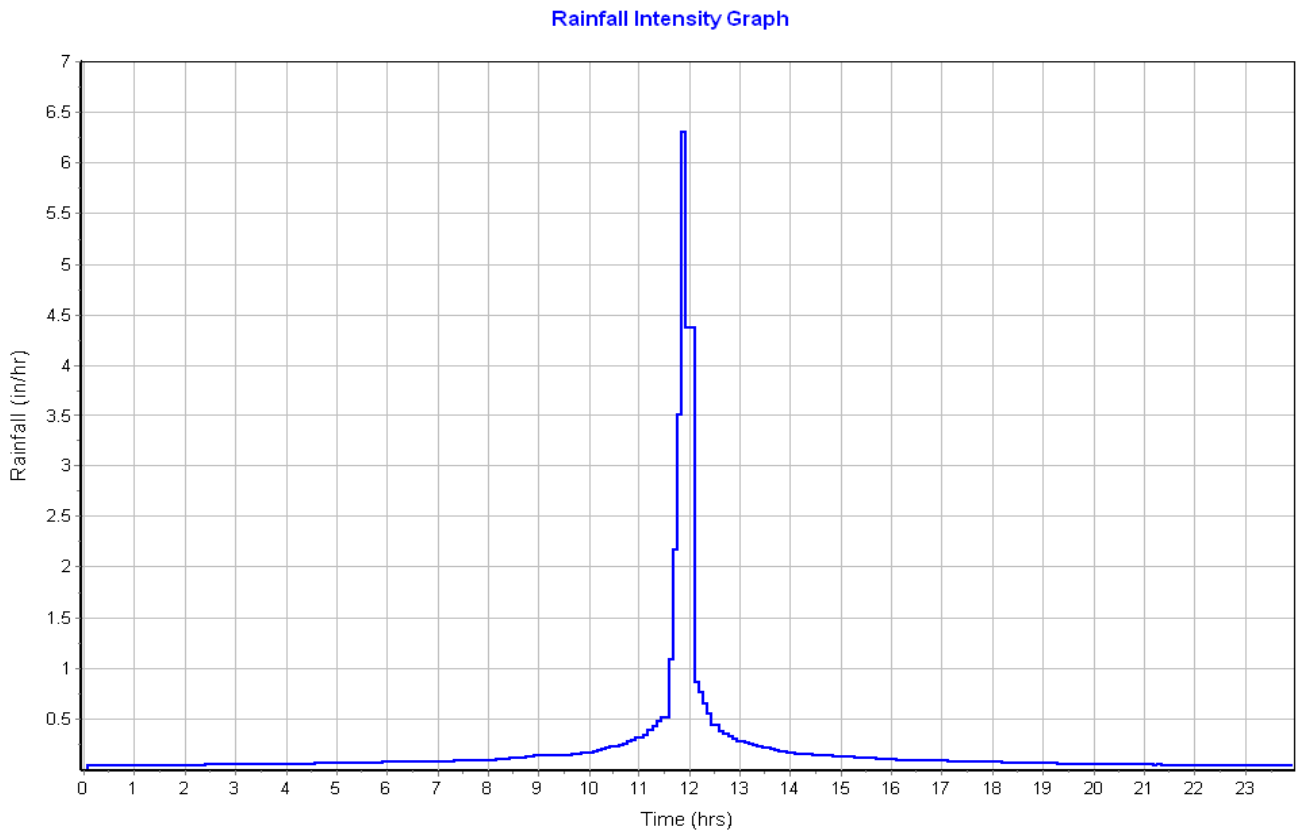
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	3678	0.00	0.00
Channel Slope (%) :	3	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	10.04	0.00	0.00
Computed Flow Time (min) :	6.11	0.00	0.00

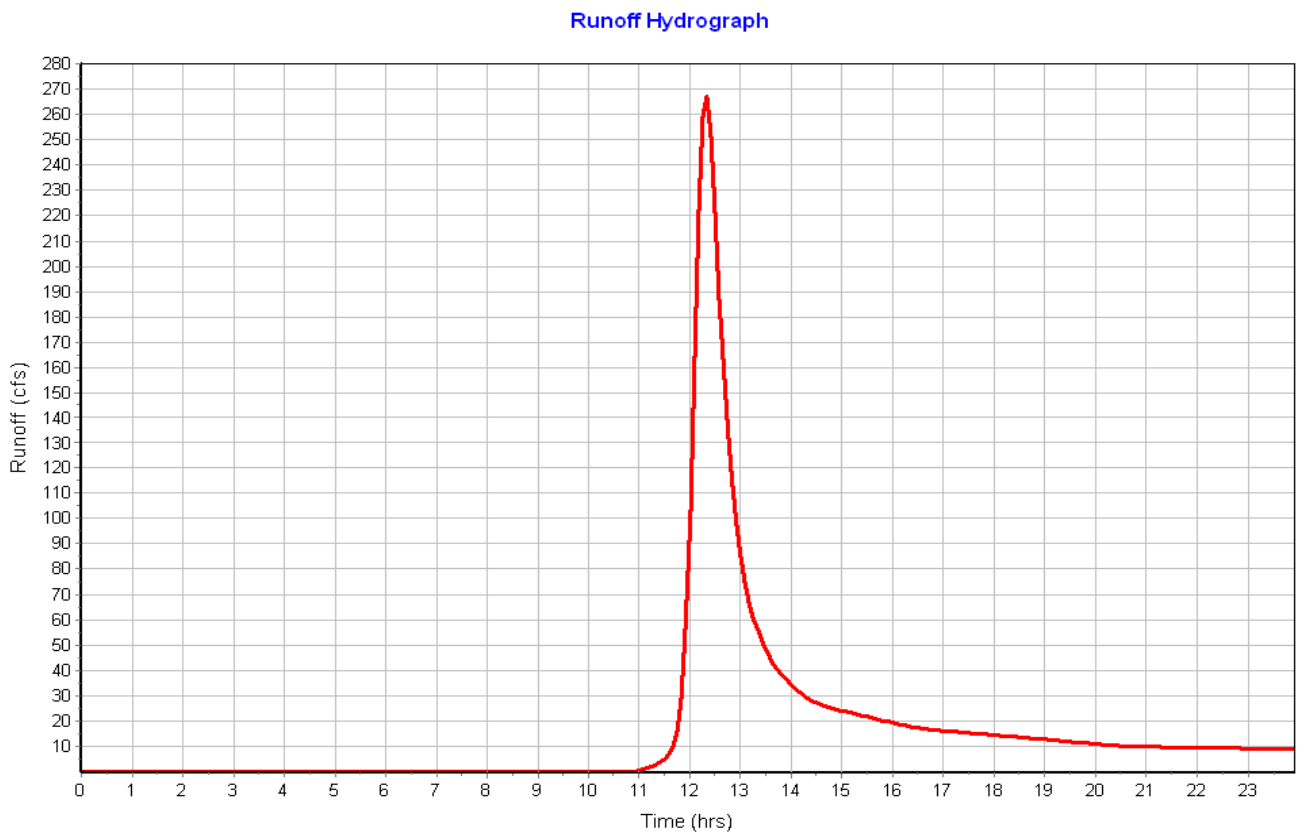
Total TOC (min) 40.94

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.58
Peak Runoff (cfs) 267.69
Weighted Curve Number 67.70
Time of Concentration (days hh:mm:ss) 0 00:40:56

Subbasin : Dc


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Ea

Input Data

Area (ac) 37.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	37.90	B	60.00
Composite Area & Weighted CN	37.90		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	4.9	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.11	0.00	0.00
Computed Flow Time (min) :	7.51	0.00	0.00

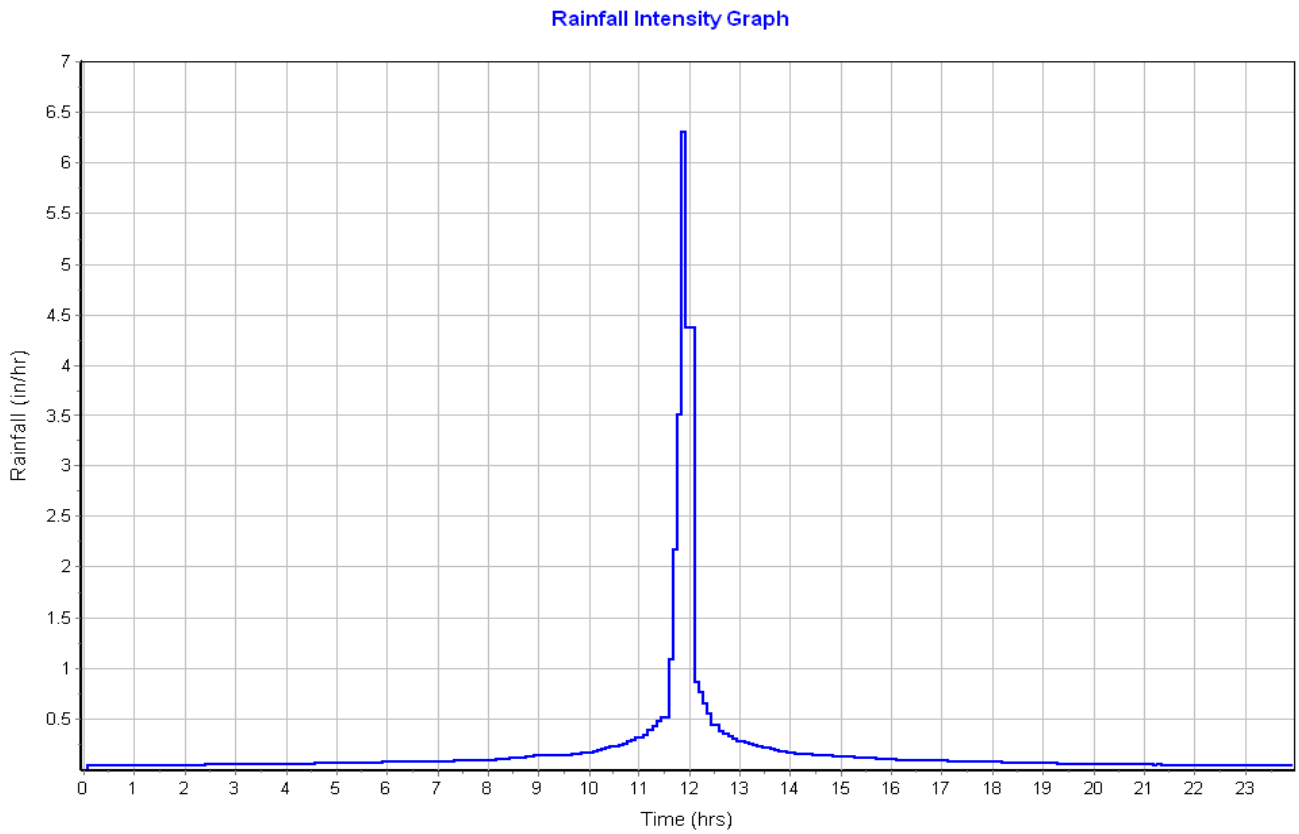
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1227	0.00	0.00
Channel Slope (%) :	4.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00

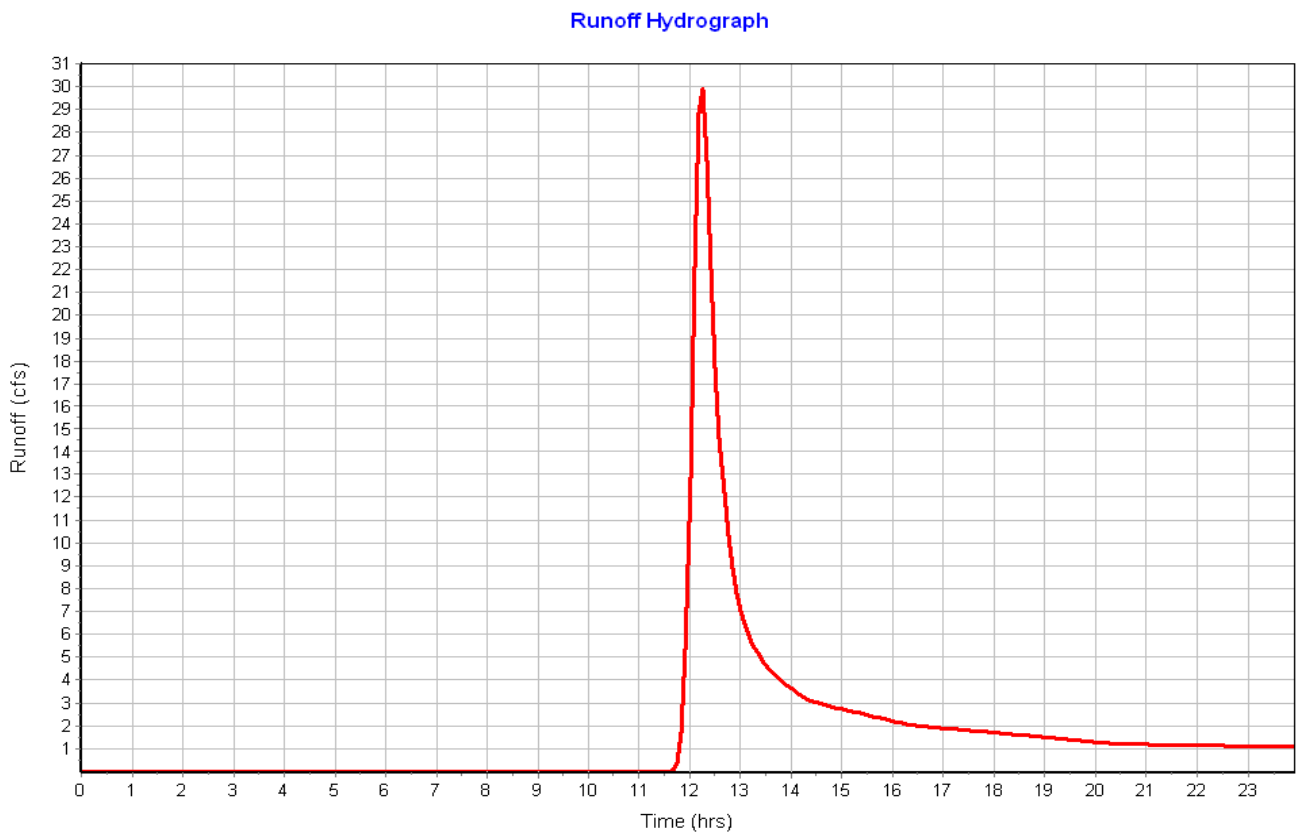
Total TOC (min) 30.50

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 30.18
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:30:30

Subbasin : Ea


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Eb

Input Data

Area (ac) 74.60
Weighted Curve Number 67.20
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	91.84	B	69.00
5 Acre Lots, 7% Impervious	22.96	B	60.00
Composite Area & Weighted CN	114.80		67.20

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	12.25	0.00	0.00

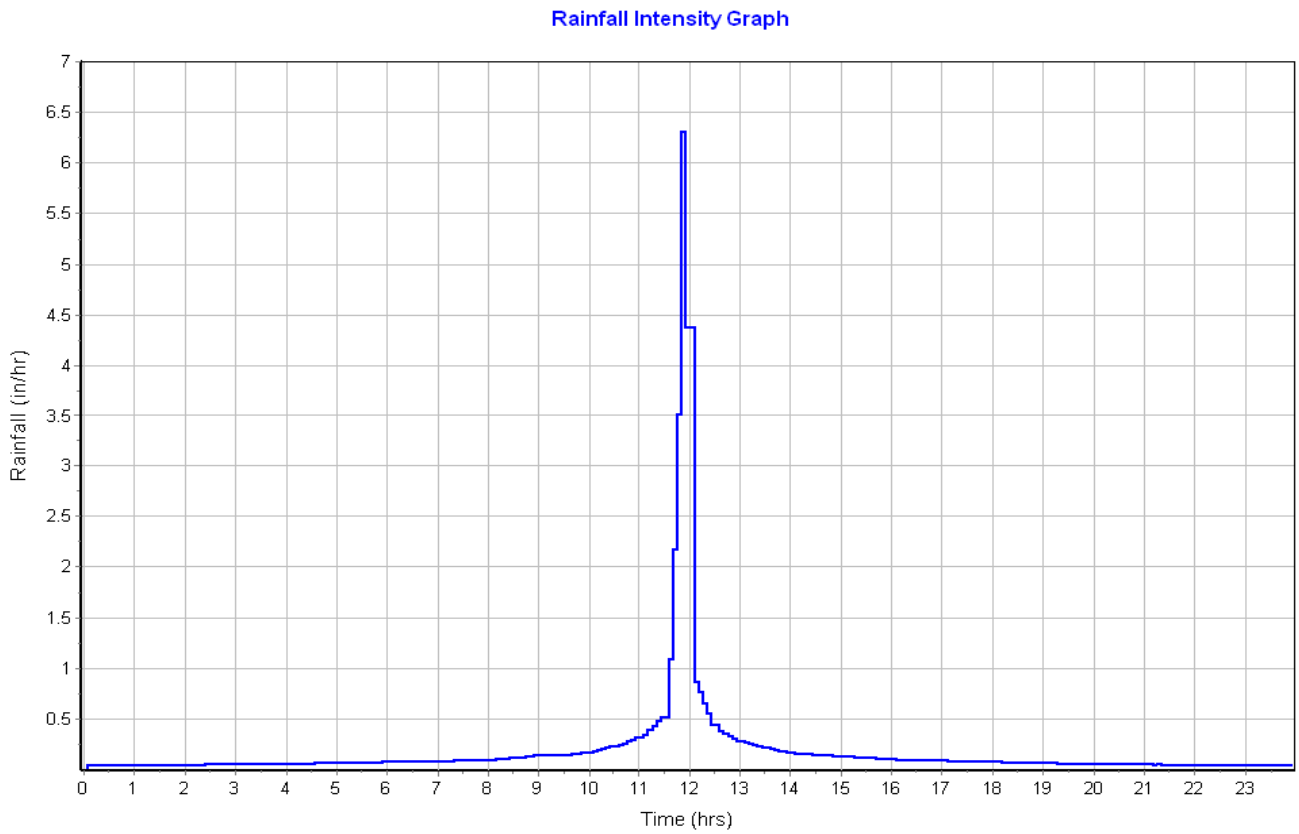
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	2766	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	4.94	0.00	0.00

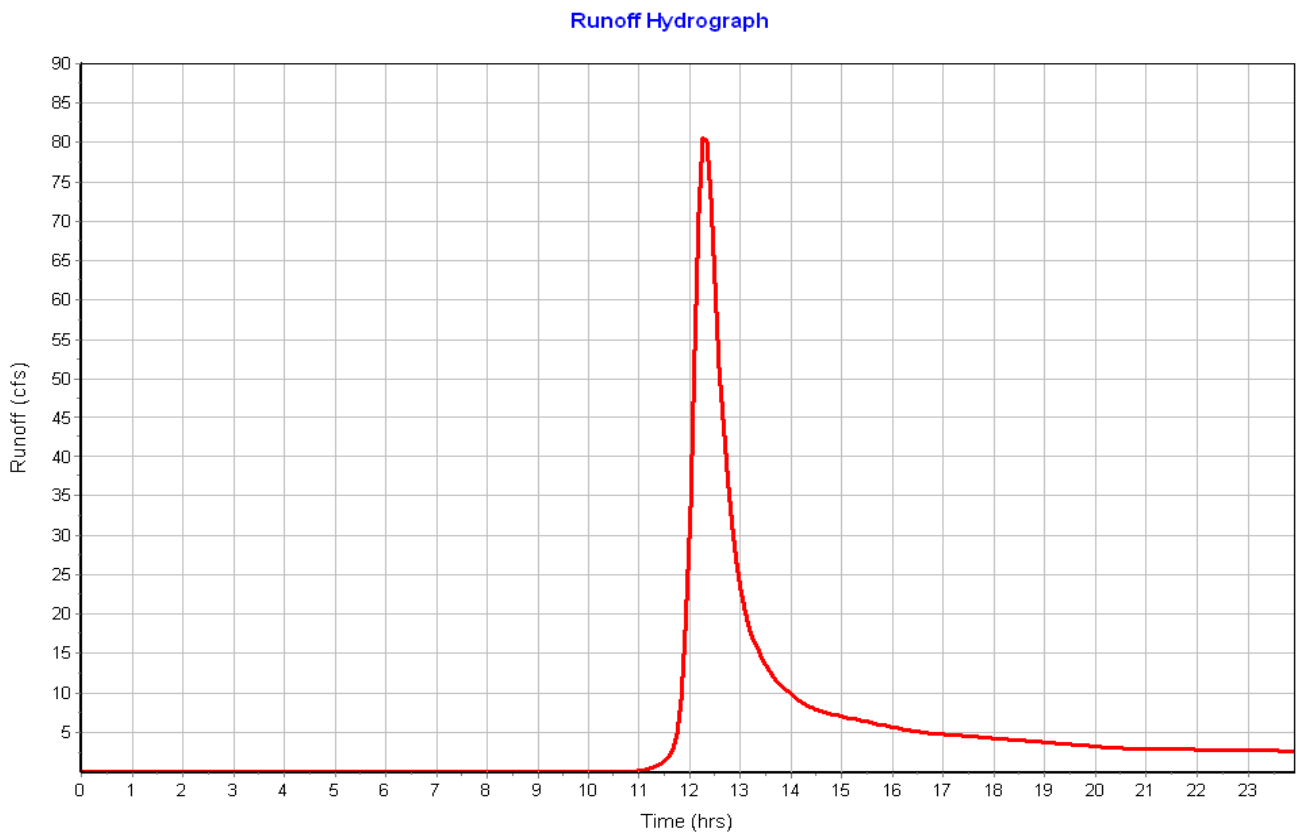
Total TOC (min) 38.26

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.54
Peak Runoff (cfs) 81.57
Weighted Curve Number 67.20
Time of Concentration (days hh:mm:ss) 0 00:38:16

Subbasin : Eb


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : F

Input Data

Area (ac) 44.50
Weighted Curve Number 69.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	44.50	B	69.00
Composite Area & Weighted CN	44.50		69.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	13.33	0.00	0.00

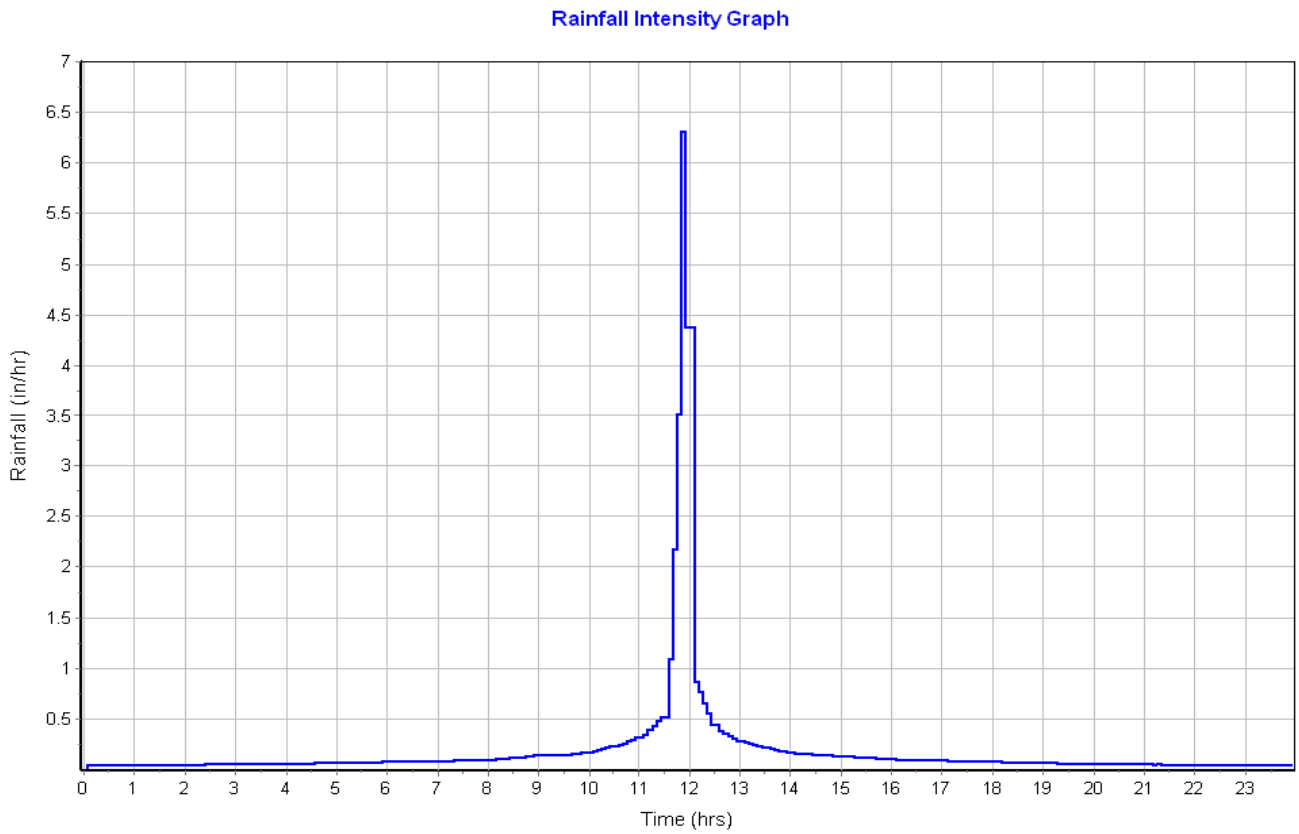
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1707	0.00	0.00
Channel Slope (%) :	3.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.56	0.00	0.00
Computed Flow Time (min) :	3.32	0.00	0.00

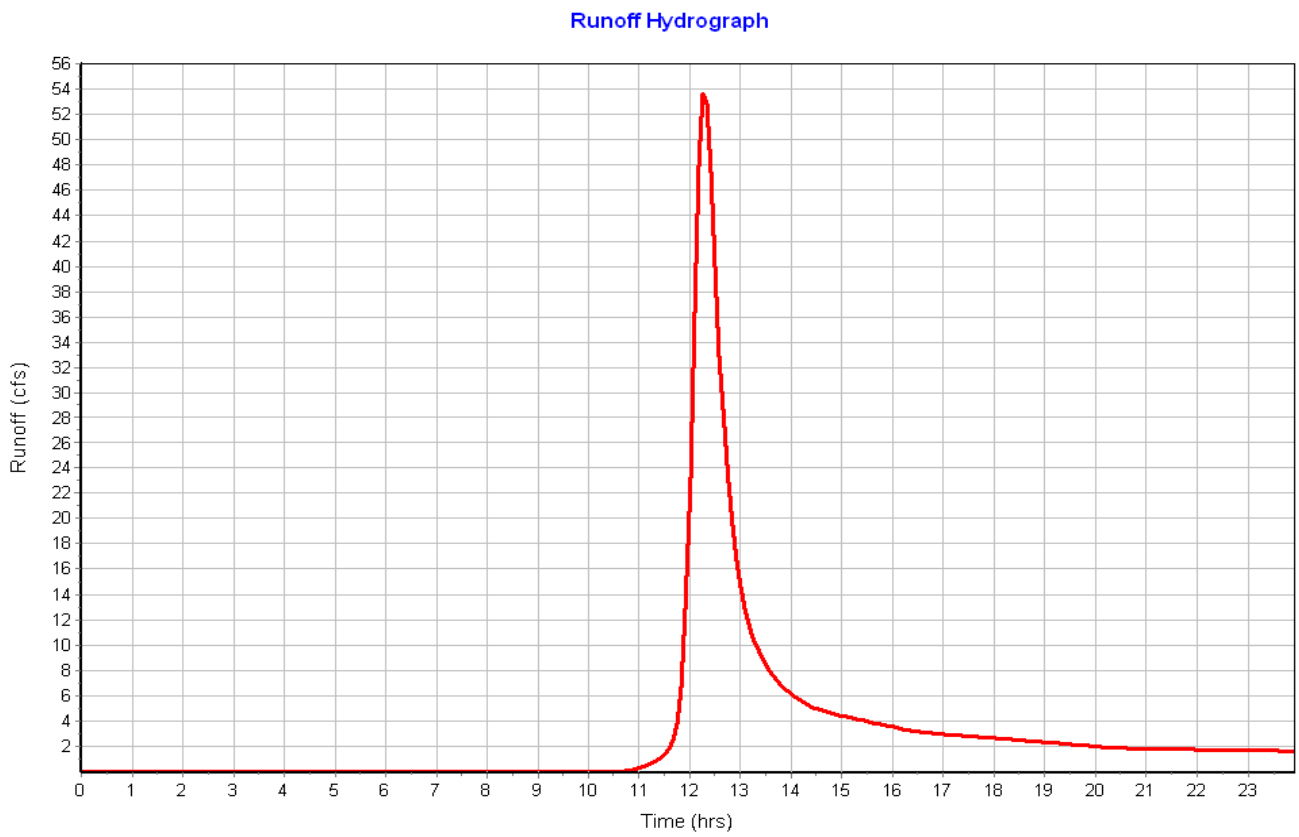
Total TOC (min) 37.72

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.67
Peak Runoff (cfs) 54.18
Weighted Curve Number 69.00
Time of Concentration (days hh:mm:ss) 0 00:37:43

Subbasin : F


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : G

Input Data

Area (ac) 107.60
Weighted Curve Number 74.50
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	59.18	C	79.00
Pasture, grassland, or range, Fair	48.42	B	69.00
Composite Area & Weighted CN	107.60		74.50

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.7	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.52	0.00	0.00
Computed Flow Time (min) :	10.96	0.00	0.00

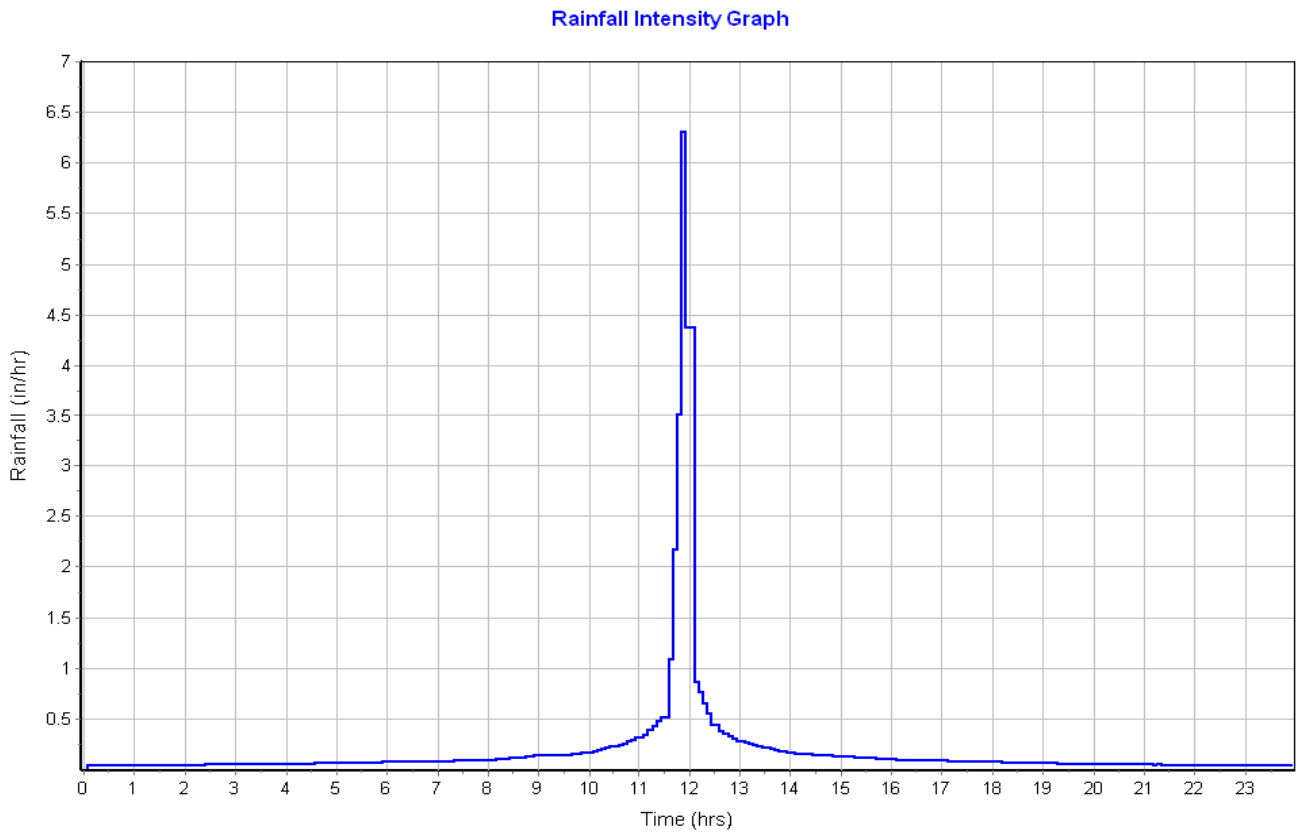
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1441	0.00	0.00
Channel Slope (%) :	4.7	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	12.56	0.00	0.00
Computed Flow Time (min) :	1.91	0.00	0.00

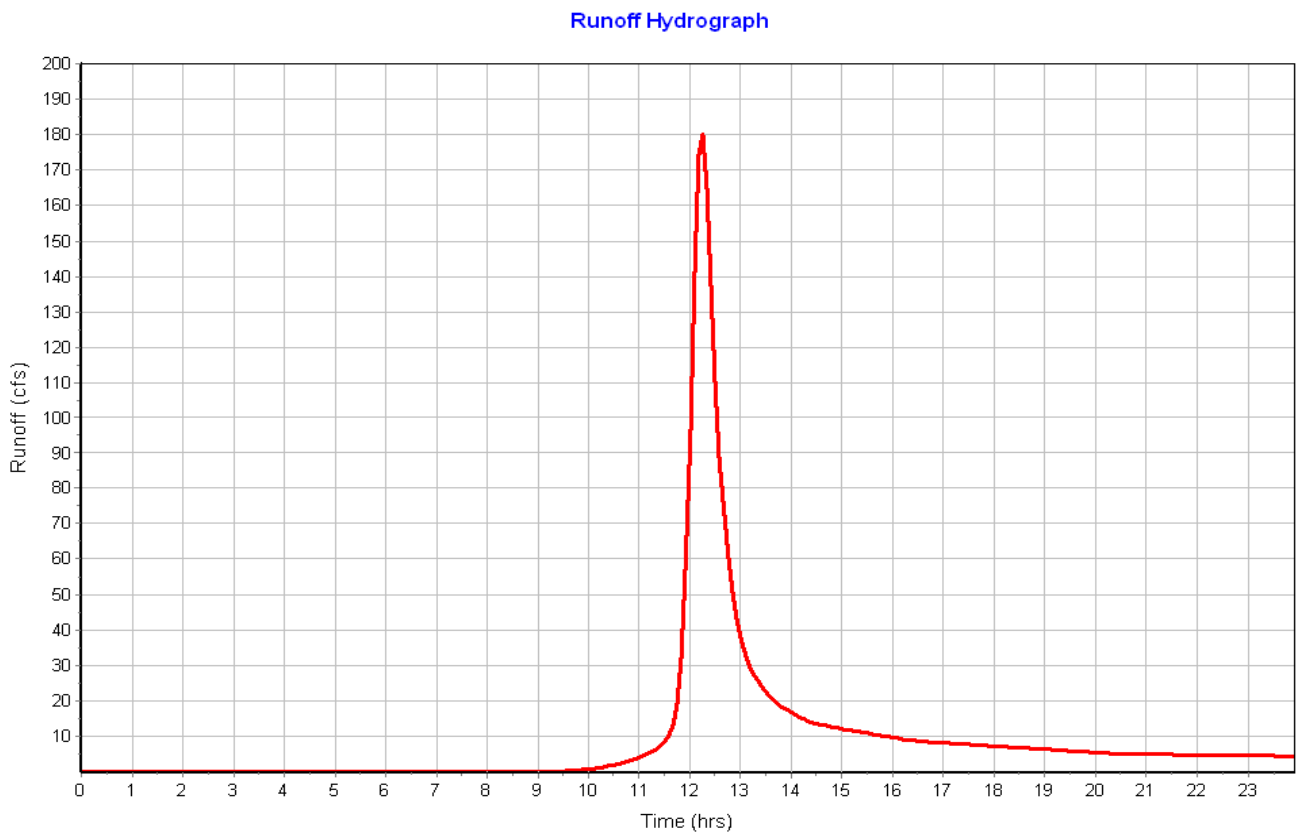
Total TOC (min) 33.93

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 2.09
Peak Runoff (cfs) 181.44
Weighted Curve Number 74.50
Time of Concentration (days hh:mm:ss) 0 00:33:56

Subbasin : G


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : H

Input Data

Area (ac) 121.80
Weighted Curve Number 71.76
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	54.81	C	79.00
Woods, Fair	31.67	B	60.00
Pasture, grassland, or range, Fair	30.45	B	69.00
Pasture, grassland, or range, Fair	4.87	D	84.00
Composite Area & Weighted CN	121.80		71.76

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.43	0.00	0.00
Computed Flow Time (min) :	11.66	0.00	0.00

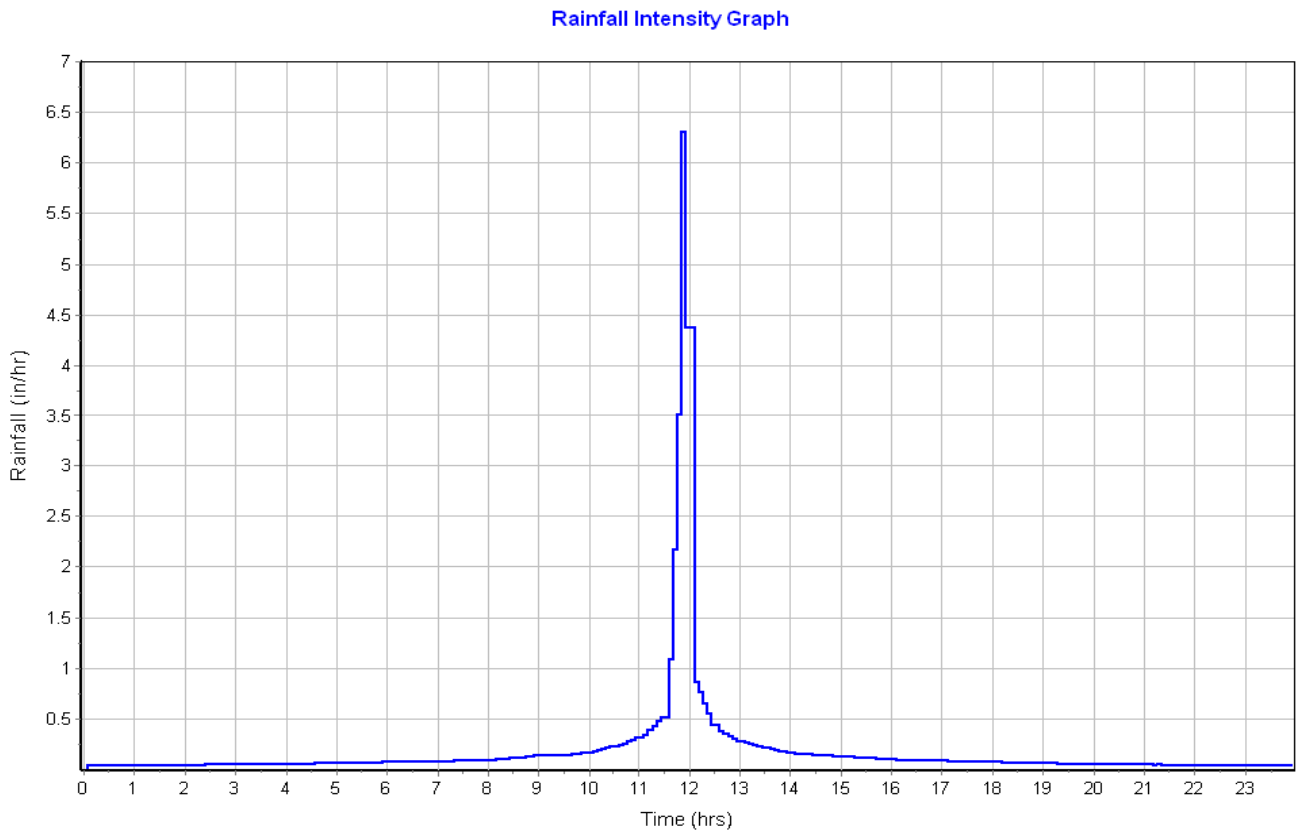
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	676	0.00	0.00
Channel Slope (%) :	4.2	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	11.88	0.00	0.00
Computed Flow Time (min) :	0.95	0.00	0.00

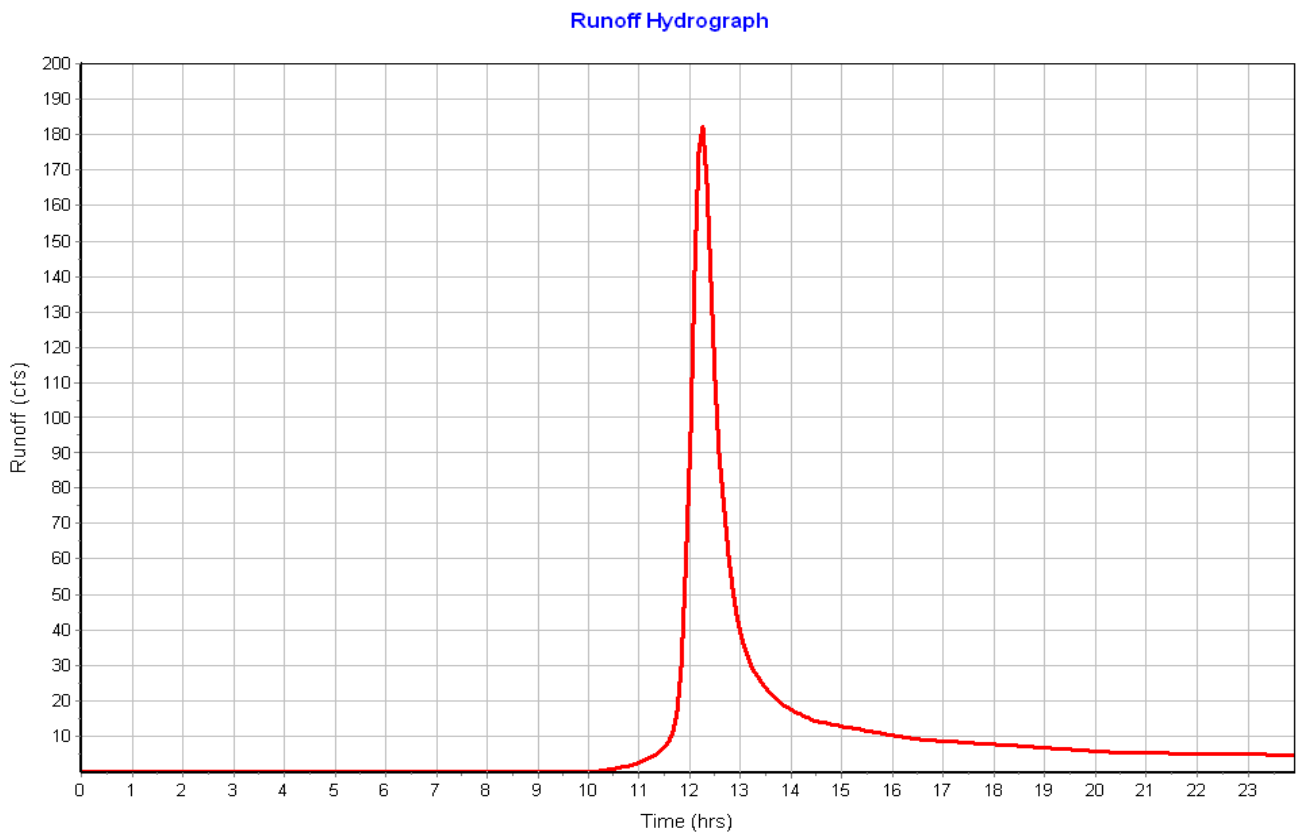
Total TOC (min) 33.66

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.88
Peak Runoff (cfs) 182.91
Weighted Curve Number 71.76
Time of Concentration (days hh:mm:ss) 0 00:33:40

Subbasin : H


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : I

Input Data

Area (ac) 37.50
Weighted Curve Number 79.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	37.50	C	79.00
Composite Area & Weighted CN	37.50		79.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.58	0.00	0.00
Computed Flow Time (min) :	10.55	0.00	0.00

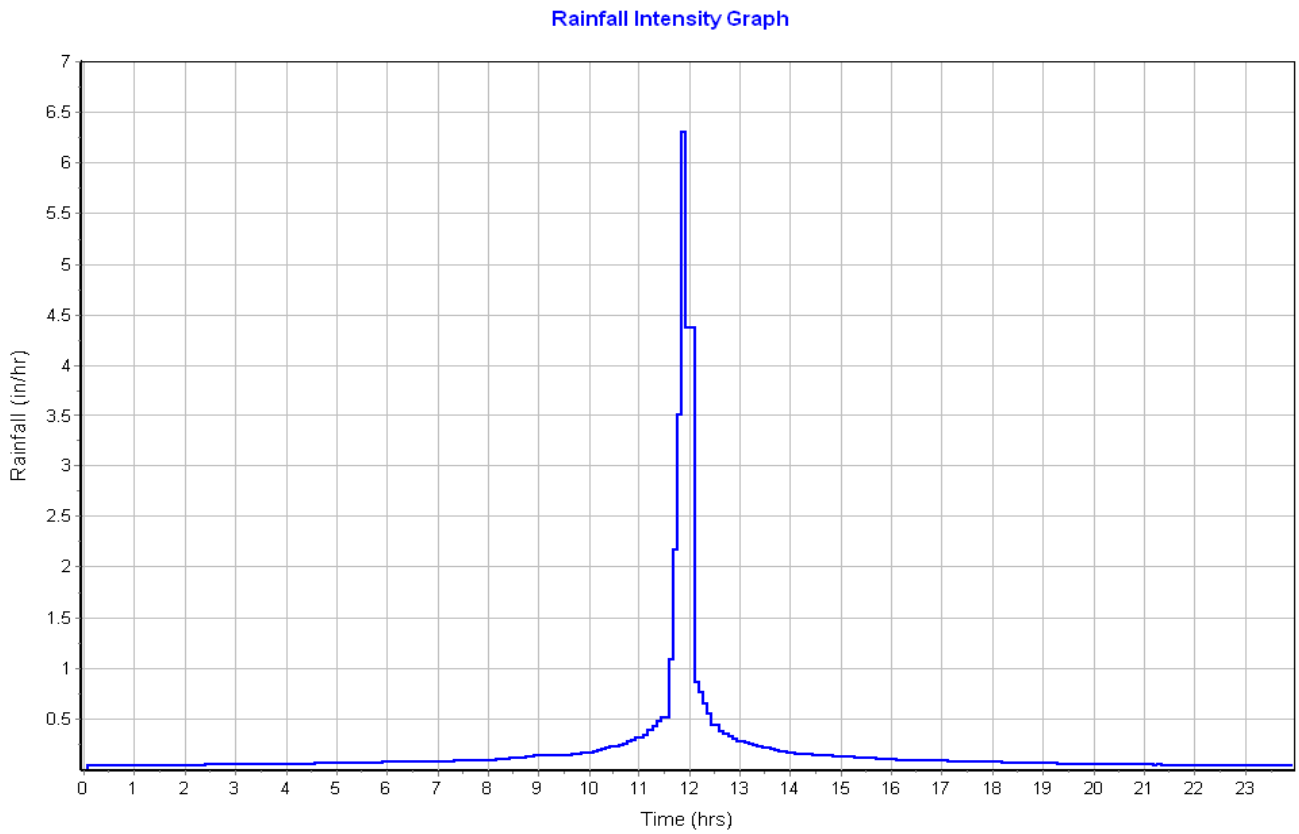
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	134	0.00	0.00
Channel Slope (%) :	5.1	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.80	0.00	0.00
Computed Flow Time (min) :	0.21	0.00	0.00

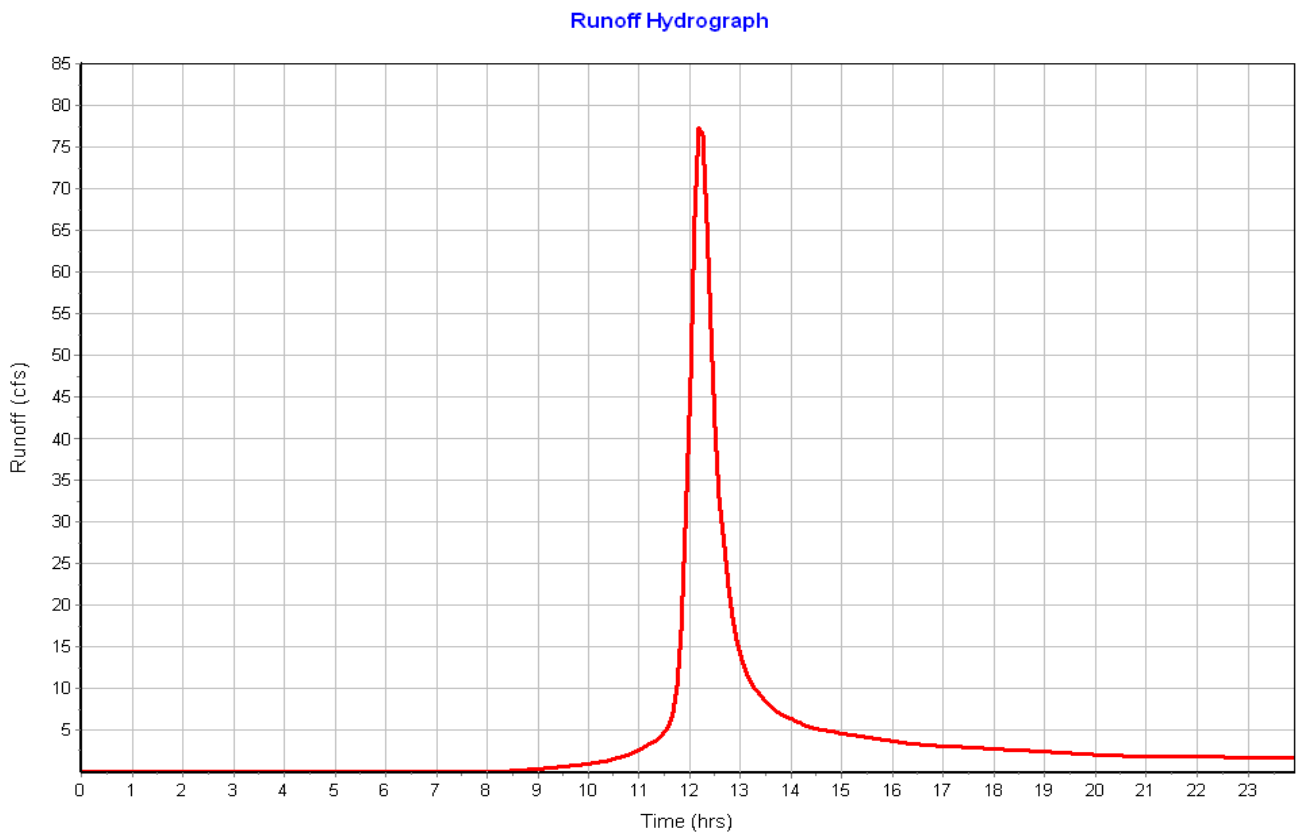
Total TOC (min) 31.81

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 2.46
Peak Runoff (cfs) 78.32
Weighted Curve Number 79.00
Time of Concentration (days hh:mm:ss) 0 00:31:49

Subbasin : I


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : J

Input Data

Area (ac) 10.10
Weighted Curve Number 69.50
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	5.05	B	60.00
Woods, Fair	5.05	D	79.00
Composite Area & Weighted CN	10.10		69.50

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	8.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	2.08	0.00	0.00
Computed Flow Time (min) :	1.60	0.00	0.00

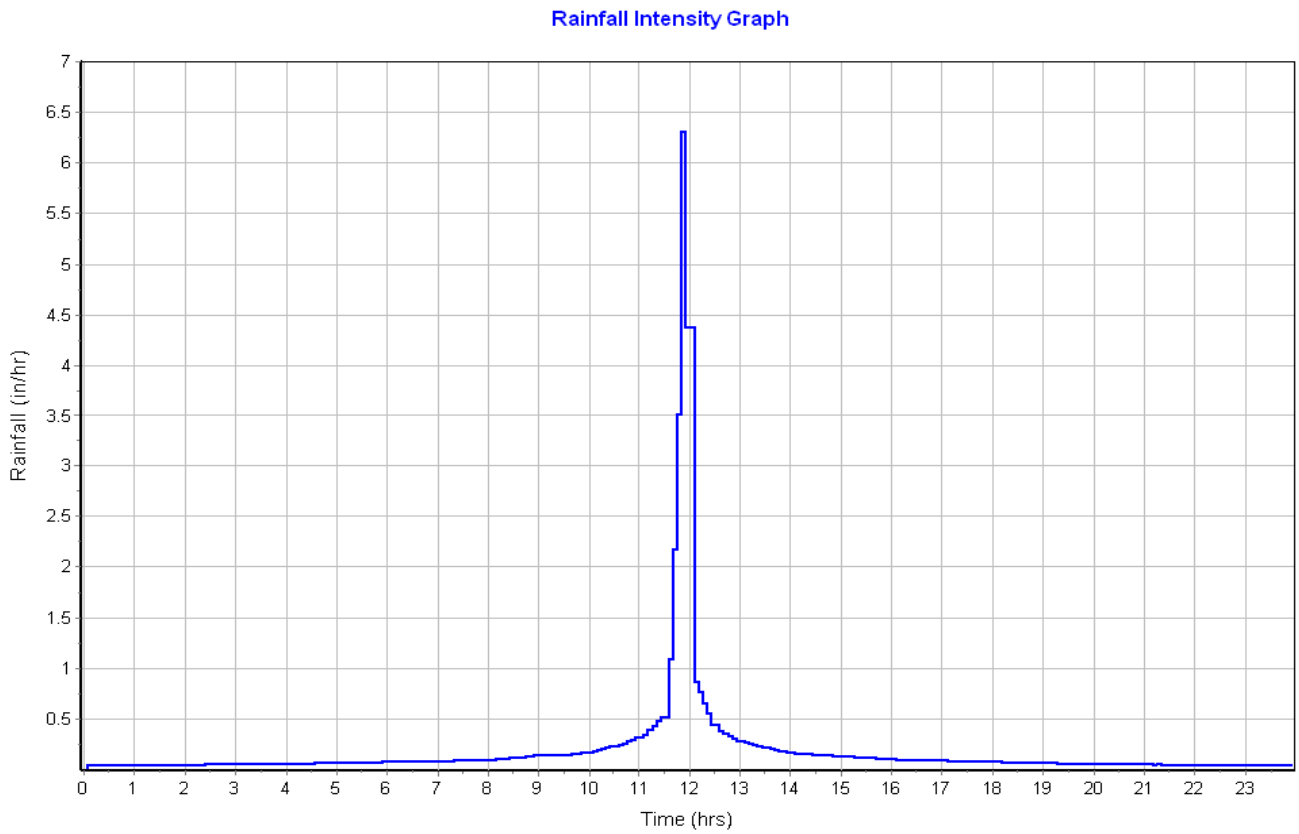
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	228	0.00	0.00
Channel Slope (%) :	8.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	14.19	0.00	0.00
Computed Flow Time (min) :	0.27	0.00	0.00

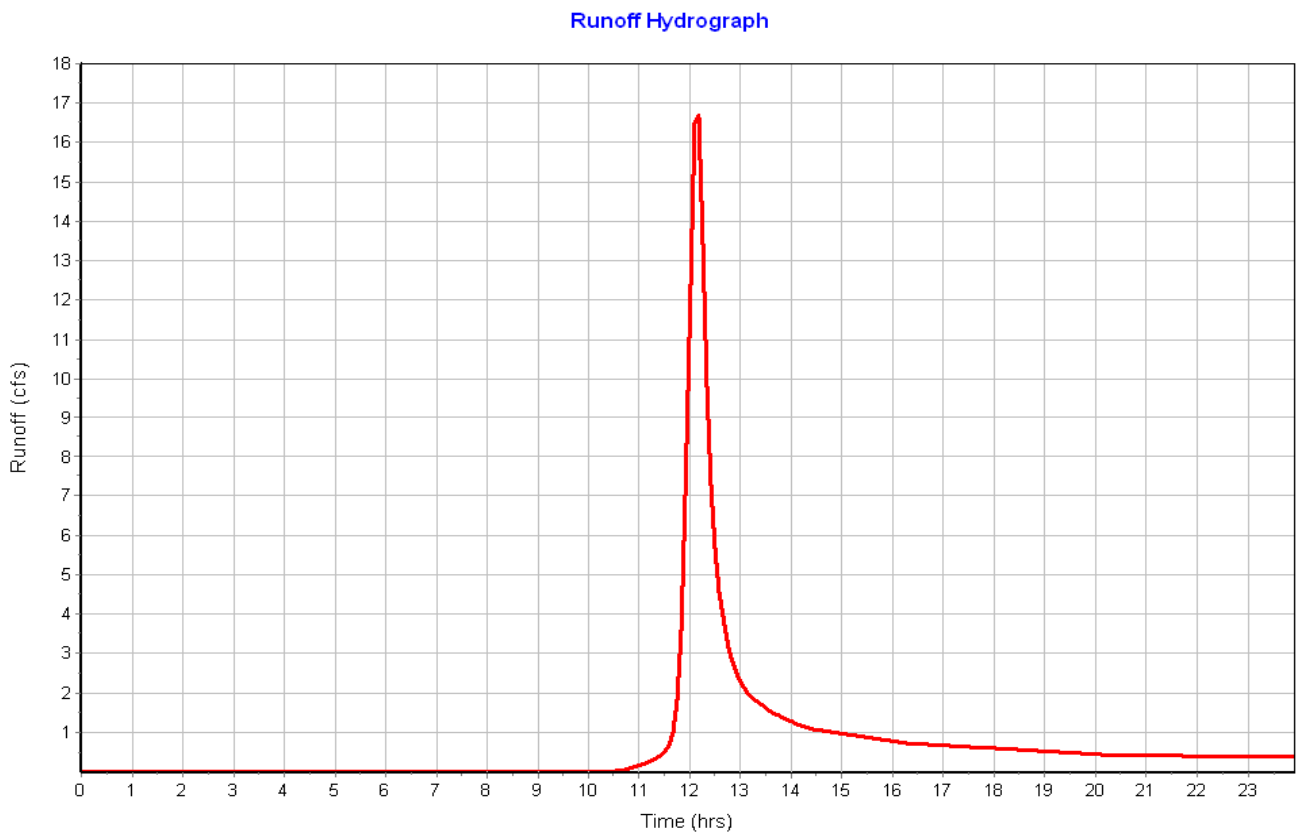
Total TOC (min) 22.93

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.71
Peak Runoff (cfs) 17.21
Weighted Curve Number 69.50
Time of Concentration (days hh:mm:ss) 0 00:22:56

Subbasin : J


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : K

Input Data

Area (ac) 17.80
Weighted Curve Number 76.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	17.80	C	76.00
Composite Area & Weighted CN	17.80		76.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	3.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.38	0.00	0.00
Computed Flow Time (min) :	2.42	0.00	0.00

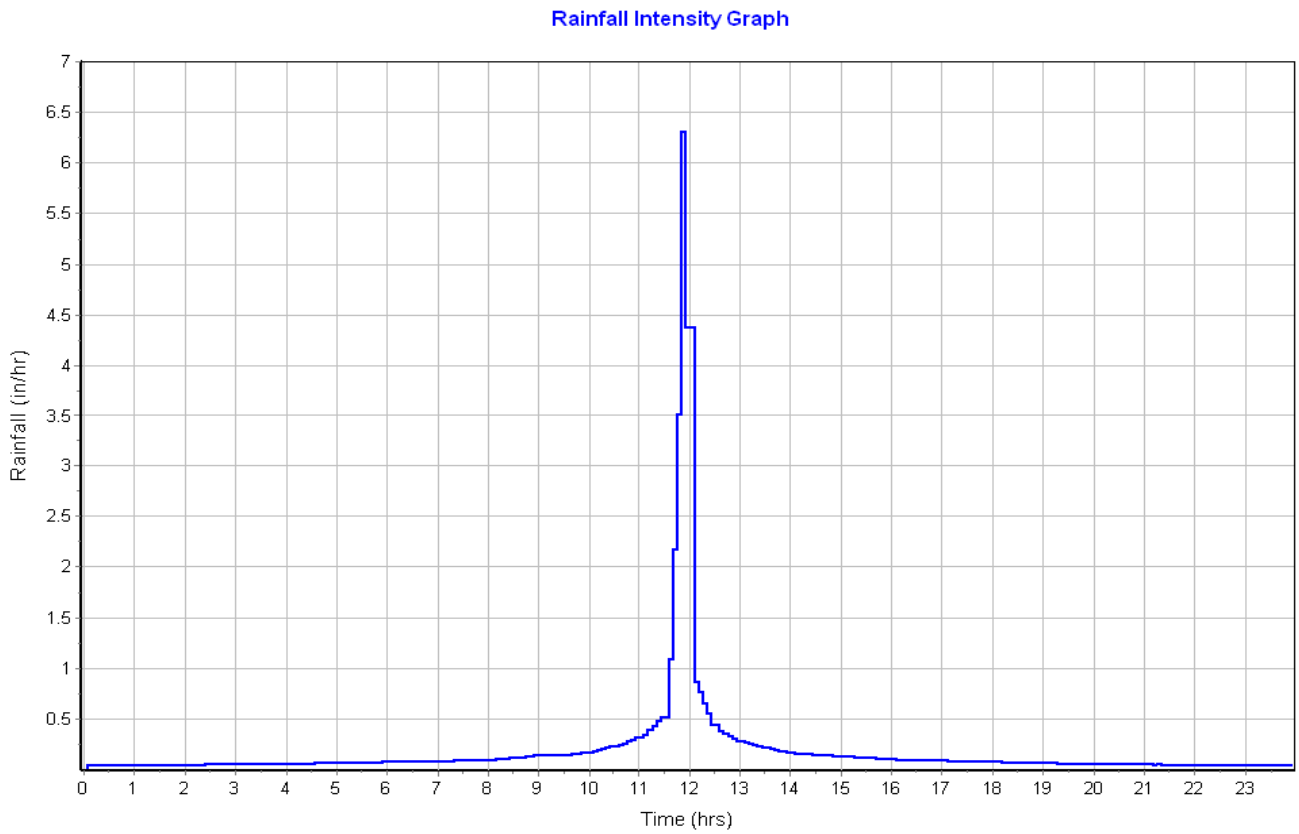
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	354	0.00	0.00
Channel Slope (%) :	3.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.45	0.00	0.00
Computed Flow Time (min) :	0.62	0.00	0.00

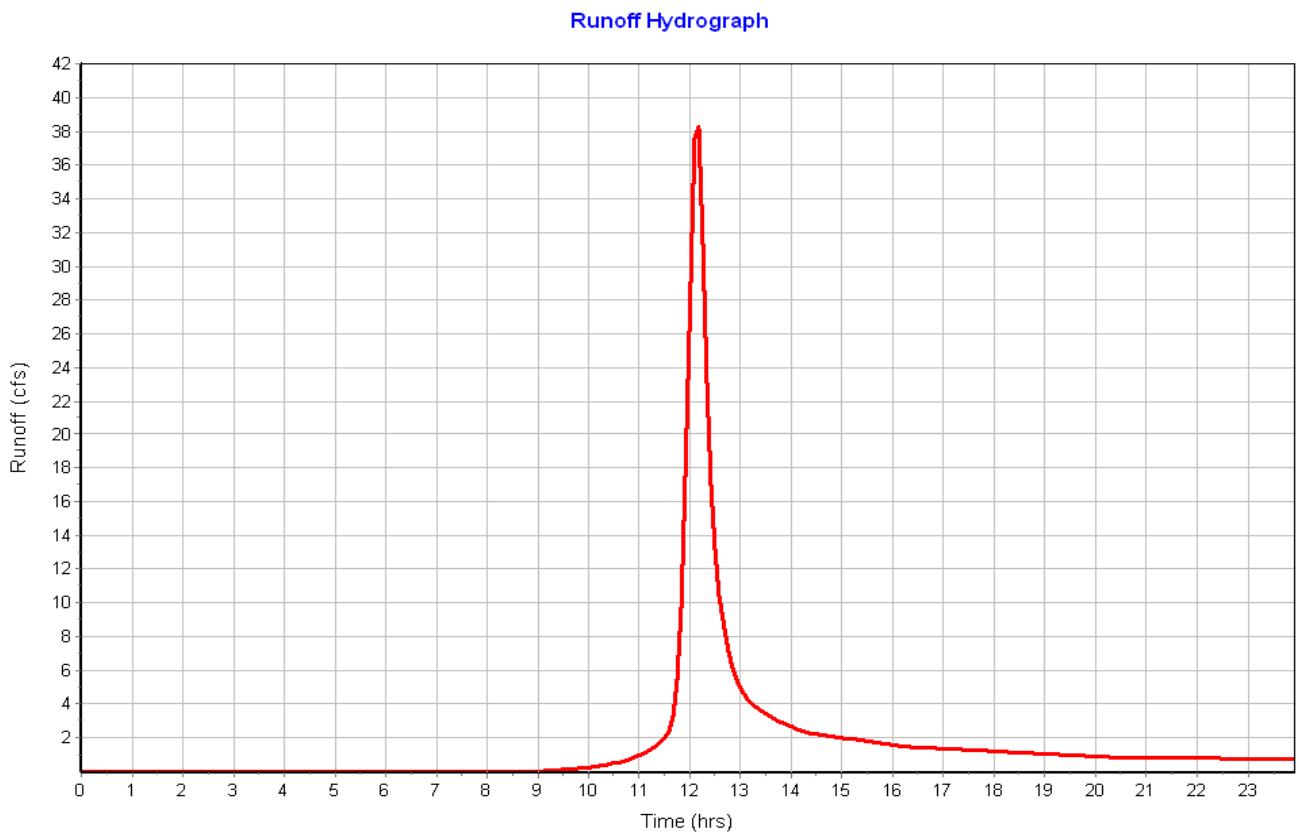
Total TOC (min) 24.10

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 2.21
Peak Runoff (cfs) 39.26
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:06

Subbasin : K


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Project Description

File Name ..... Filing 1 - 2019.11.19.SPF

Project Options

Flow Units ..... CFS
Elevation Type ..... Depth
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Sep 14, 2018 00:00:00
End Analysis On ..... Sep 15, 2018 00:00:00
Start Reporting On ..... Sep 14, 2018 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	22
Nodes	66
Junctions	55
Outfalls	1
Flow Diversions	4
Inlets	0
Storage Nodes	6
Links	67
Channels	39
Pipes	22
Pumps	0
Orifices	6
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-1	Time Series	TS-01	Cumulative	inches	Colorado	El Paso	100	4.60	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A	915.40	60.36	4.60	1.10	1003.28	506.27	0 00:53:00
2	B1	3836.70	60.34	4.60	1.10	4201.19	1443.11	0 01:29:33
3	B2	13.10	64.00	4.60	1.33	17.38	15.92	0 00:24:27
4	B3	54.90	65.10	4.60	1.40	76.86	52.19	0 00:39:21
5	B4	41.48	68.50	4.60	1.64	67.86	47.71	0 00:39:30
6	C1	162.70	60.00	4.60	1.07	174.74	113.04	0 00:37:12
7	C2	22.40	64.00	4.60	1.33	29.72	22.55	0 00:32:36
8	C3	16.10	64.00	4.60	1.33	21.36	17.80	0 00:28:22
9	C4	23.80	65.00	4.60	1.39	33.15	21.79	0 00:41:07
10	D1.1	161.30	60.00	4.60	1.07	173.24	112.52	0 00:36:59
11	D1.2	49.90	60.00	4.60	1.07	53.59	30.63	0 00:44:12
12	D2	68.70	64.75	4.60	1.38	94.60	69.43	0 00:34:49
13	D3.4.6	167.00	66.35	4.60	1.49	248.00	170.47	0 00:39:22
14	D5	12.80	67.20	4.60	1.54	19.76	16.27	0 00:30:31
15	Ea	37.90	60.00	4.60	1.07	40.70	30.18	0 00:30:30
16	Eb	74.60	66.23	4.60	1.48	110.18	77.30	0 00:38:15
17	F	44.50	69.00	4.60	1.67	74.40	54.18	0 00:37:43
18	G	107.60	74.50	4.60	2.09	224.78	181.44	0 00:33:55
19	H	121.80	71.76	4.60	1.88	228.50	182.91	0 00:33:39
20	I	37.50	79.00	4.60	2.46	92.29	78.32	0 00:31:48
21	J	10.10	69.50	4.60	1.71	17.25	17.21	0 00:22:55
22	K	17.80	76.00	4.60	2.21	39.34	39.26	0 00:24:06

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 915.40
Weighted Curve Number 60.36
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	839.92	B	60.00
Pasture, grassland, or range, Fair	8.66	D	84.00
5 Acre Lots, 7% Impervious	8.66	C	72.00
Composite Area & Weighted CN	857.24		60.36

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	10.62	0.00	0.00

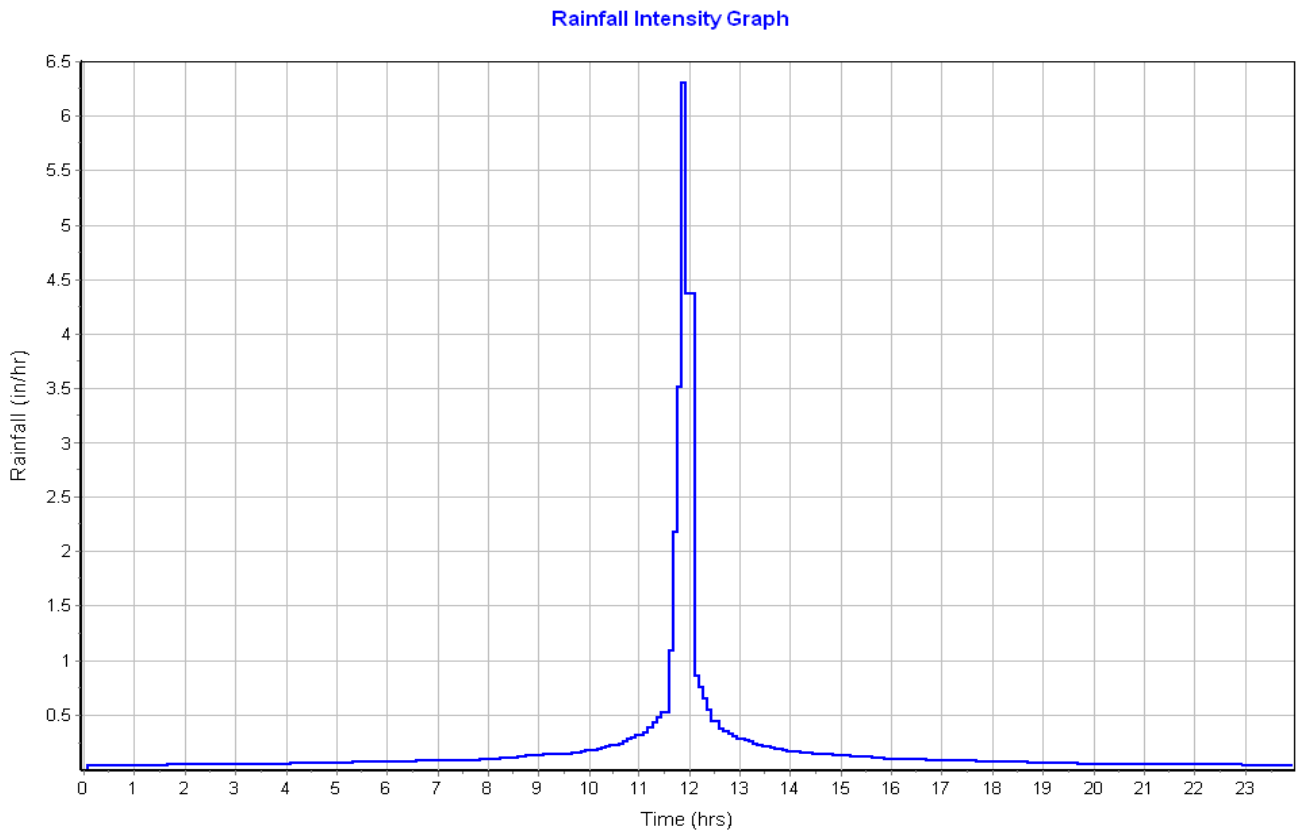
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	10494	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft²) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	8.20	0.00	0.00
Computed Flow Time (min) :	21.34	0.00	0.00

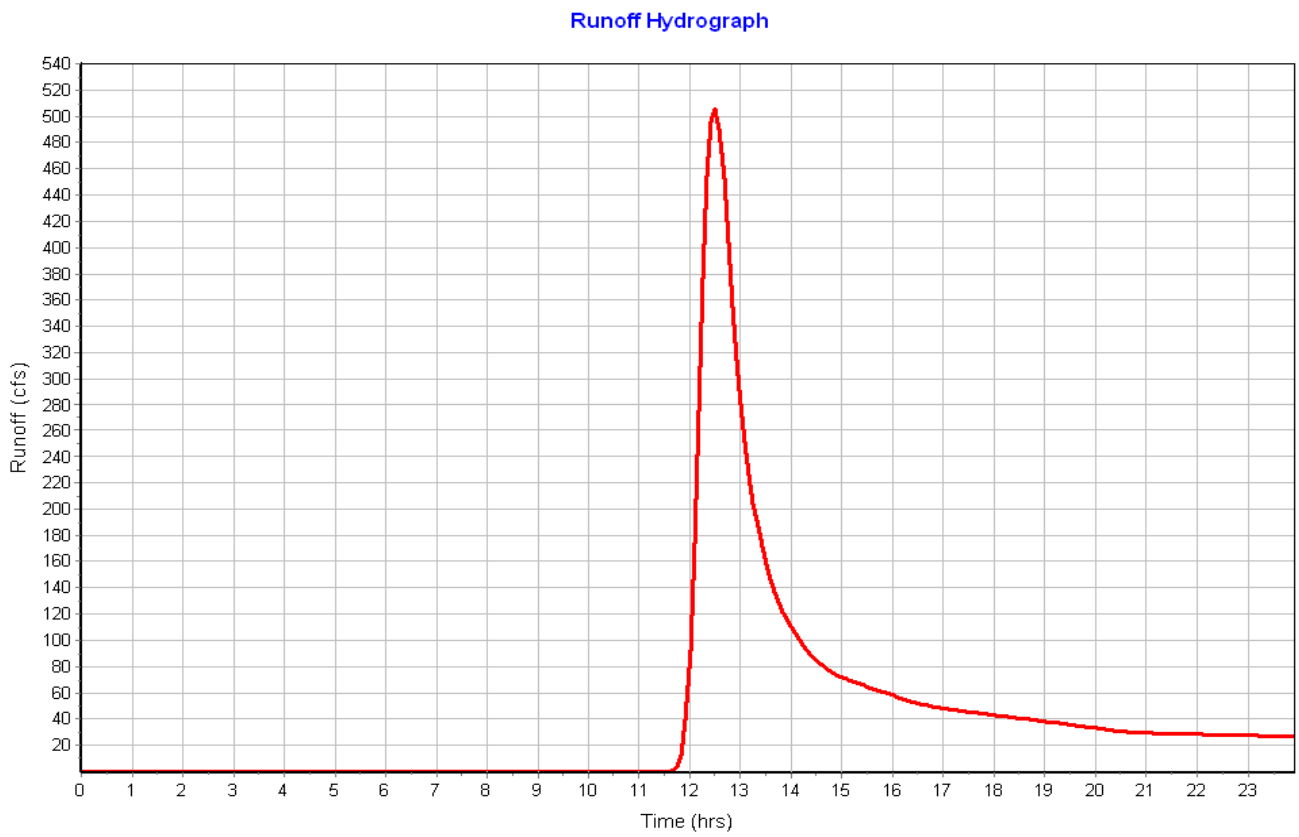
Total TOC (min) 53.01

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.10
Peak Runoff (cfs) 506.27
Weighted Curve Number 60.36
Time of Concentration (days hh:mm:ss) 0 00:53:01

Subbasin : A


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B1

Input Data

Area (ac) 3836.70
Weighted Curve Number 60.34
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	3759.97	B	60.00
5 Acre Lots, 7% Impervious	76.73	D	77.00
Composite Area & Weighted CN	3836.70		60.34

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.40	0.00	0.00
Computed Flow Time (min) :	11.90	0.00	0.00

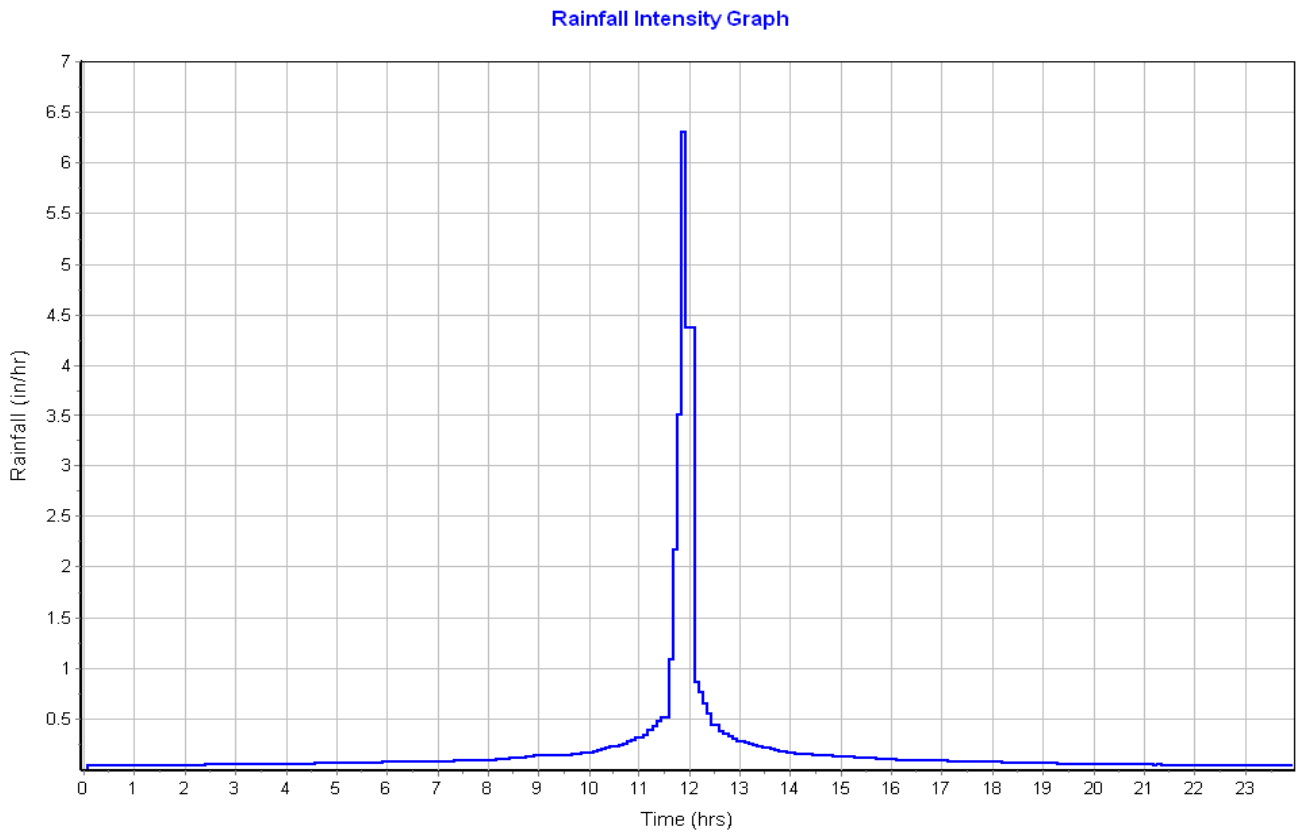
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	23284	0.00	0.00
Channel Slope (%) :	1.4	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	6.86	0.00	0.00
Computed Flow Time (min) :	56.59	0.00	0.00

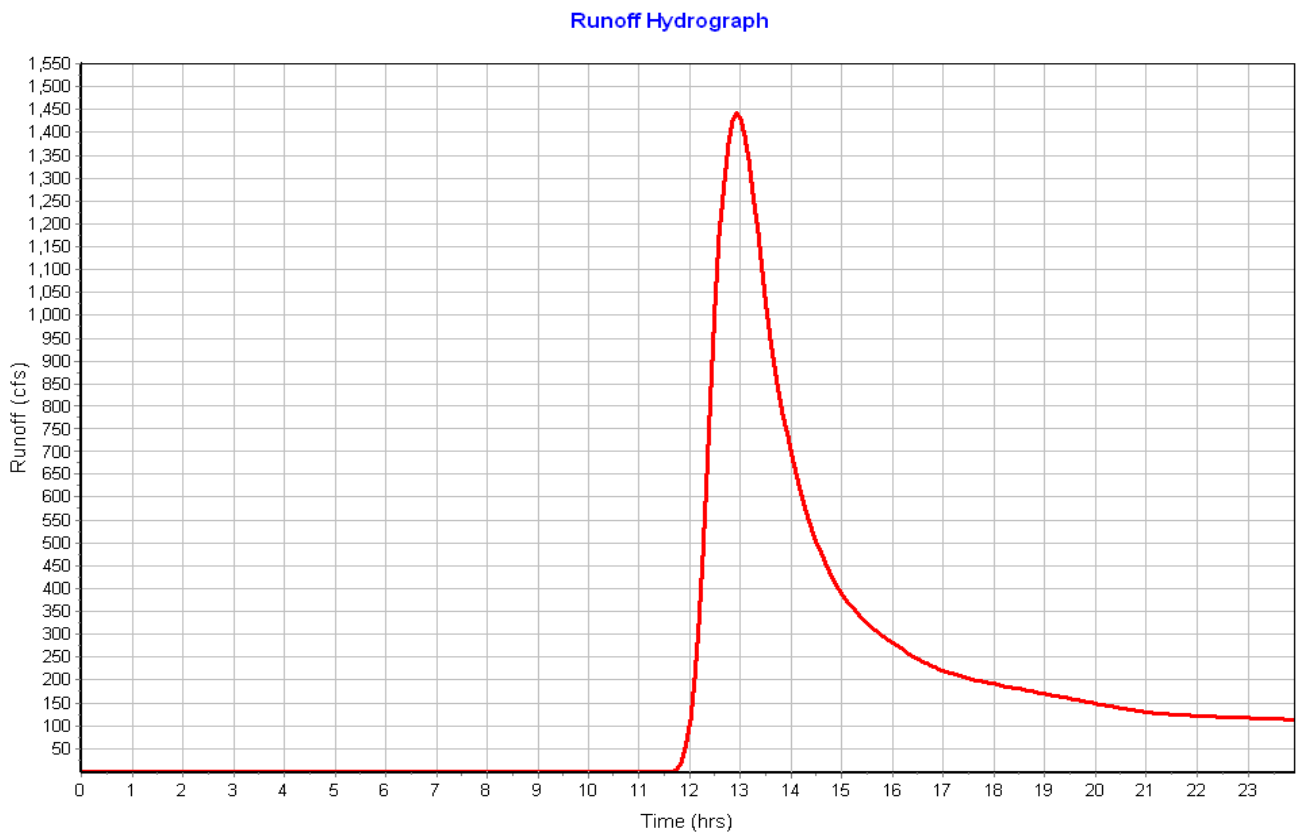
Total TOC (min) 89.56

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.10
Peak Runoff (cfs) 1443.11
Weighted Curve Number 60.34
Time of Concentration (days hh:mm:ss) 0 01:29:34

Subbasin : B1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B2

Input Data

Area (ac) 13.10
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	13.10	B	64.00
Composite Area & Weighted CN	13.10		64.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	5.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.60	0.00	0.00
Computed Flow Time (min) :	3.13	0.00	0.00

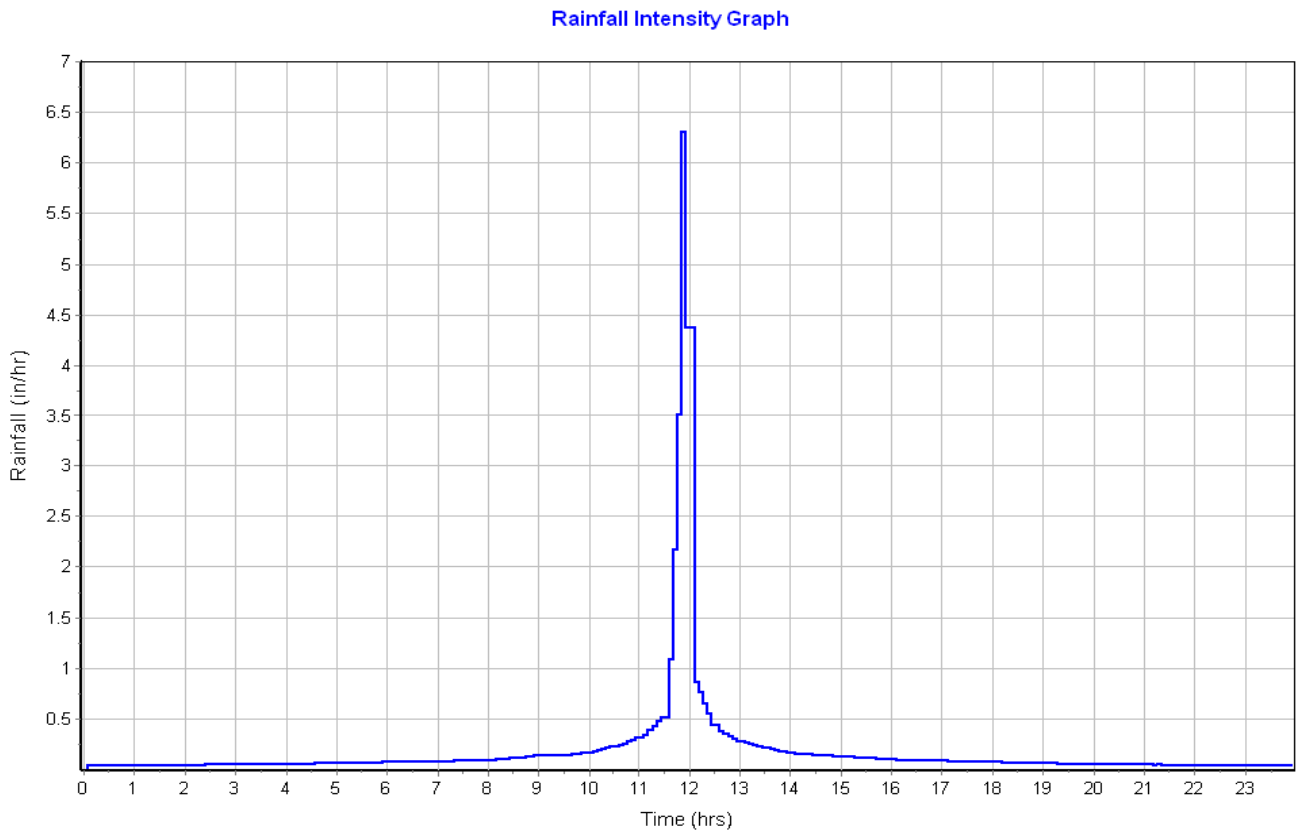
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	177	0.00	0.00
Channel Slope (%) :	5.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.91	0.00	0.00
Computed Flow Time (min) :	0.27	0.00	0.00

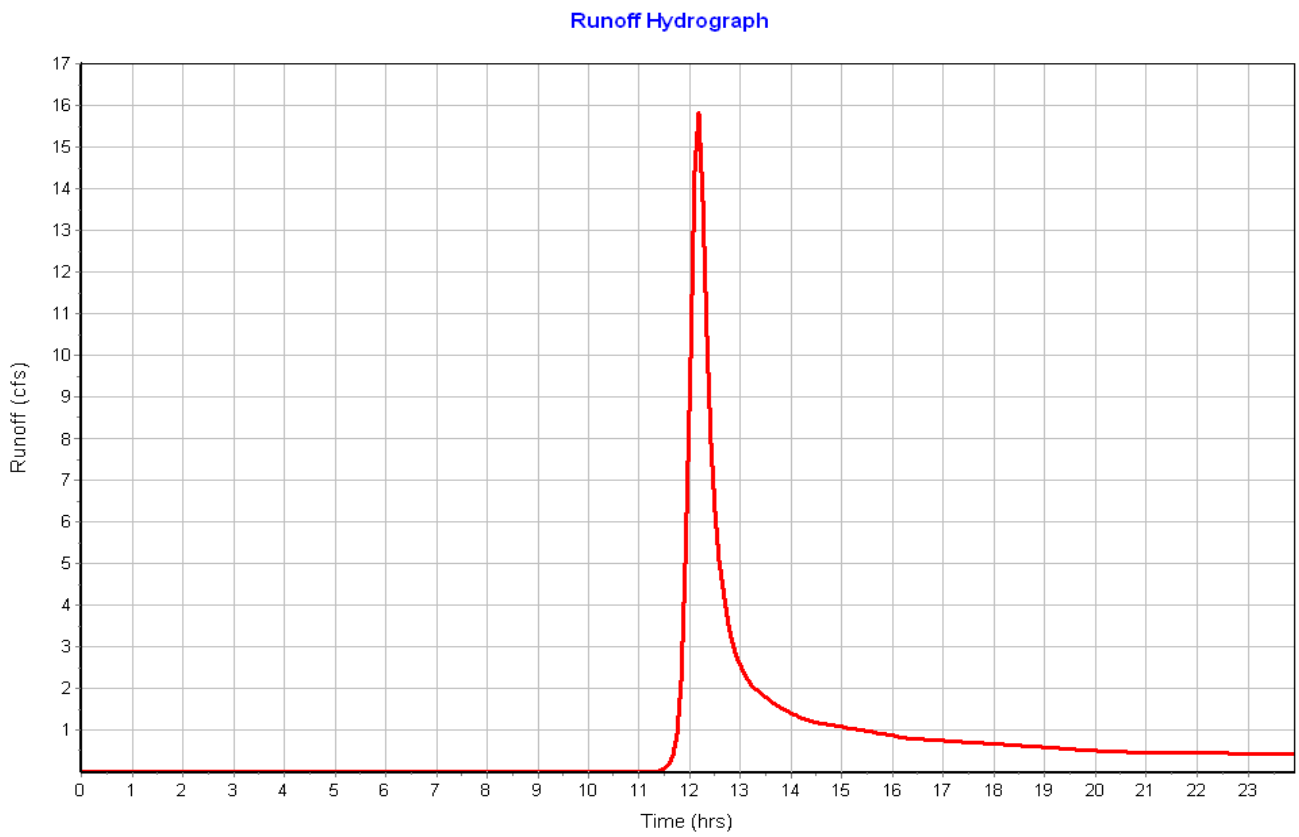
Total TOC (min) 24.45

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.33
Peak Runoff (cfs) 15.92
Weighted Curve Number 64.00
Time of Concentration (days hh:mm:ss) 0 00:24:27

Subbasin : B2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B3

Input Data

Area (ac) 54.90
Weighted Curve Number 65.10
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	38.43	B	60.00
5 Acre Lots, 7% Impervious	16.47	D	77.00
Composite Area & Weighted CN	54.90		65.10

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.27	0.00	0.00
Computed Flow Time (min) :	13.12	0.00	0.00

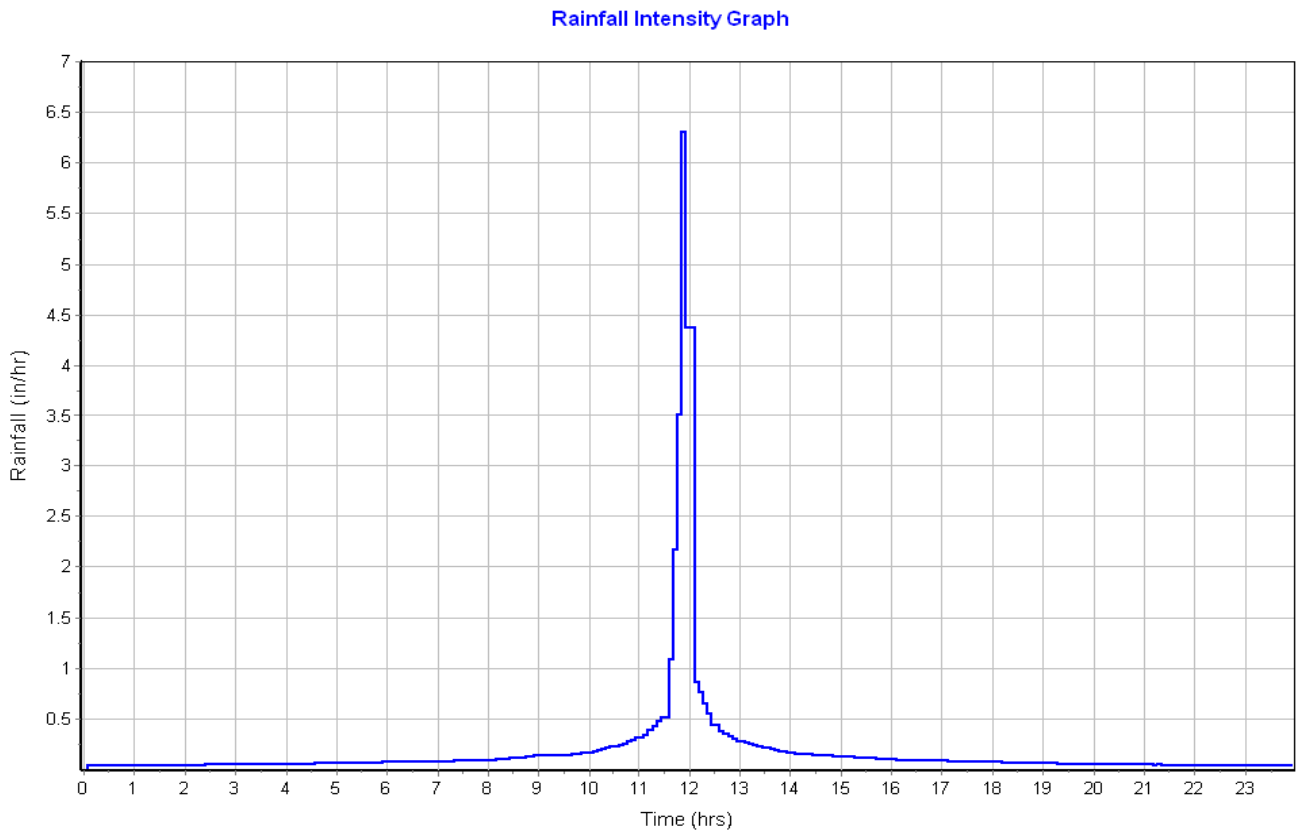
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	2693	0.00	0.00
Channel Slope (%) :	3.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.69	0.00	0.00
Computed Flow Time (min) :	5.17	0.00	0.00

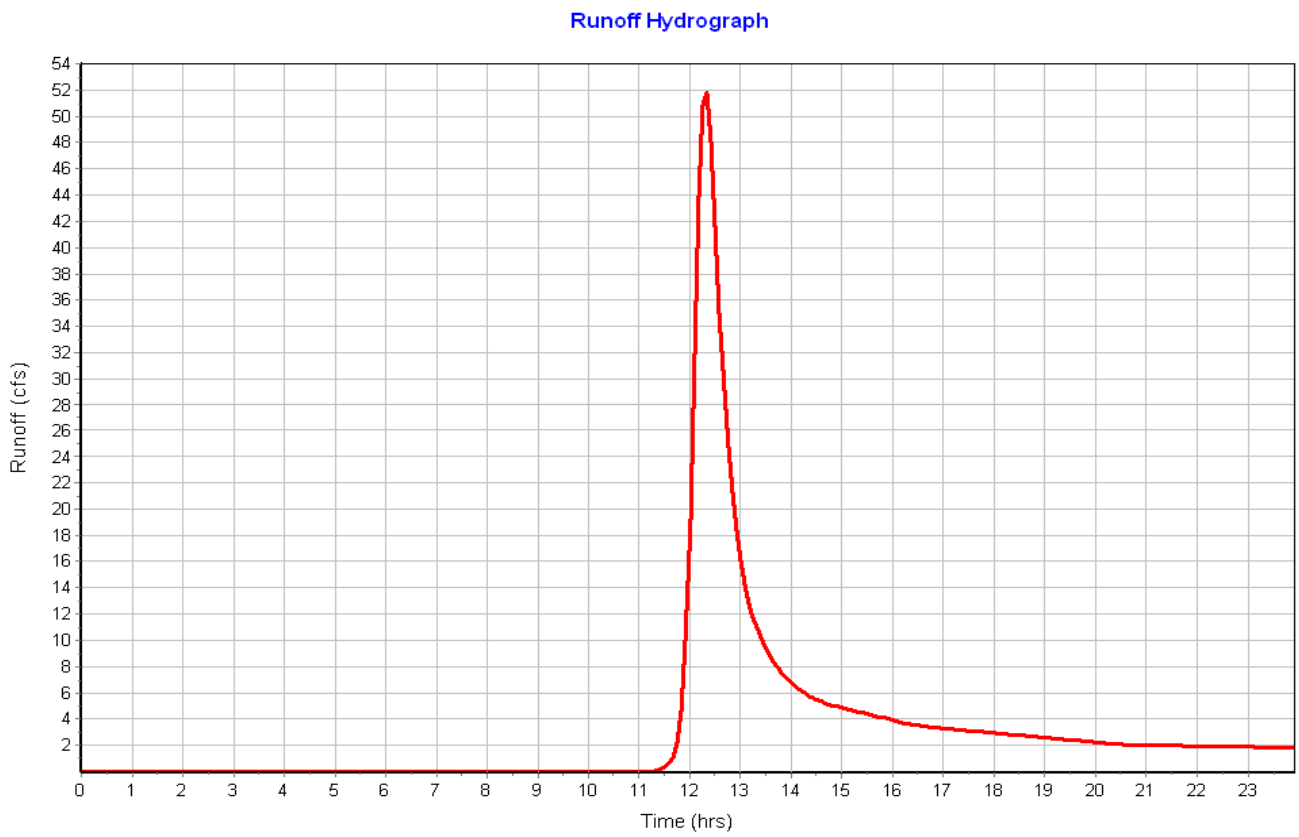
Total TOC (min) 39.35

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.40
Peak Runoff (cfs) 52.19
Weighted Curve Number 65.10
Time of Concentration (days hh:mm:ss) 0 00:39:21

Subbasin : B3


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : B4

Input Data

Area (ac) 41.48
Weighted Curve Number 68.50
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	22.81	B	64.00
Pasture, grassland, or range, Fair	12.44	B	69.00
Pasture, grassland, or range, Fair	6.22	D	84.00
Composite Area & Weighted CN	41.47		68.50

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	15.72	0.00	0.00

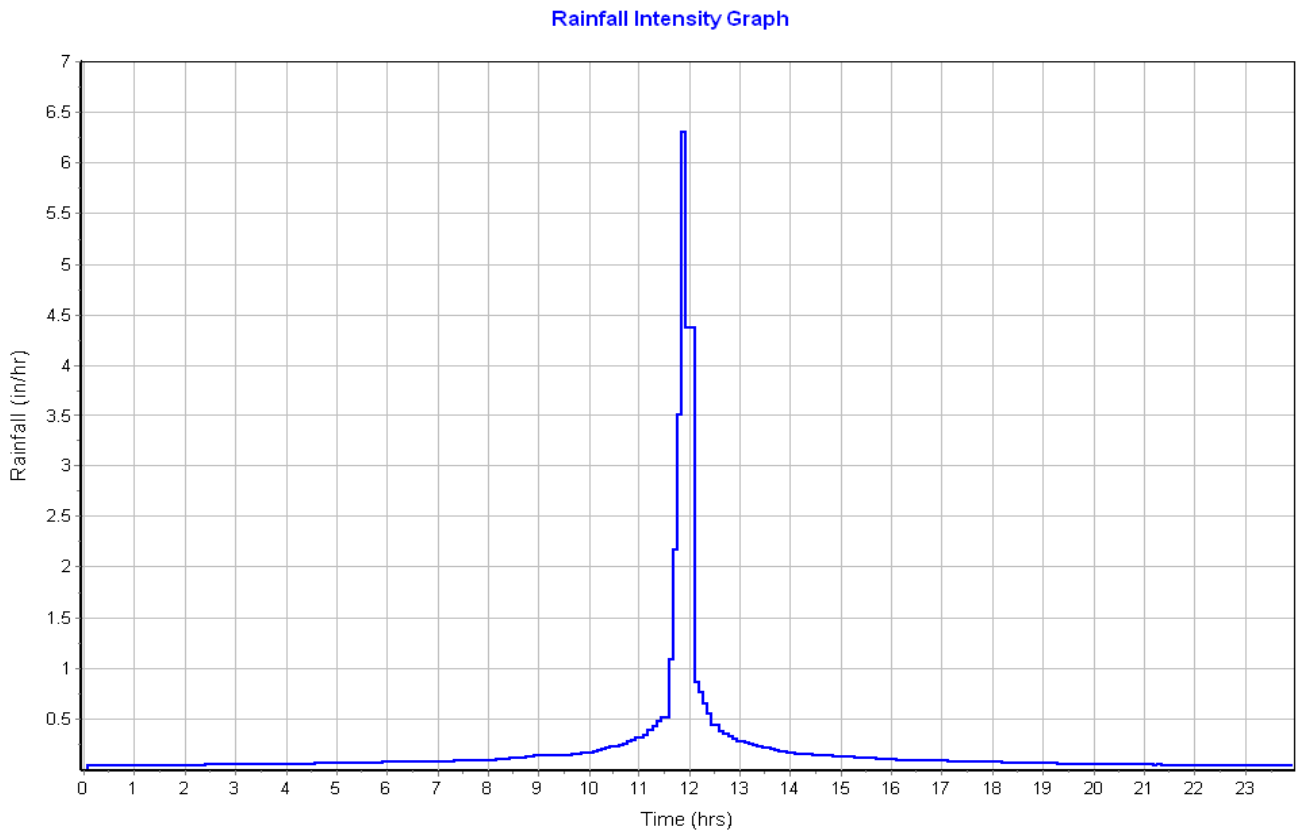
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1188	0.00	0.00
Channel Slope (%) :	2.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.25	0.00	0.00
Computed Flow Time (min) :	2.73	0.00	0.00

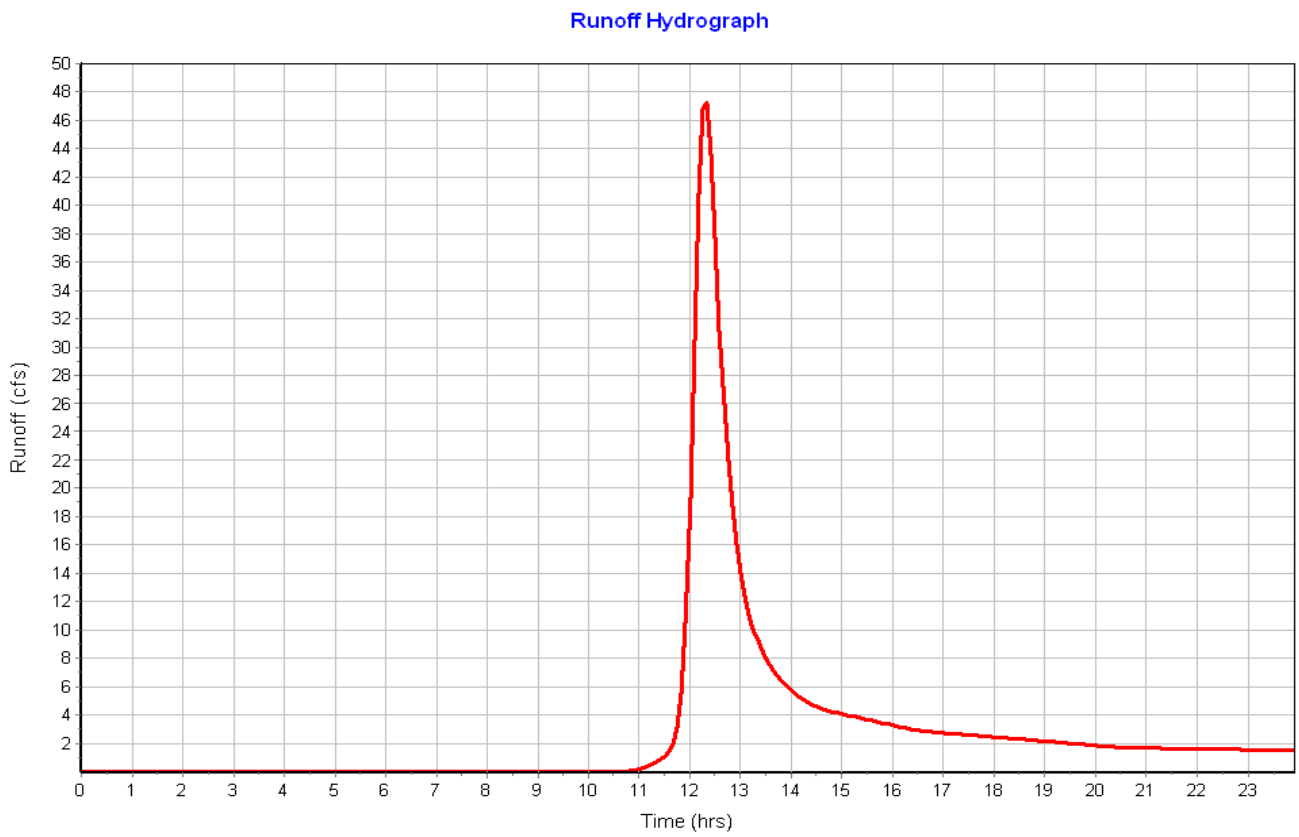
Total TOC (min) 39.51

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.64
Peak Runoff (cfs) 47.71
Weighted Curve Number 68.50
Time of Concentration (days hh:mm:ss) 0 00:39:31

Subbasin : B4


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C1

Input Data

Area (ac) 162.70
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	162.70	B	60.00
Composite Area & Weighted CN	162.70		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.42	0.00	0.00
Computed Flow Time (min) :	11.74	0.00	0.00

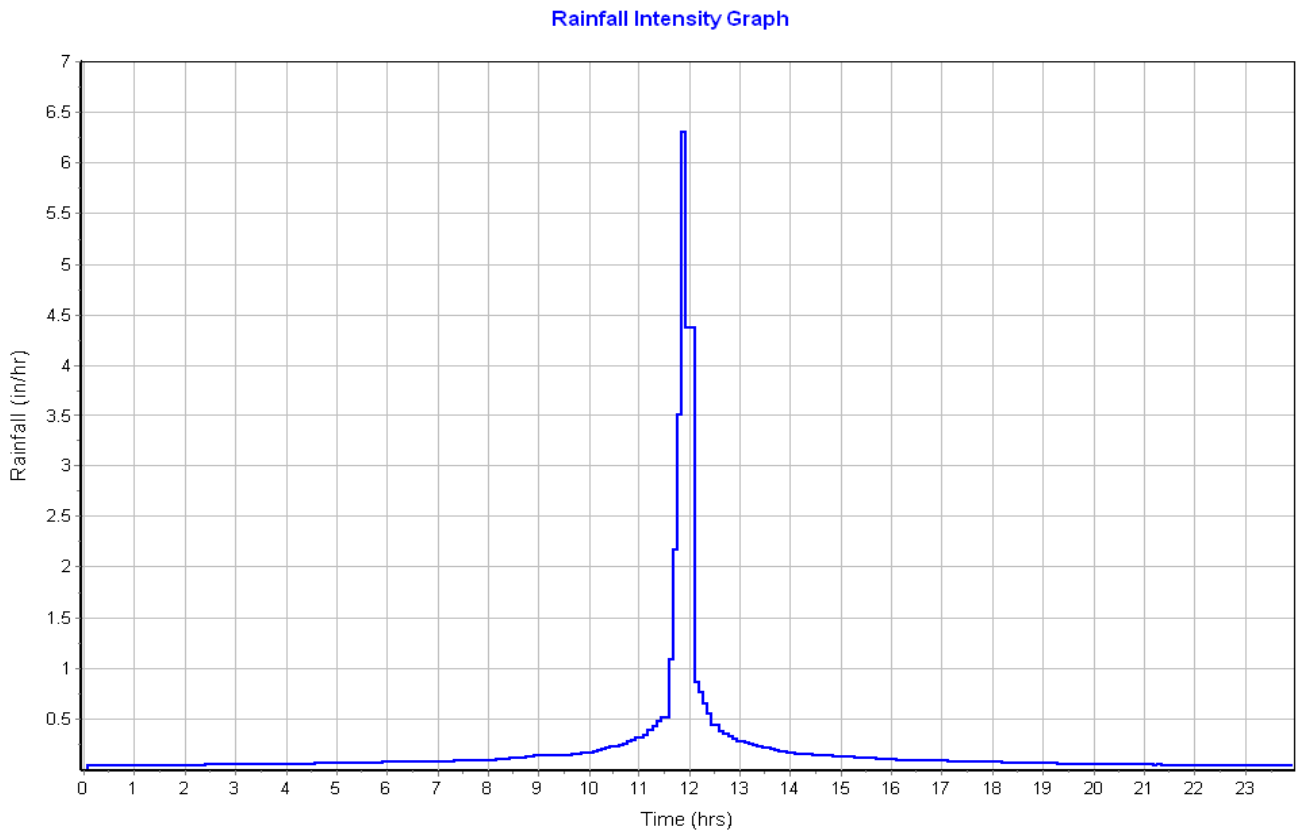
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	3099	0.00	0.00
Channel Slope (%) :	4.1	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	11.73	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

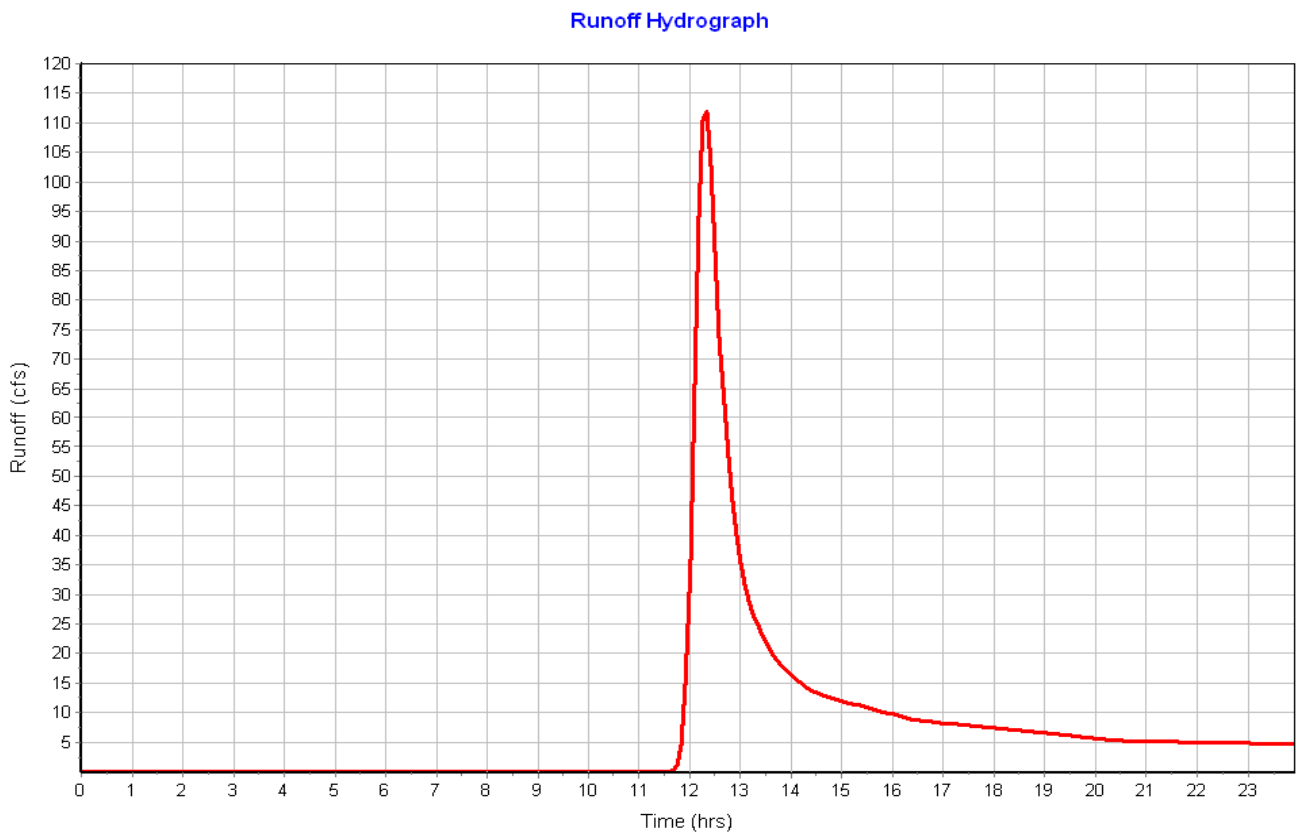
Total TOC (min) 37.20

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 113.04
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:37:12

Subbasin : C1


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C2

Input Data

Area (ac) 22.40
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	22.40	B	64.00
Composite Area & Weighted CN	22.40		64.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	5.31	0.00	0.00

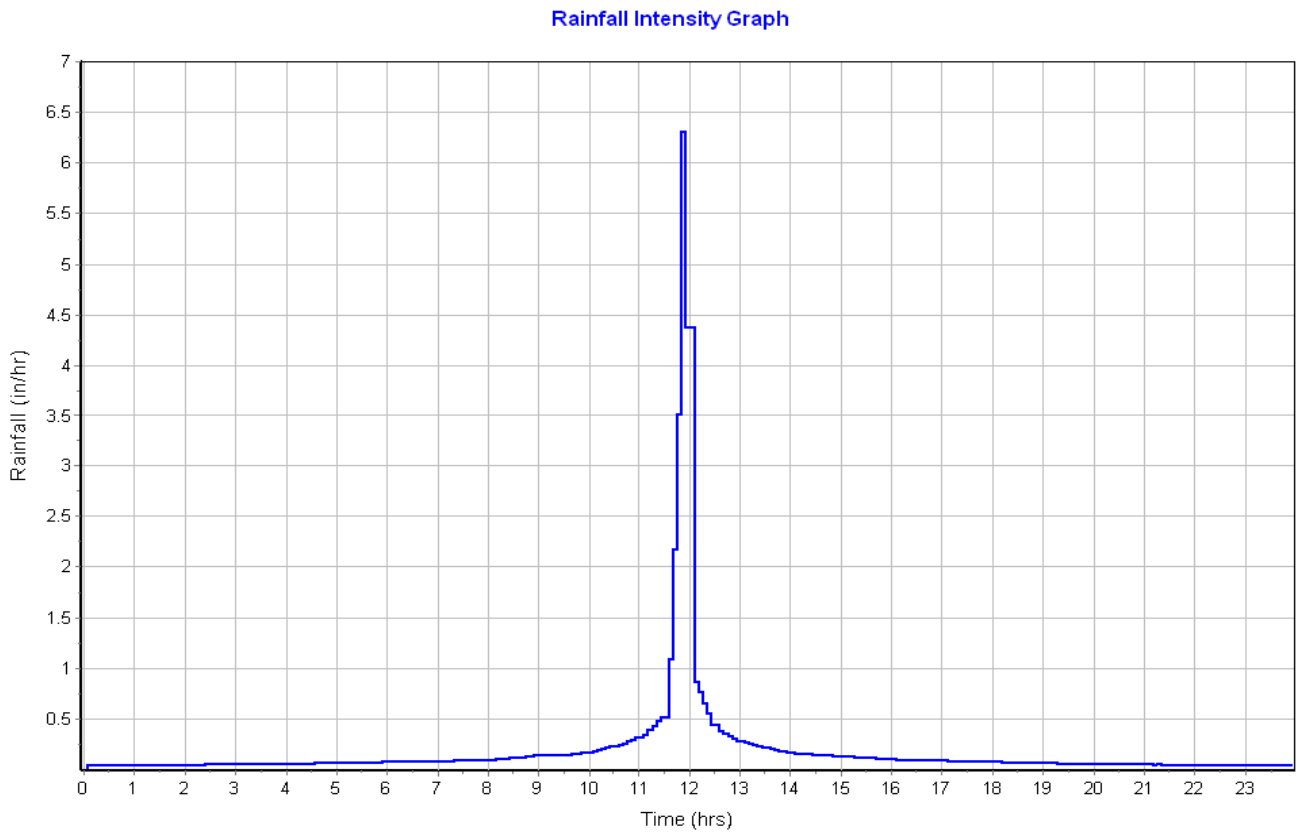
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	401	0.00	0.00
Channel Slope (%) :	.05	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	1.07	0.00	0.00
Computed Flow Time (min) :	6.25	0.00	0.00

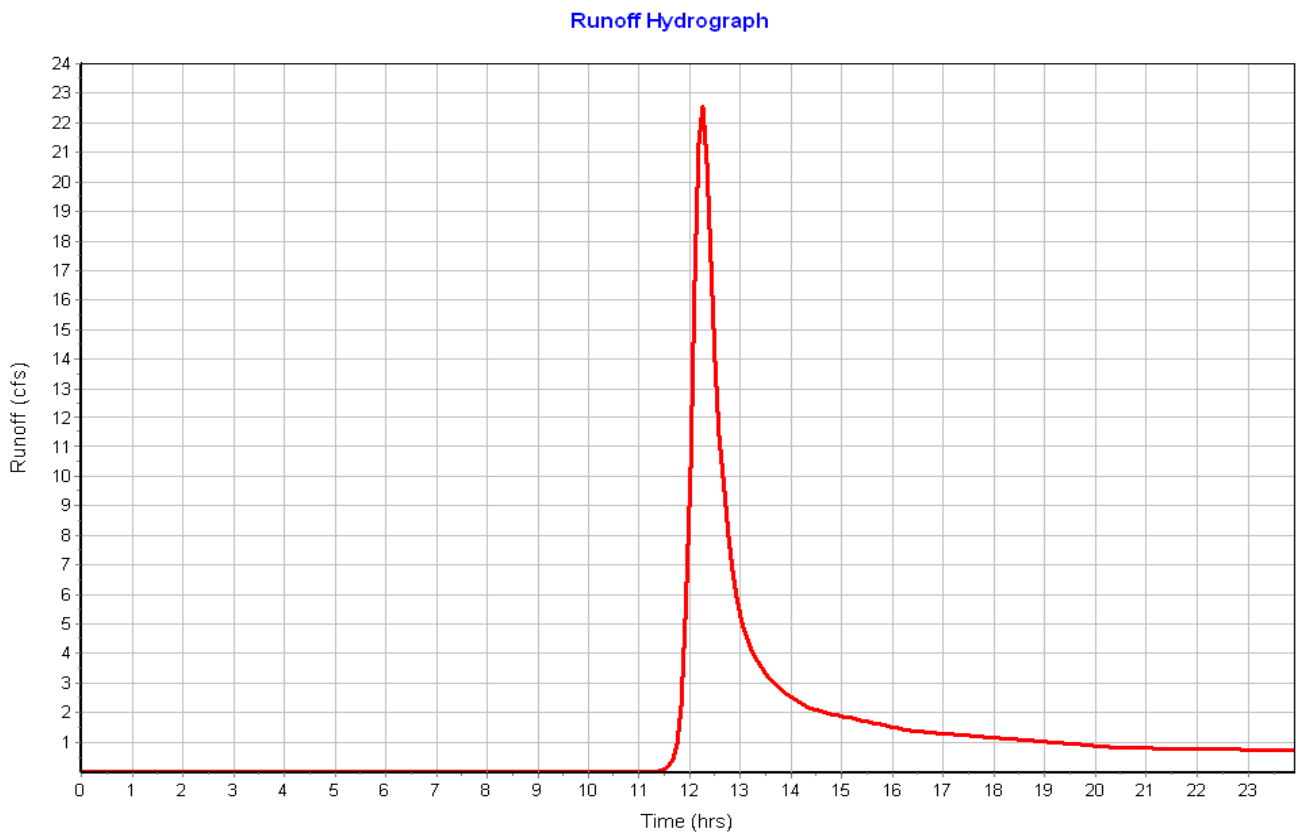
Total TOC (min) 32.61

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.33
Peak Runoff (cfs) 22.55
Weighted Curve Number 64.00
Time of Concentration (days hh:mm:ss) 0 00:32:37

Subbasin : C2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C3

Input Data

Area (ac) 16.10
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	16.10	B	64.00
Composite Area & Weighted CN	16.10		64.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	6.13	0.00	0.00

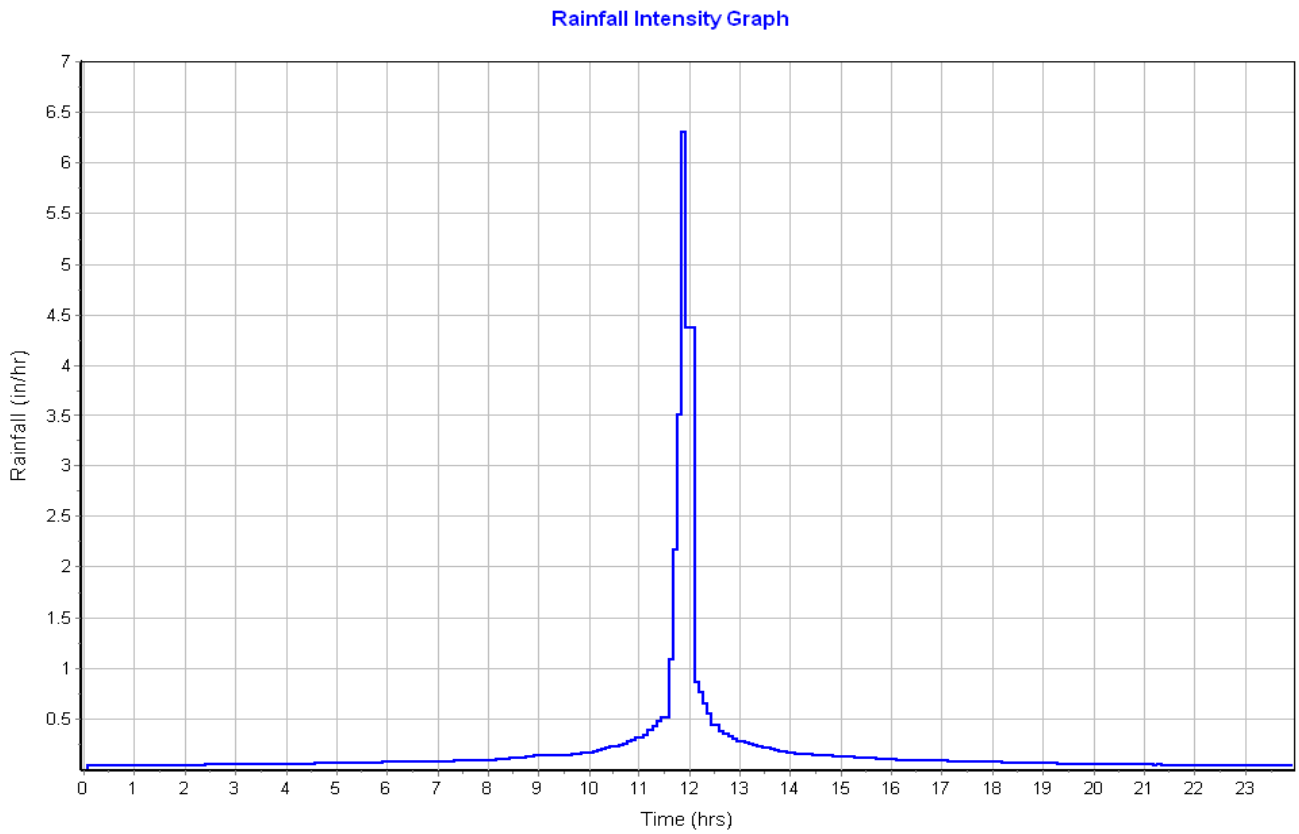
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	666	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	1.19	0.00	0.00

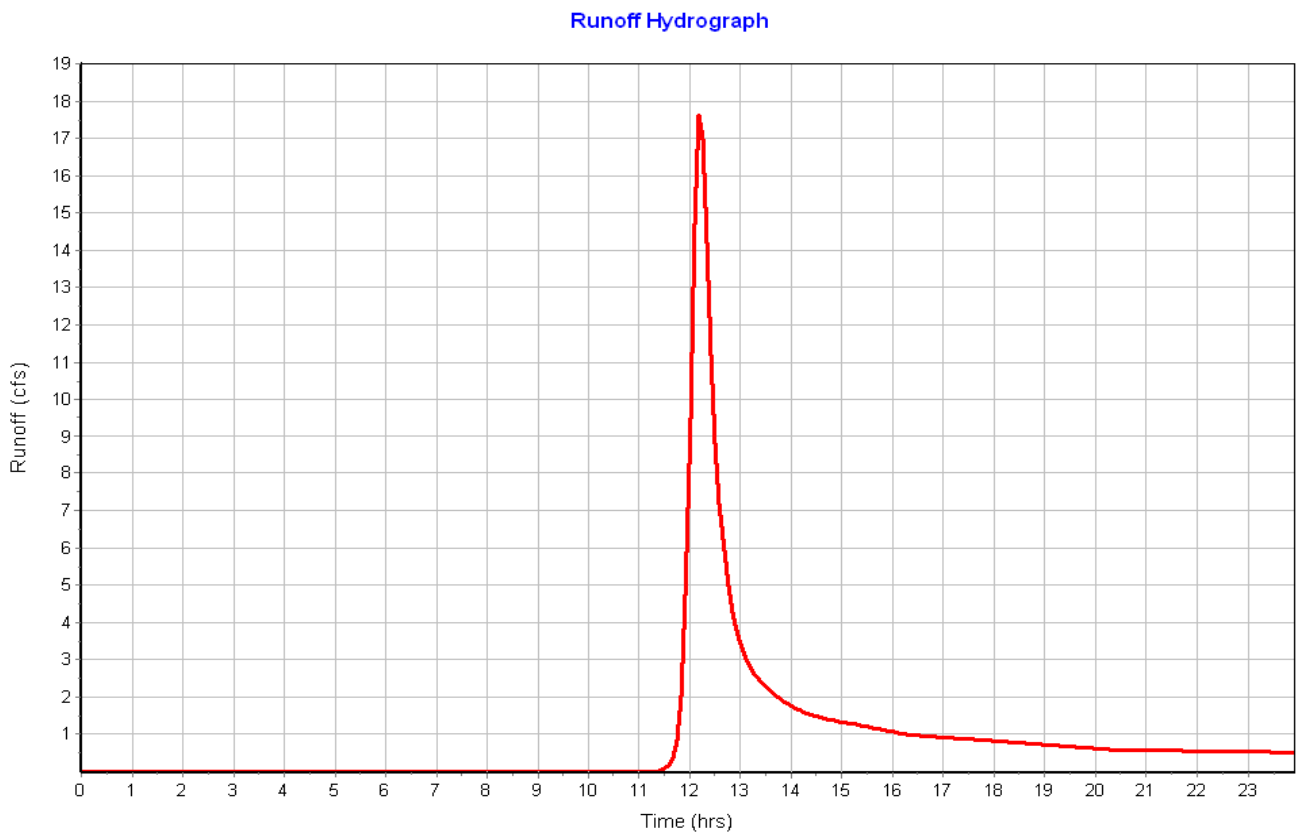
Total TOC (min) 28.38

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.33
Peak Runoff (cfs) 17.80
Weighted Curve Number 64.00
Time of Concentration (days hh:mm:ss) 0 00:28:23

Subbasin : C3


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : C4

Input Data

Area (ac) 23.80
Weighted Curve Number 65.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	11.90	B	60.00
Pasture, grassland, or range, Fair	1.19	C	79.00
Pasture, grassland, or range, Fair	10.71	B	69.00
Composite Area & Weighted CN	23.80		65.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	1.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.96	0.00	0.00
Computed Flow Time (min) :	17.36	0.00	0.00

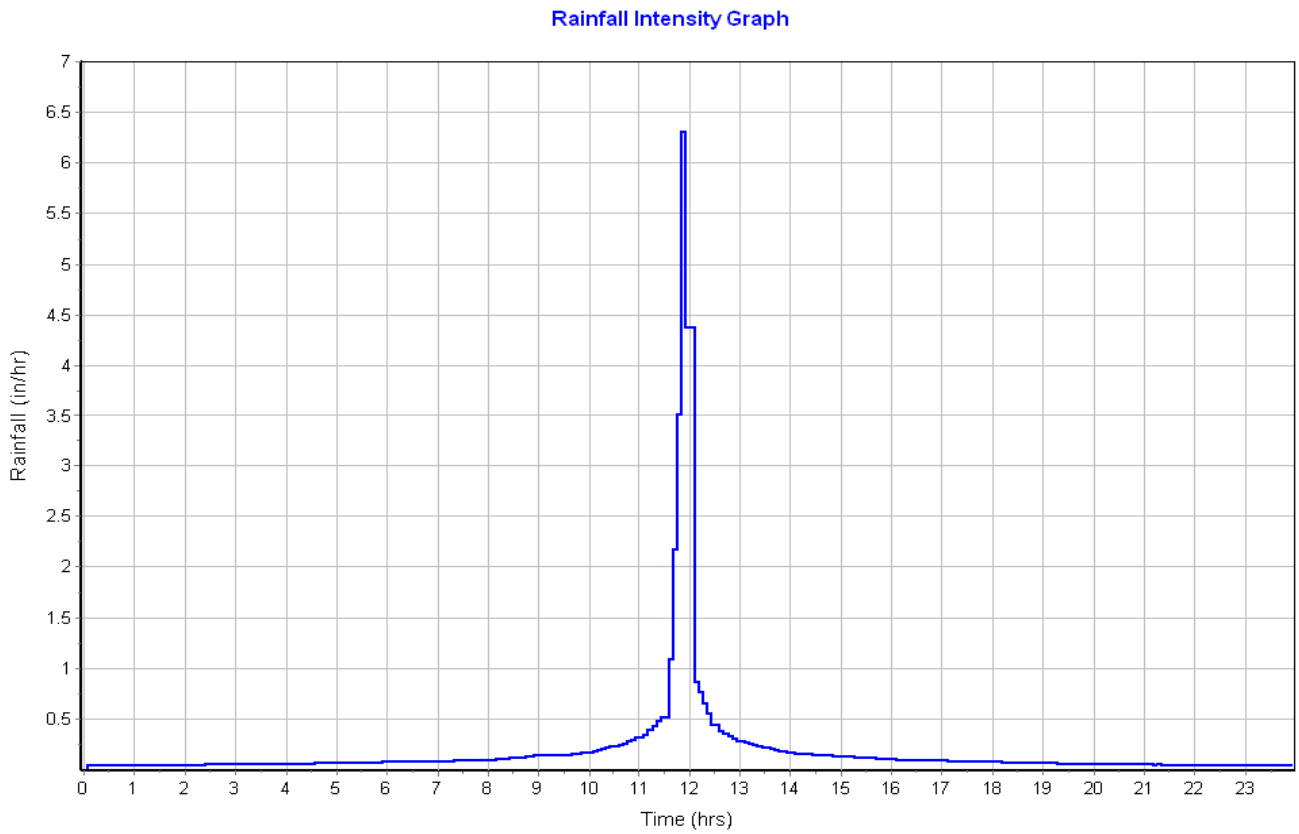
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1074	0.00	0.00
Channel Slope (%) :	1.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	2.71	0.00	0.00

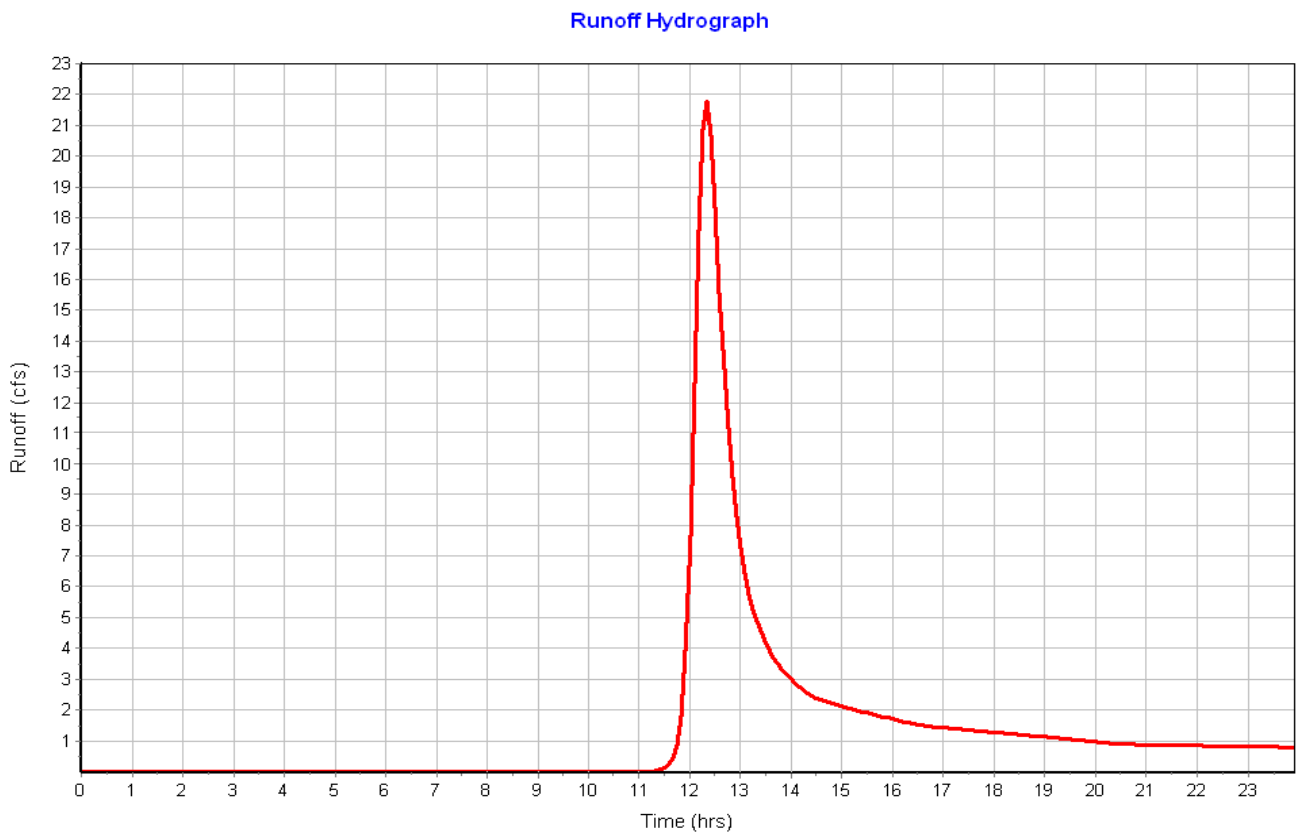
Total TOC (min) 41.13

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.39
Peak Runoff (cfs) 21.79
Weighted Curve Number 65.00
Time of Concentration (days hh:mm:ss) 0 00:41:08

Subbasin : C4


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D1.1

Input Data

Area (ac) 161.30
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	161.30	B	60.00
Composite Area & Weighted CN	161.30		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.19	0.00	0.00
Computed Flow Time (min) :	14.01	0.00	0.00

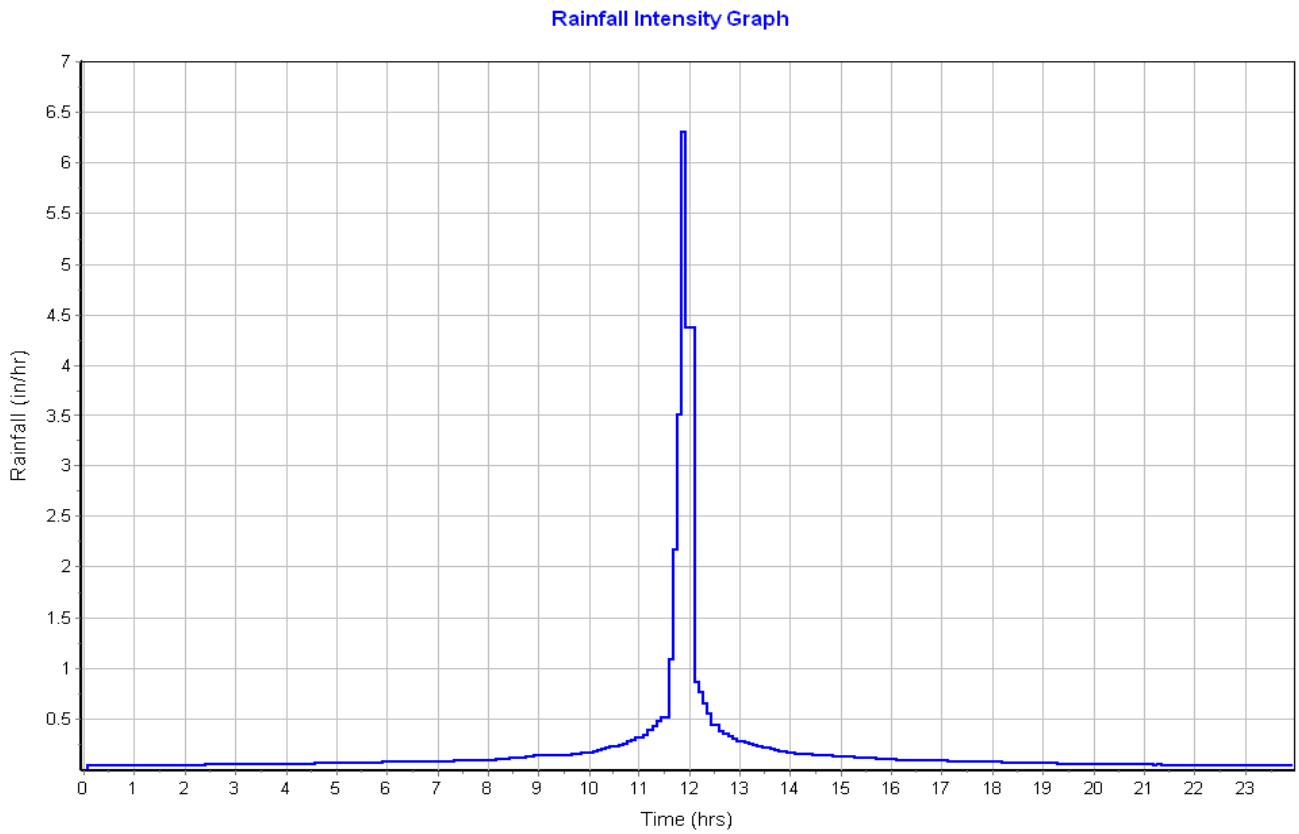
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1601	0.00	0.00
Channel Slope (%) :	5.7	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	13.84	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00

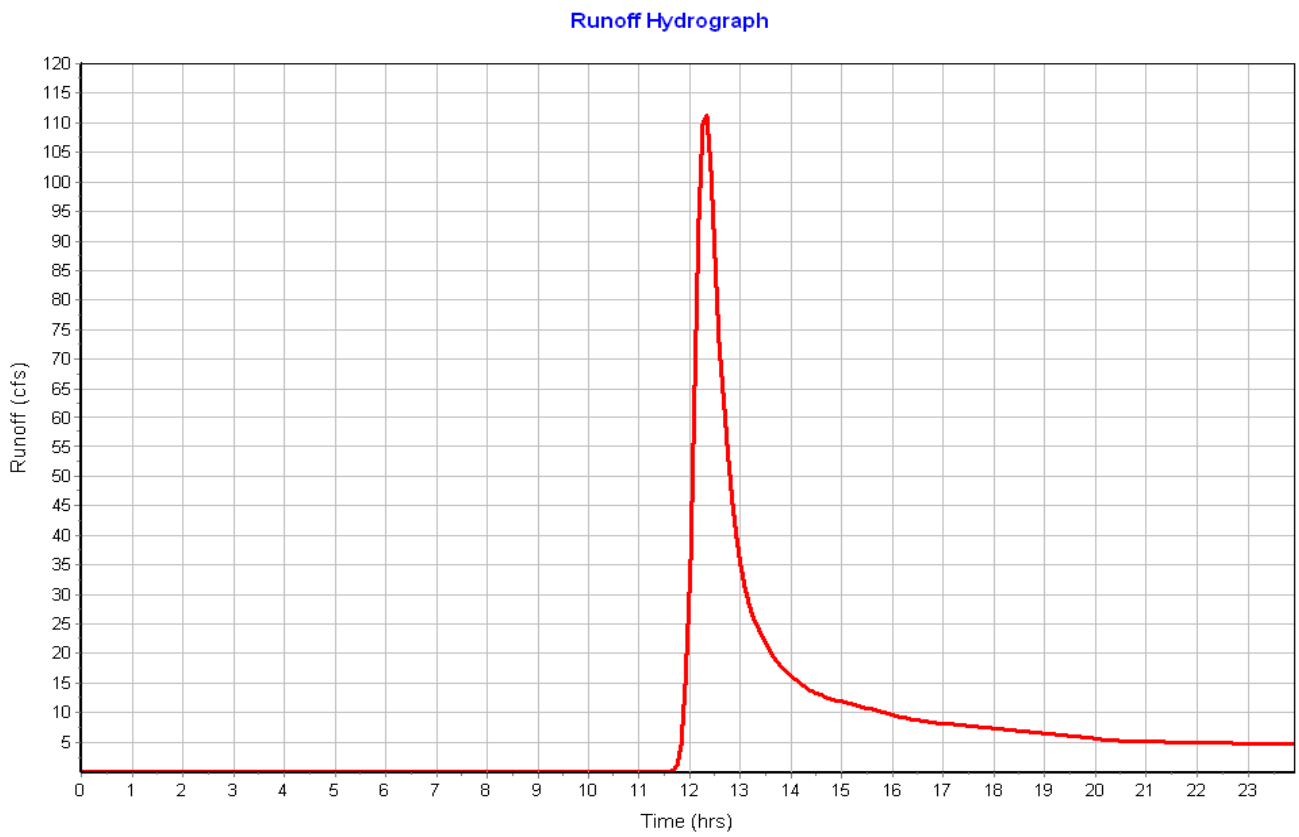
Total TOC (min) 36.99

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 112.52
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:36:59

Subbasin : D1.1





Subbasin : D1.2

Input Data

Area (ac) 49.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	49.90	B	60.00
Composite Area & Weighted CN	49.90		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.48	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.79	0.00	0.00
Computed Flow Time (min) :	21.10	0.00	0.00

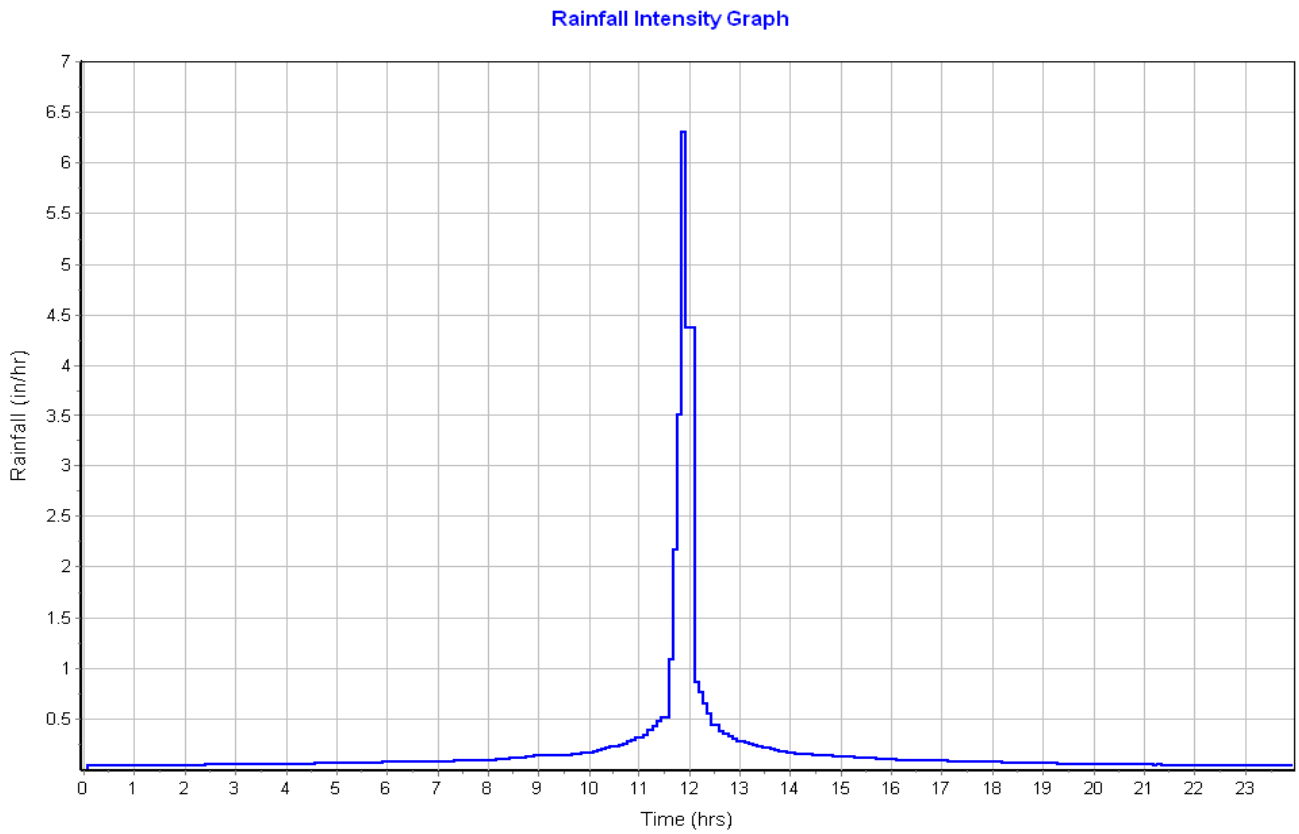
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	922	0.00	0.00
Channel Slope (%) :	2.48	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.53	0.00	0.00
Computed Flow Time (min) :	2.04	0.00	0.00

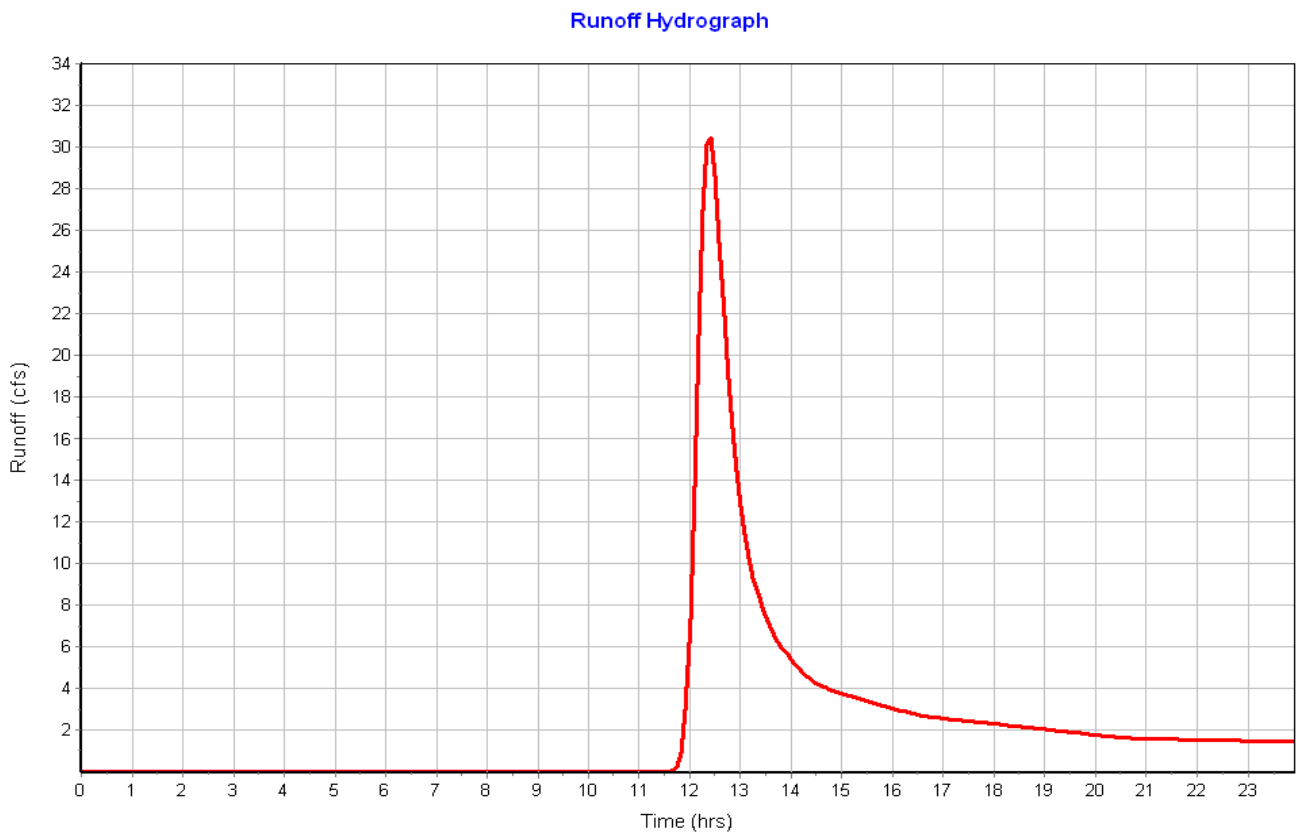
Total TOC (min) 44.20

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 30.63
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:44:12

Subbasin : D1.2





Subbasin : D2

Input Data

Area (ac) 68.70
Weighted Curve Number 64.75
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	10.31	B	69.00
2.5 Acre Lots, 11% Impervious	58.40	B	64.00
Composite Area & Weighted CN	68.71		64.75

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	12.25	0.00	0.00

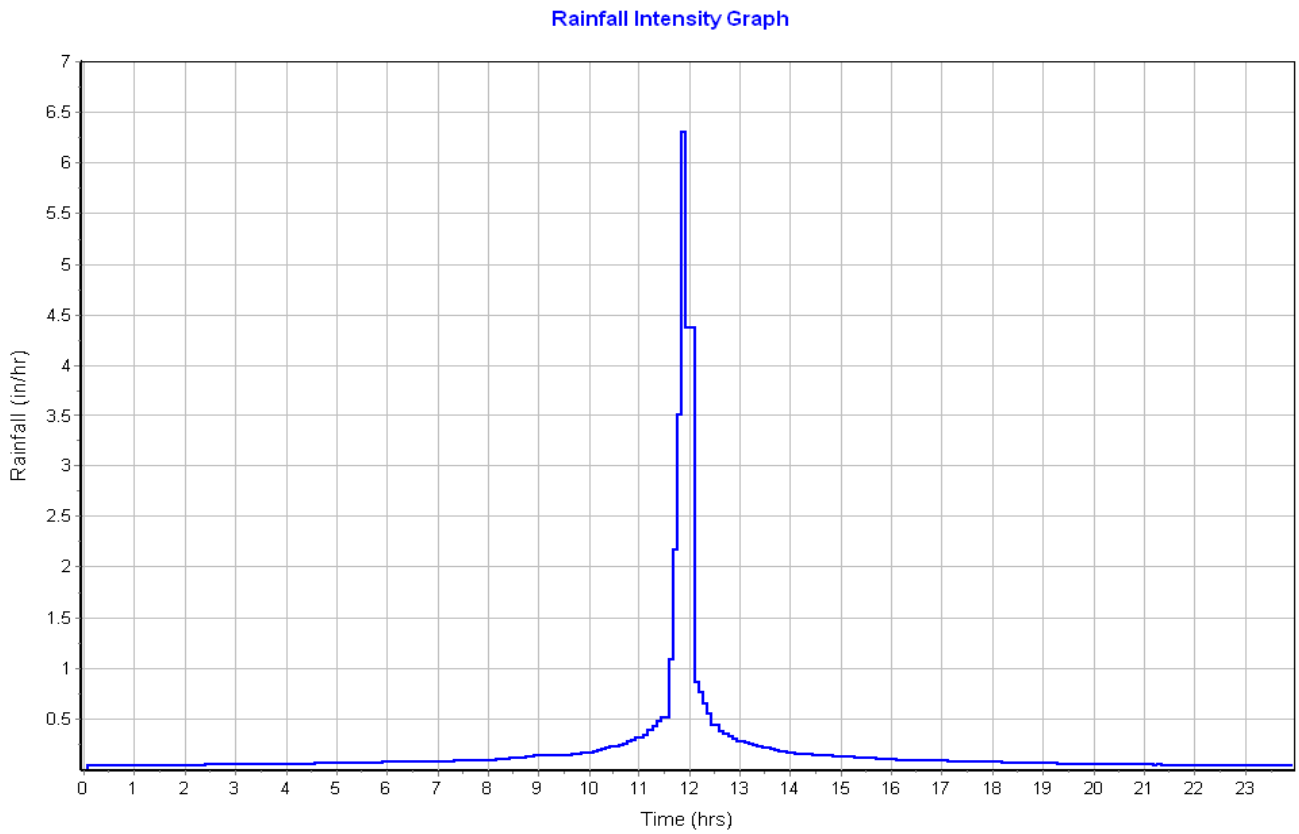
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	848	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	1.52	0.00	0.00

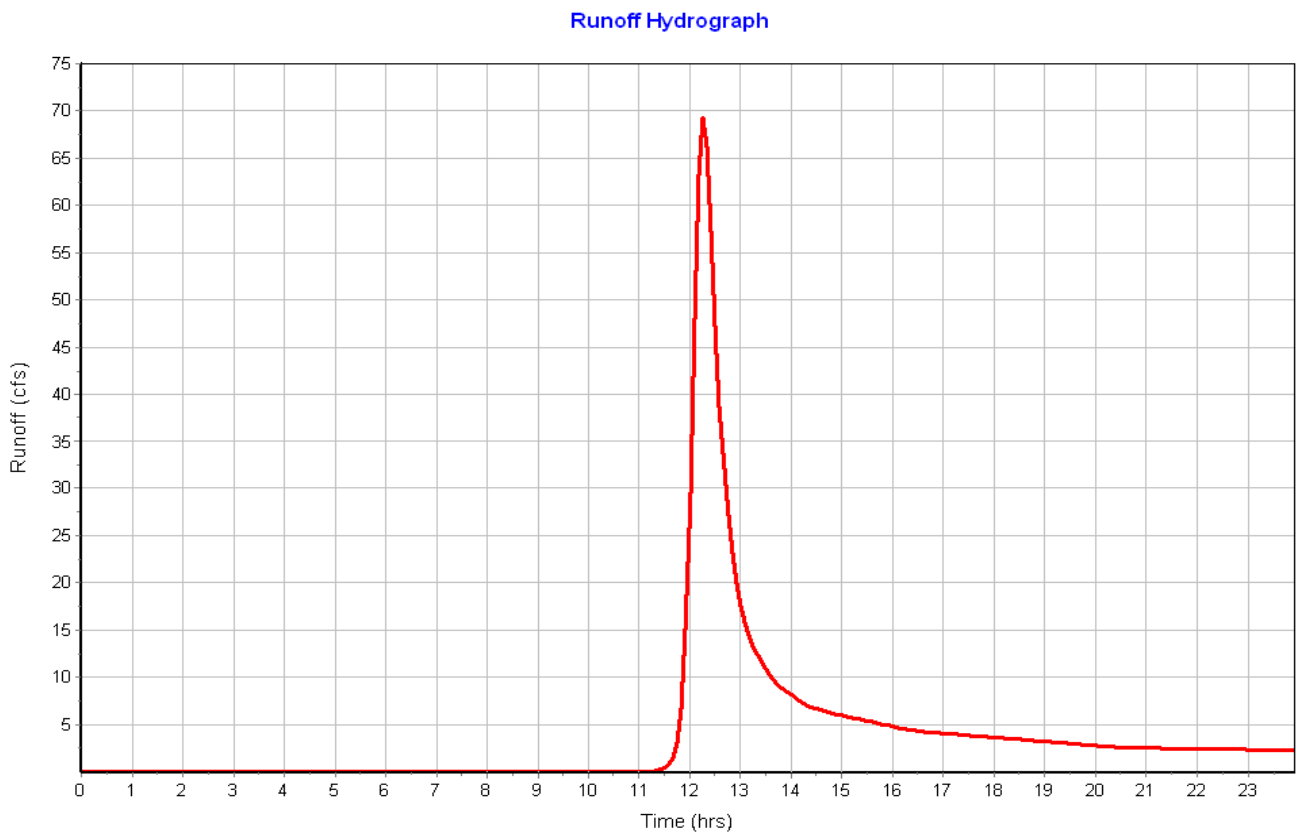
Total TOC (min) 34.83

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.38
Peak Runoff (cfs) 69.43
Weighted Curve Number 64.75
Time of Concentration (days hh:mm:ss) 0 00:34:50

Subbasin : D2


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : D3.4.6

Input Data

Area (ac) 167.00
Weighted Curve Number 66.35
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	21.61	B	64.00
Woods & grass combination, Fair	83.80	B	65.00
Pasture, grassland, or range, Fair	61.59	B	69.00
Composite Area & Weighted CN	167.00		66.35

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	15.72	0.00	0.00

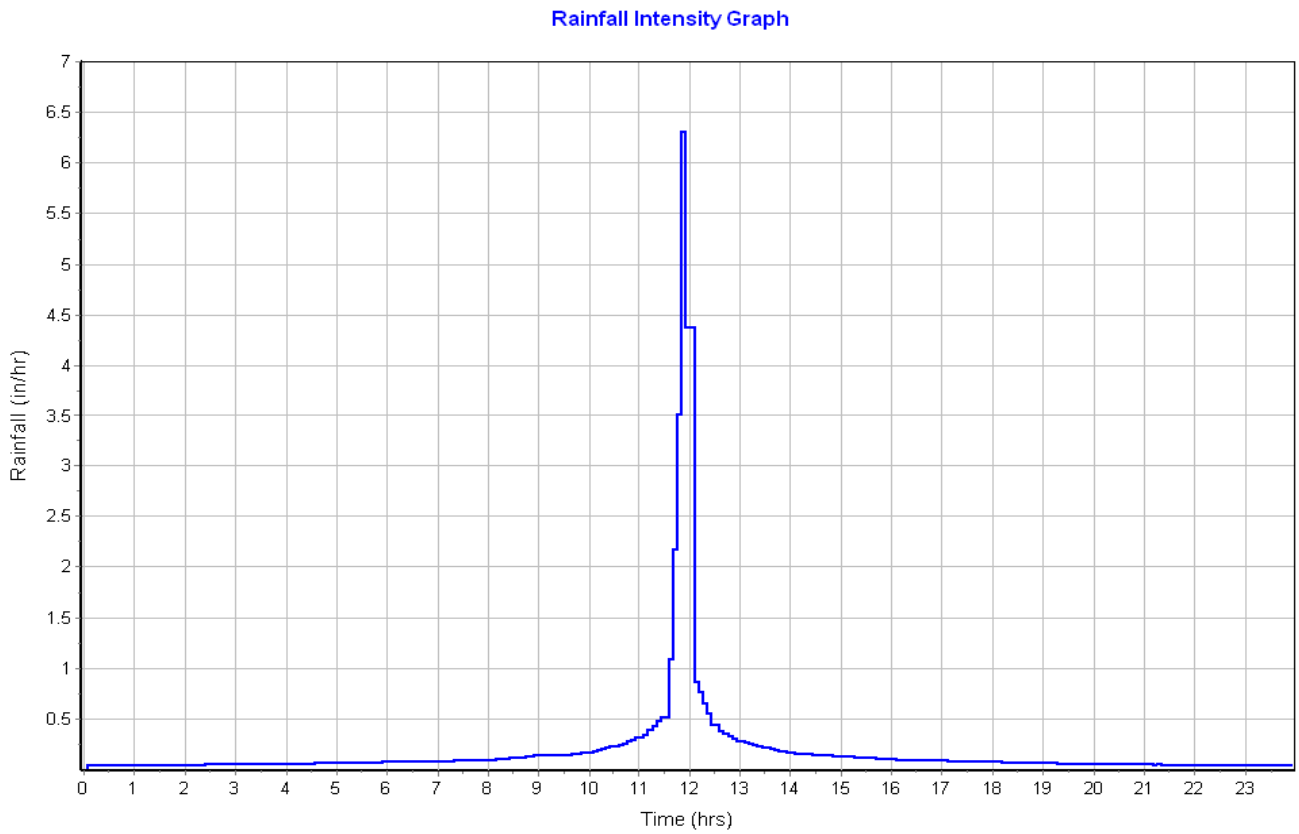
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1128	0.00	0.00
Channel Slope (%) :	2.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.25	0.00	0.00
Computed Flow Time (min) :	2.59	0.00	0.00

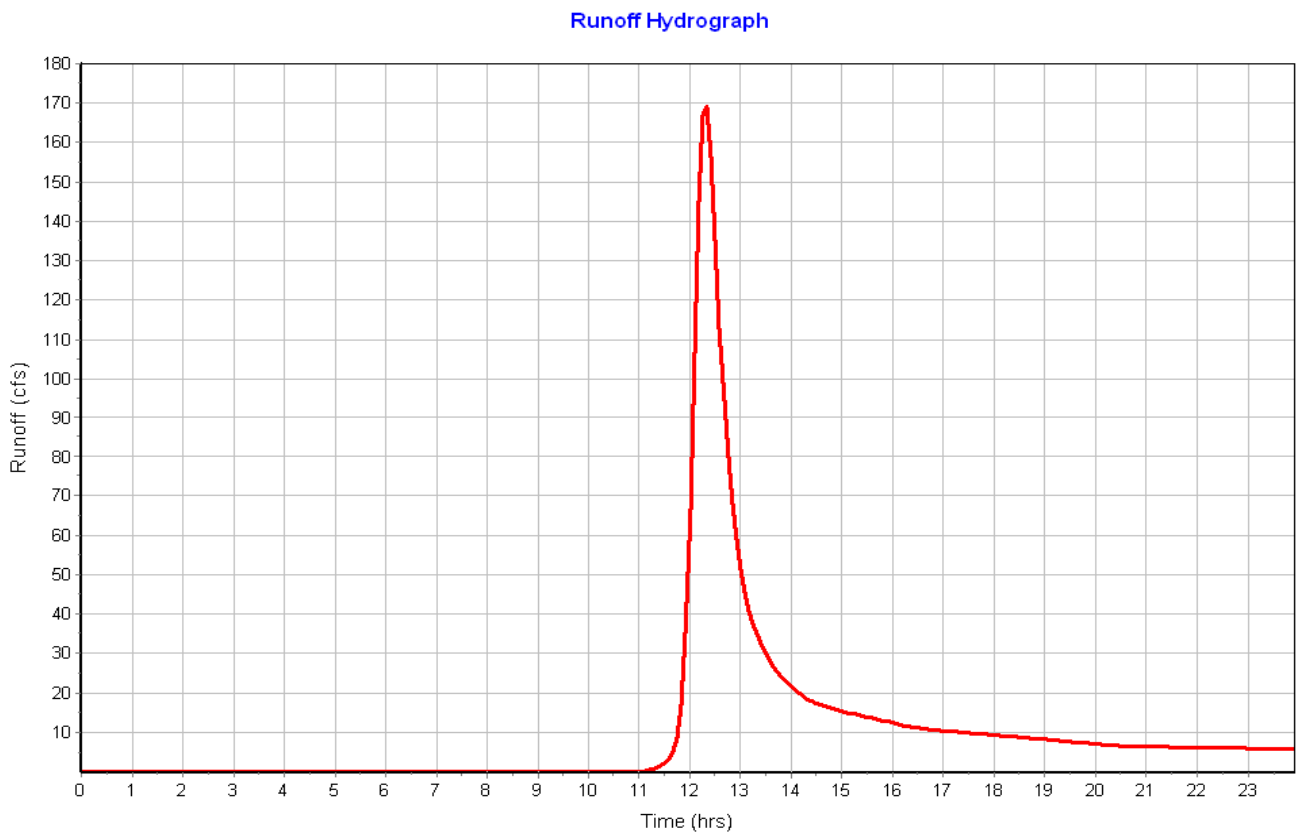
Total TOC (min) 39.37

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.49
Peak Runoff (cfs) 170.47
Weighted Curve Number 66.35
Time of Concentration (days hh:mm:ss) 0 00:39:22

Subbasin : D3.4.6





Subbasin : D5

Input Data

Area (ac) 12.80
Weighted Curve Number 67.20
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	2.56	B	60.00
Pasture, grassland, or range, Fair	10.24	B	69.00
Composite Area & Weighted CN	12.80		67.20

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	2.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	0.00	0.00
Computed Flow Time (min) :	8.25	0.00	0.00

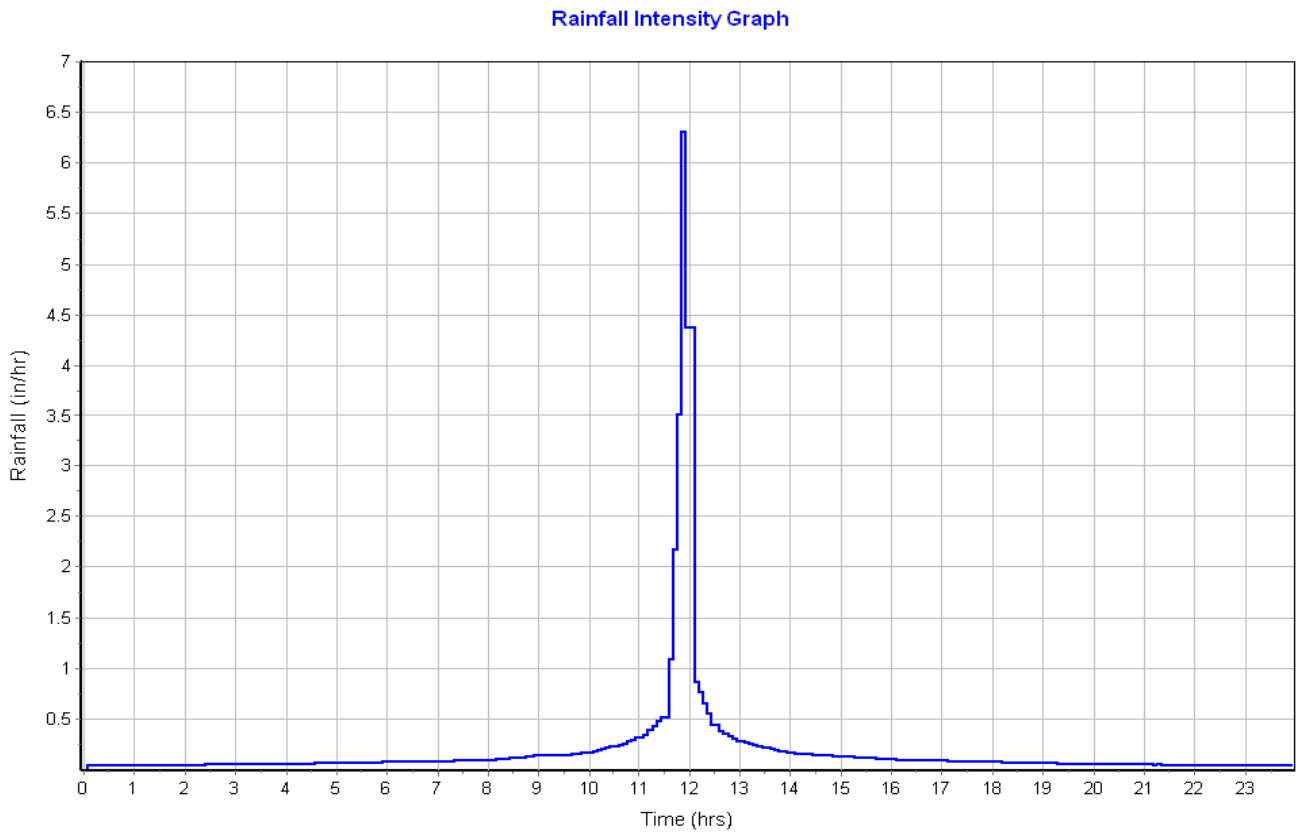
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	506	0.00	0.00
Channel Slope (%) :	2.1	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	6.93	0.00	0.00
Computed Flow Time (min) :	1.22	0.00	0.00

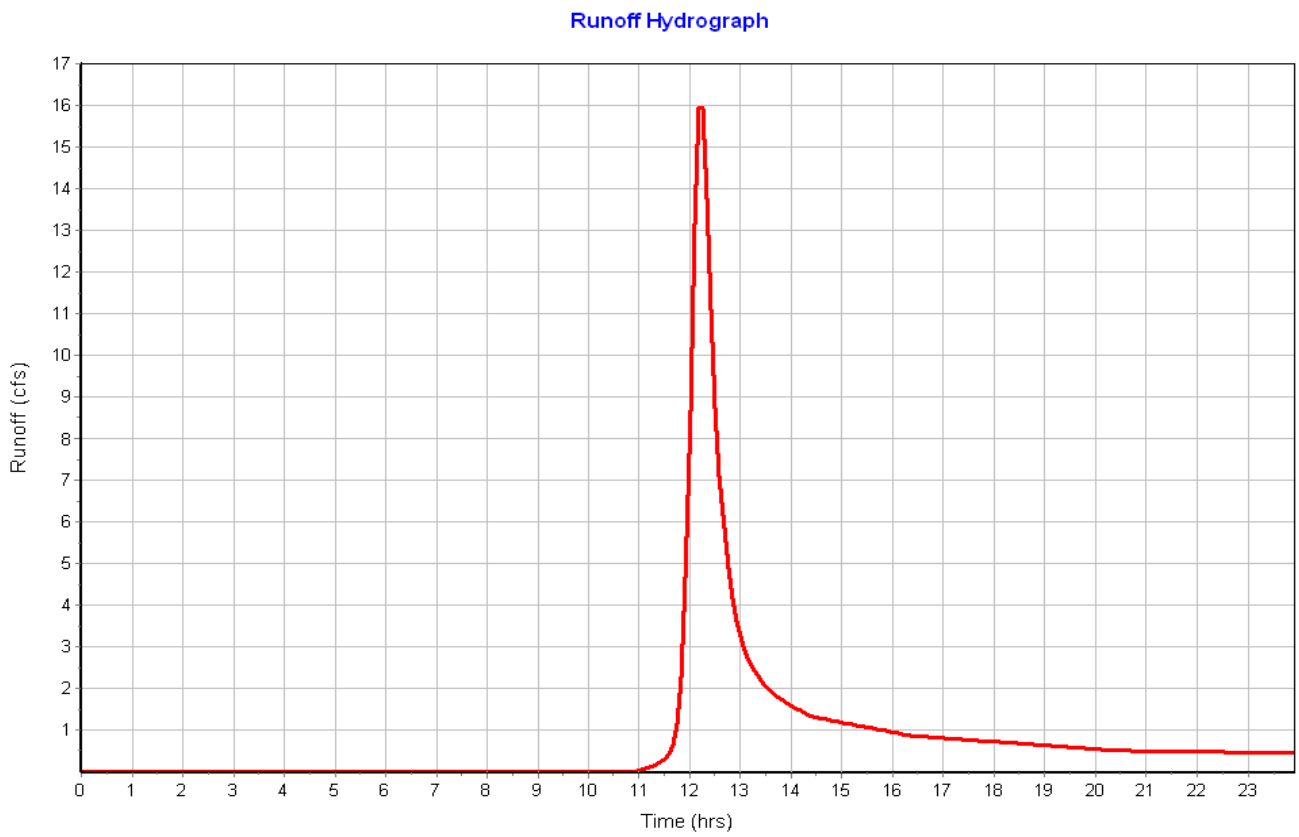
Total TOC (min) 30.53

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.54
Peak Runoff (cfs) 16.27
Weighted Curve Number 67.20
Time of Concentration (days hh:mm:ss) 0 00:30:32

Subbasin : D5


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Ea

Input Data

Area (ac) 37.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	37.90	B	60.00
Composite Area & Weighted CN	37.90		60.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	4.9	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.11	0.00	0.00
Computed Flow Time (min) :	7.51	0.00	0.00

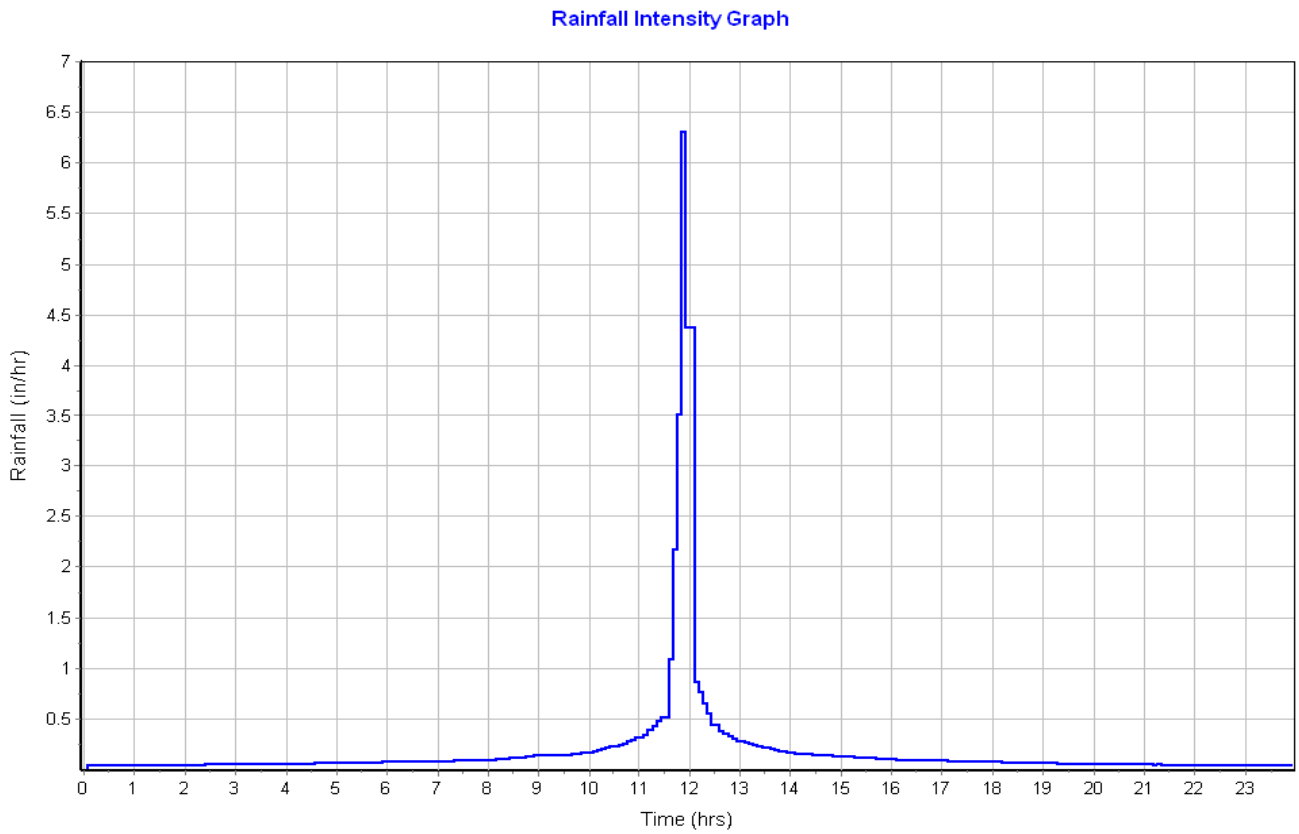
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1227	0.00	0.00
Channel Slope (%) :	4.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00

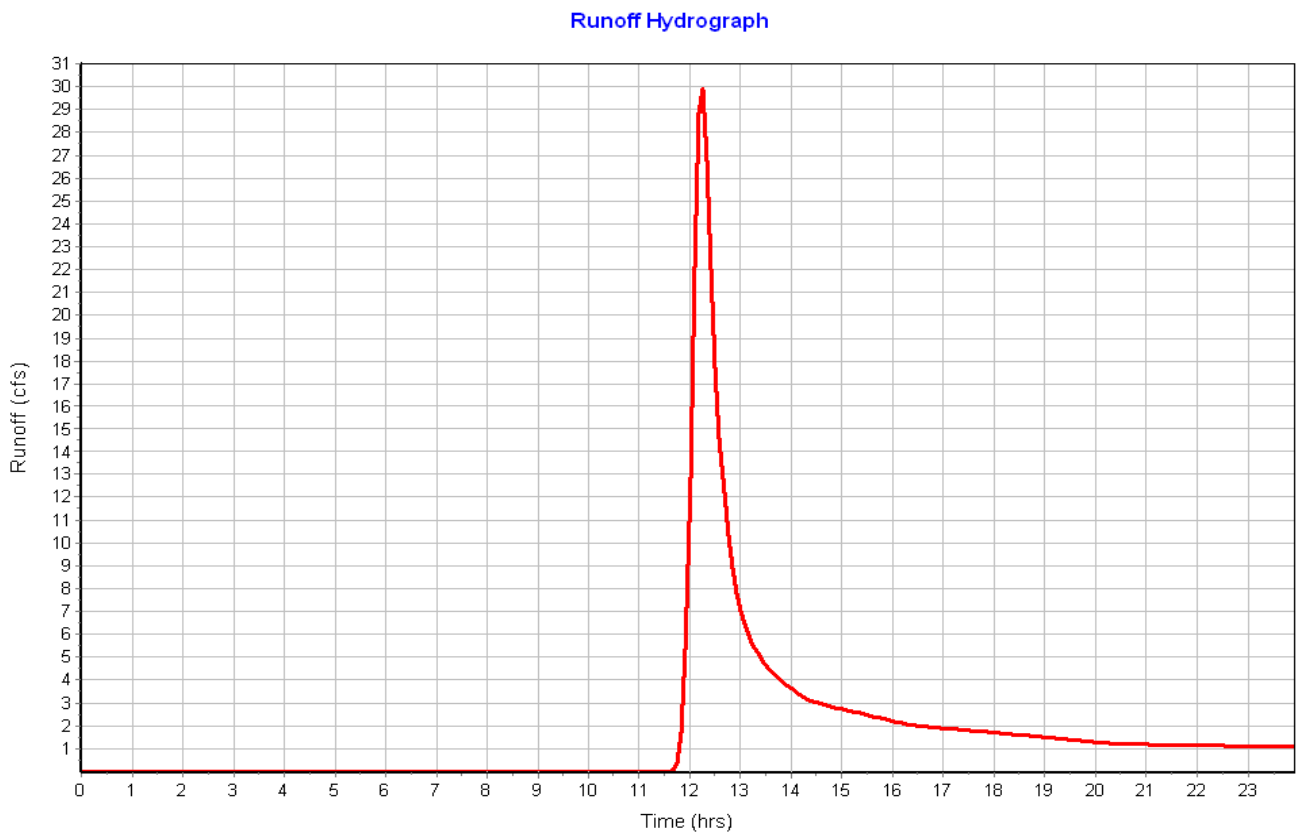
Total TOC (min) 30.50

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.07
Peak Runoff (cfs) 30.18
Weighted Curve Number 60.00
Time of Concentration (days hh:mm:ss) 0 00:30:30

Subbasin : Ea


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : Eb

Input Data

Area (ac) 74.60
Weighted Curve Number 66.23
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	22.96	B	60.00
Pasture, grassland, or range, Fair	51.64	B	69.00
Composite Area & Weighted CN	74.60		66.23

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	12.25	0.00	0.00

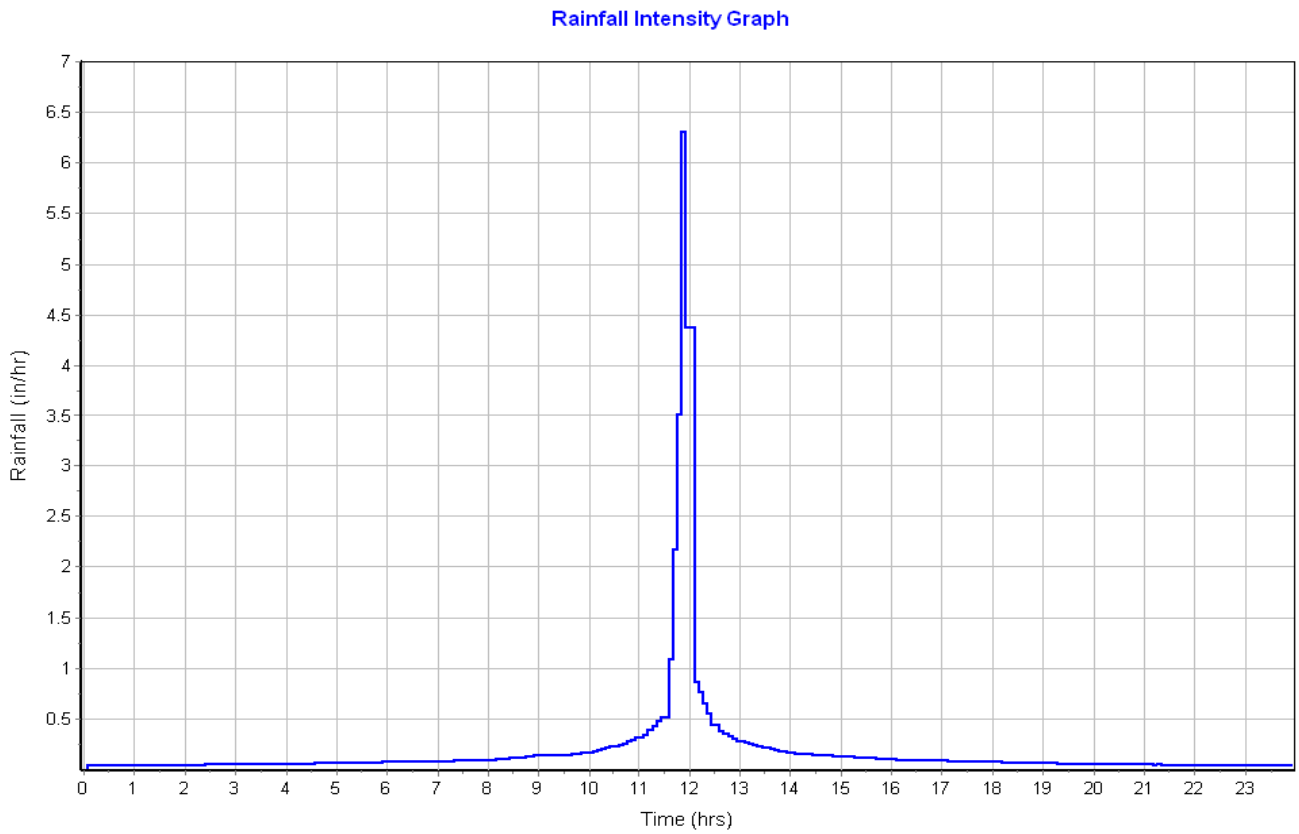
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	2766	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	4.94	0.00	0.00

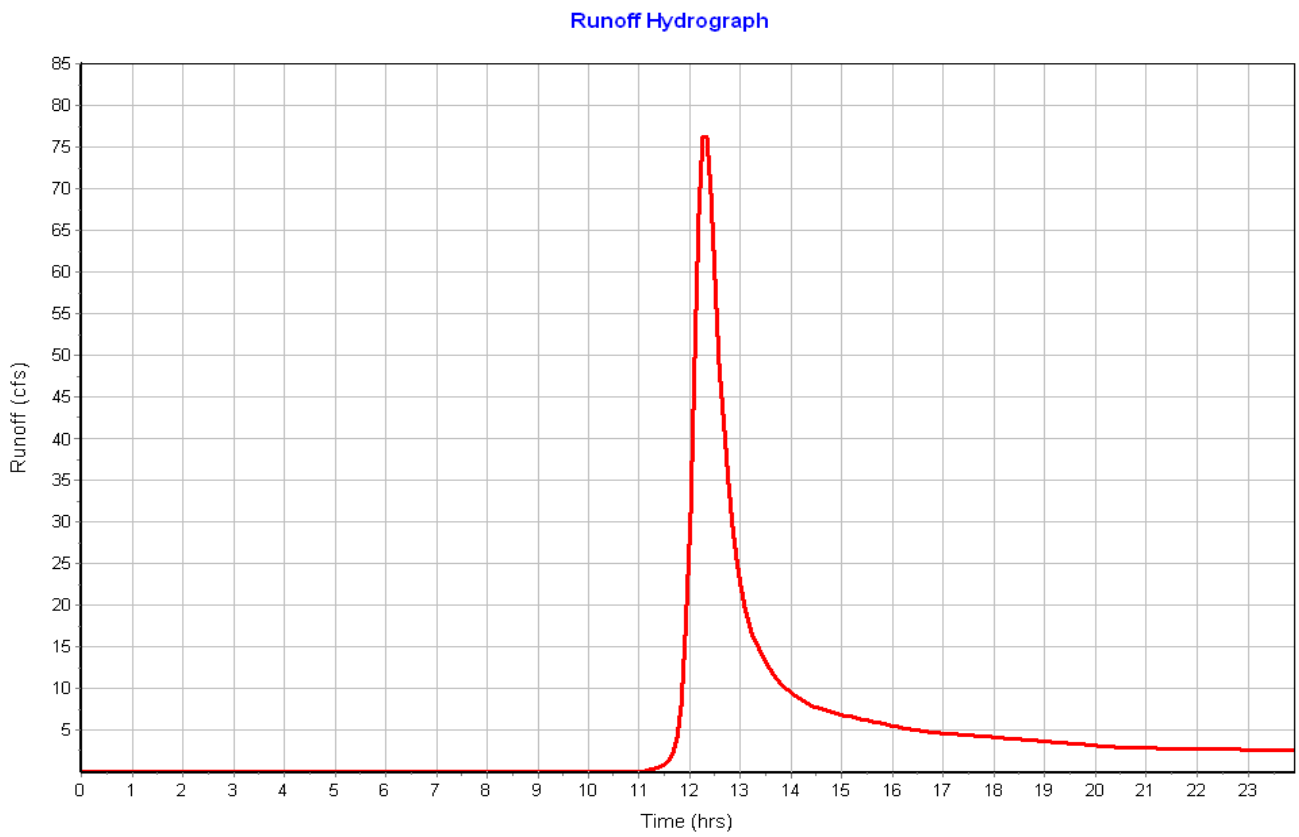
Total TOC (min) 38.26

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.48
Peak Runoff (cfs) 77.30
Weighted Curve Number 66.23
Time of Concentration (days hh:mm:ss) 0 00:38:16

Subbasin : Eb


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : F

Input Data

Area (ac) 44.50
Weighted Curve Number 69.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	44.50	B	69.00
Composite Area & Weighted CN	44.50		69.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	13.33	0.00	0.00

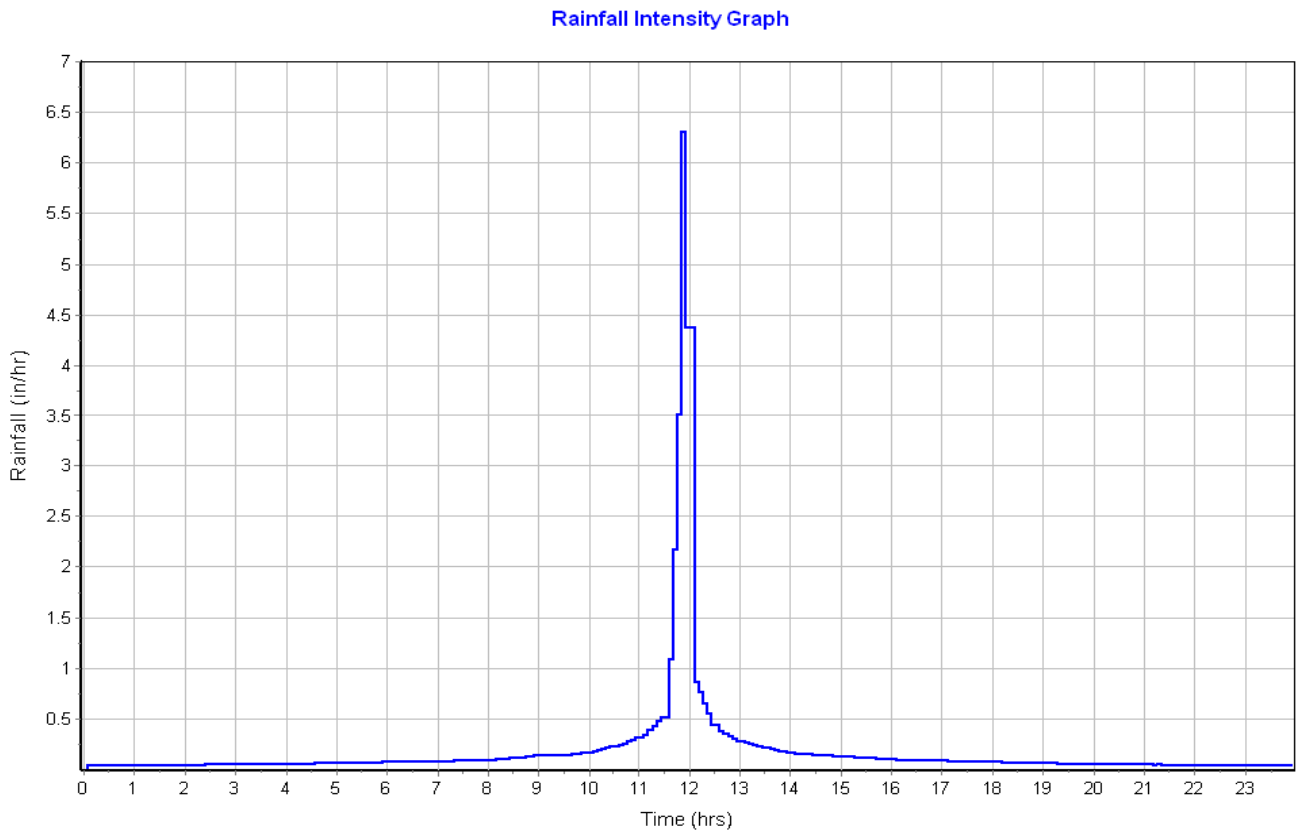
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1707	0.00	0.00
Channel Slope (%) :	3.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.56	0.00	0.00
Computed Flow Time (min) :	3.32	0.00	0.00

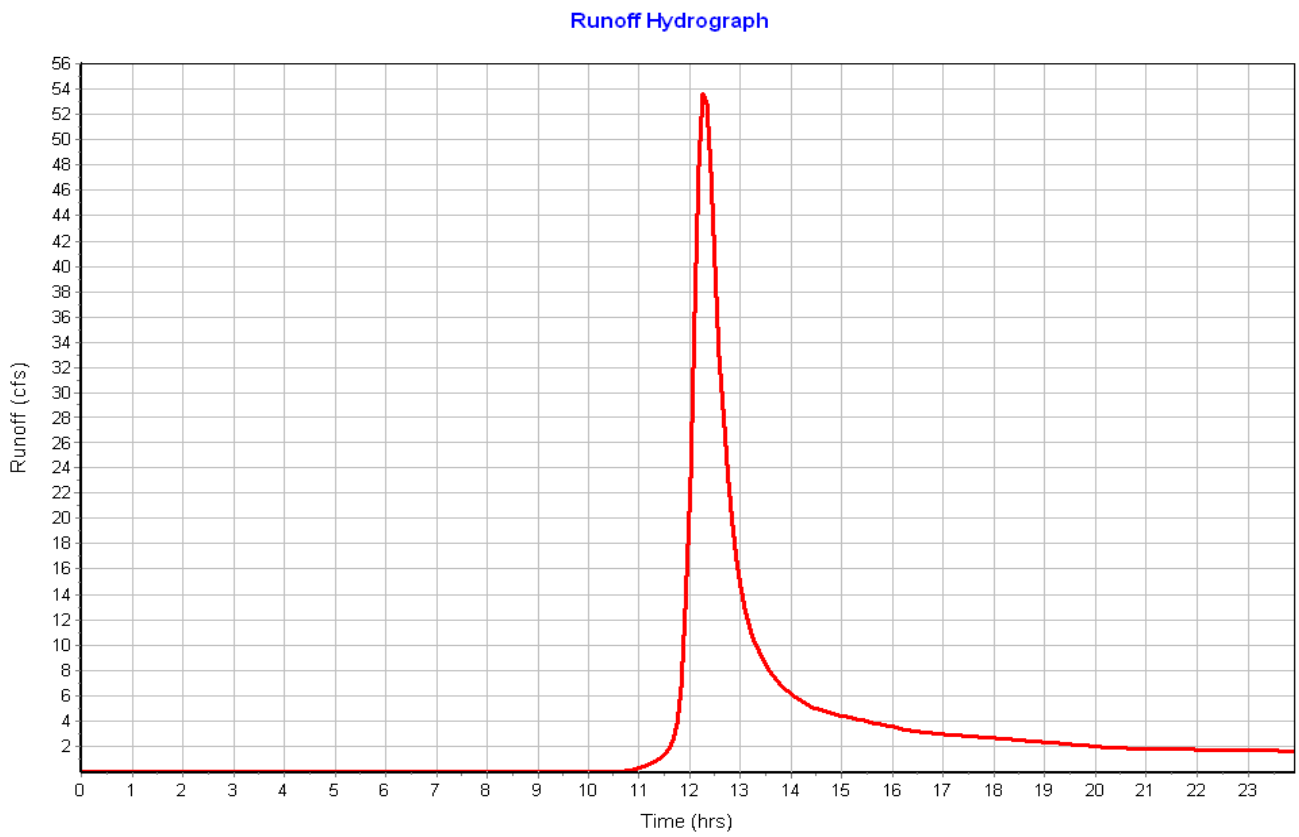
Total TOC (min) 37.72

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.67
Peak Runoff (cfs) 54.18
Weighted Curve Number 69.00
Time of Concentration (days hh:mm:ss) 0 00:37:43

Subbasin : F


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : G

Input Data

Area (ac) 107.60
Weighted Curve Number 74.50
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	59.18	C	79.00
Pasture, grassland, or range, Fair	48.42	B	69.00
Composite Area & Weighted CN	107.60		74.50

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.7	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.52	0.00	0.00
Computed Flow Time (min) :	10.96	0.00	0.00

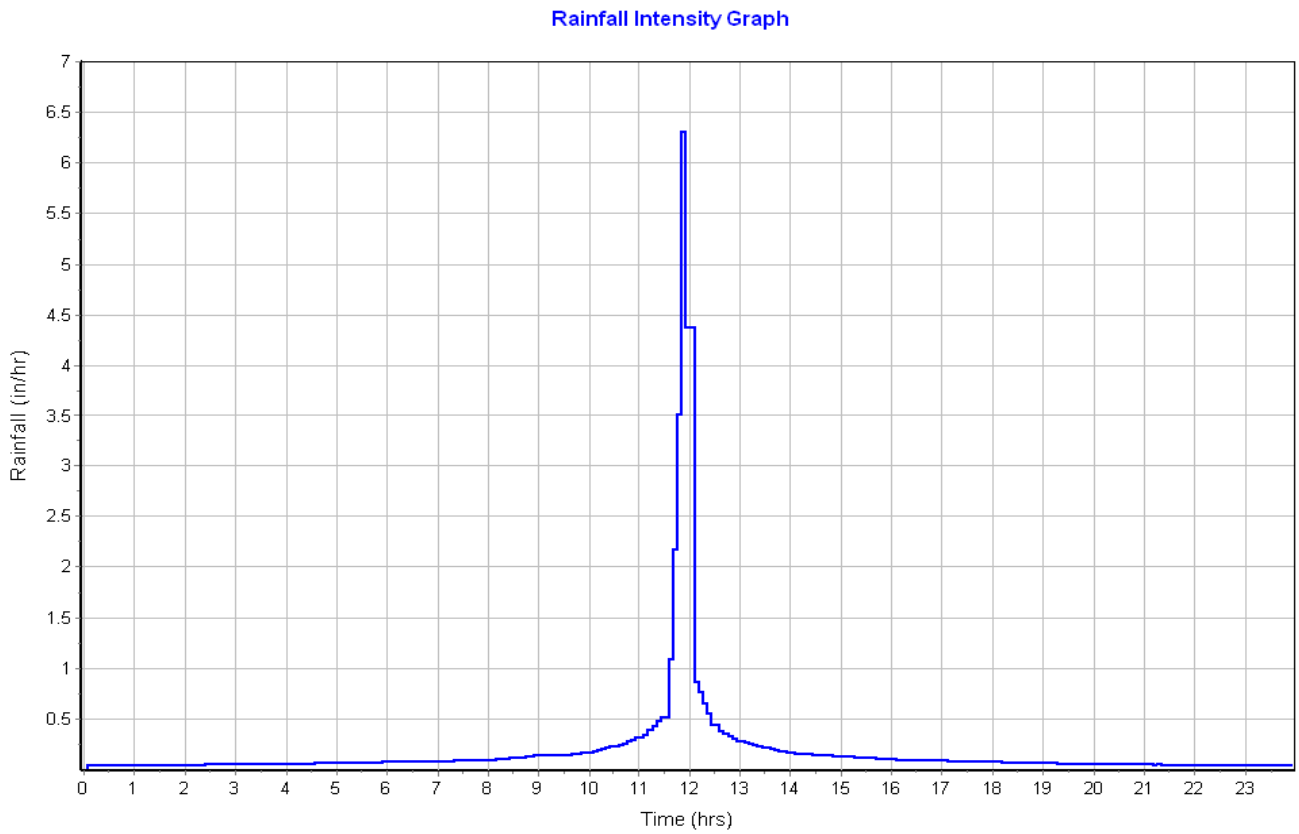
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1441	0.00	0.00
Channel Slope (%) :	4.7	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	12.56	0.00	0.00
Computed Flow Time (min) :	1.91	0.00	0.00

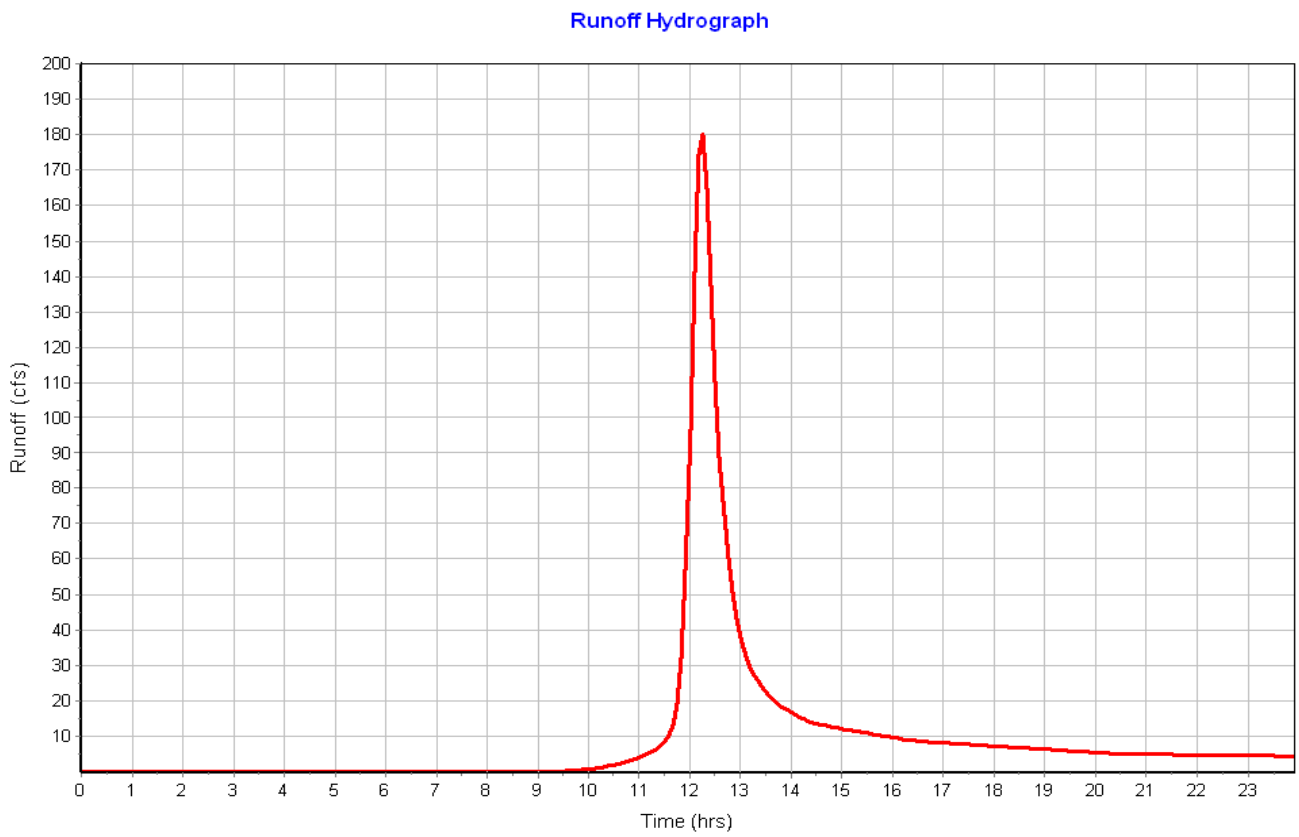
Total TOC (min) 33.93

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 2.09
Peak Runoff (cfs) 181.44
Weighted Curve Number 74.50
Time of Concentration (days hh:mm:ss) 0 00:33:56

Subbasin : G


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : H

Input Data

Area (ac) 121.80
Weighted Curve Number 71.76
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	54.81	C	79.00
Woods, Fair	31.67	B	60.00
Pasture, grassland, or range, Fair	30.45	B	69.00
Pasture, grassland, or range, Fair	4.87	D	84.00
Composite Area & Weighted CN	121.80		71.76

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.43	0.00	0.00
Computed Flow Time (min) :	11.66	0.00	0.00

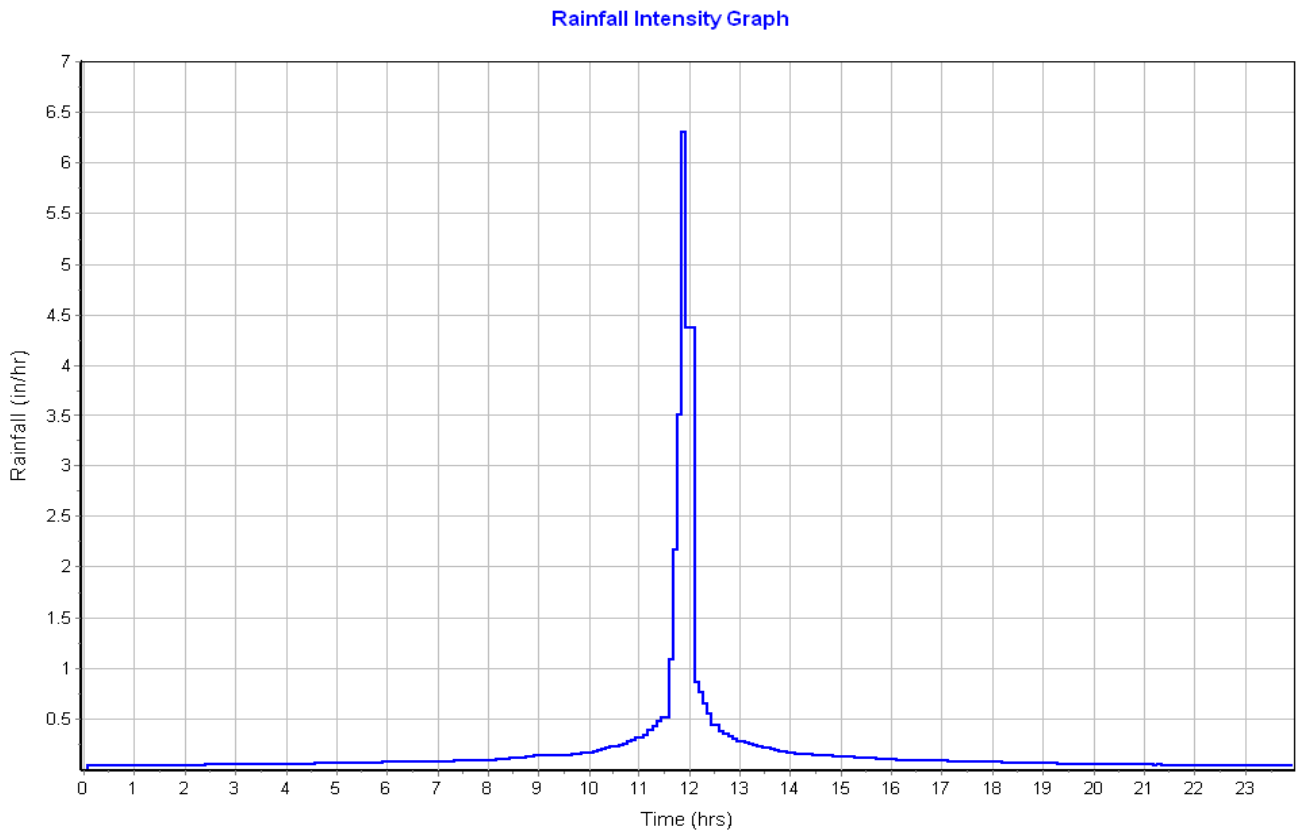
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	676	0.00	0.00
Channel Slope (%) :	4.2	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	11.88	0.00	0.00
Computed Flow Time (min) :	0.95	0.00	0.00

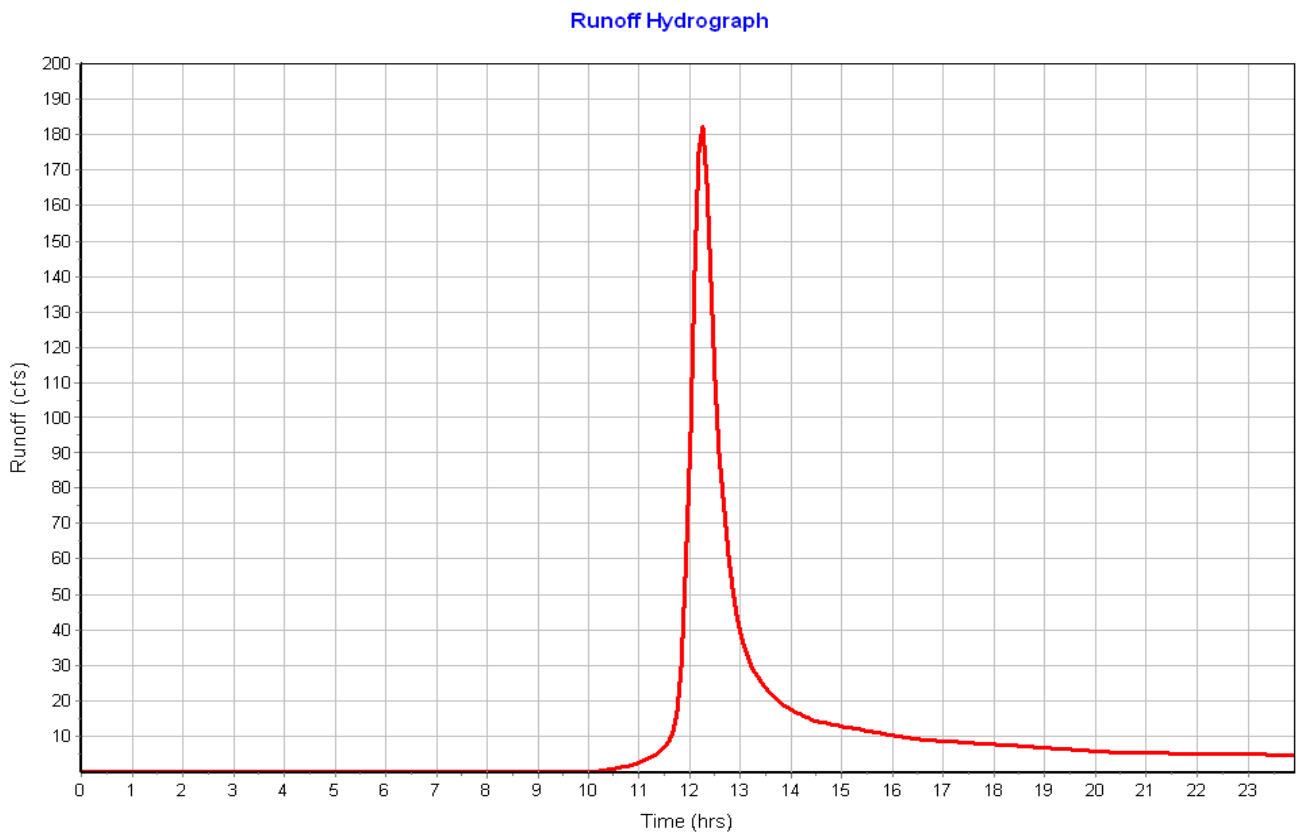
Total TOC (min) 33.66

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.88
Peak Runoff (cfs) 182.91
Weighted Curve Number 71.76
Time of Concentration (days hh:mm:ss) 0 00:33:40

Subbasin : H


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : I

Input Data

Area (ac) 37.50
Weighted Curve Number 79.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	6.80	C	79.00
Composite Area & Weighted CN	6.80		79.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.58	0.00	0.00
Computed Flow Time (min) :	10.55	0.00	0.00

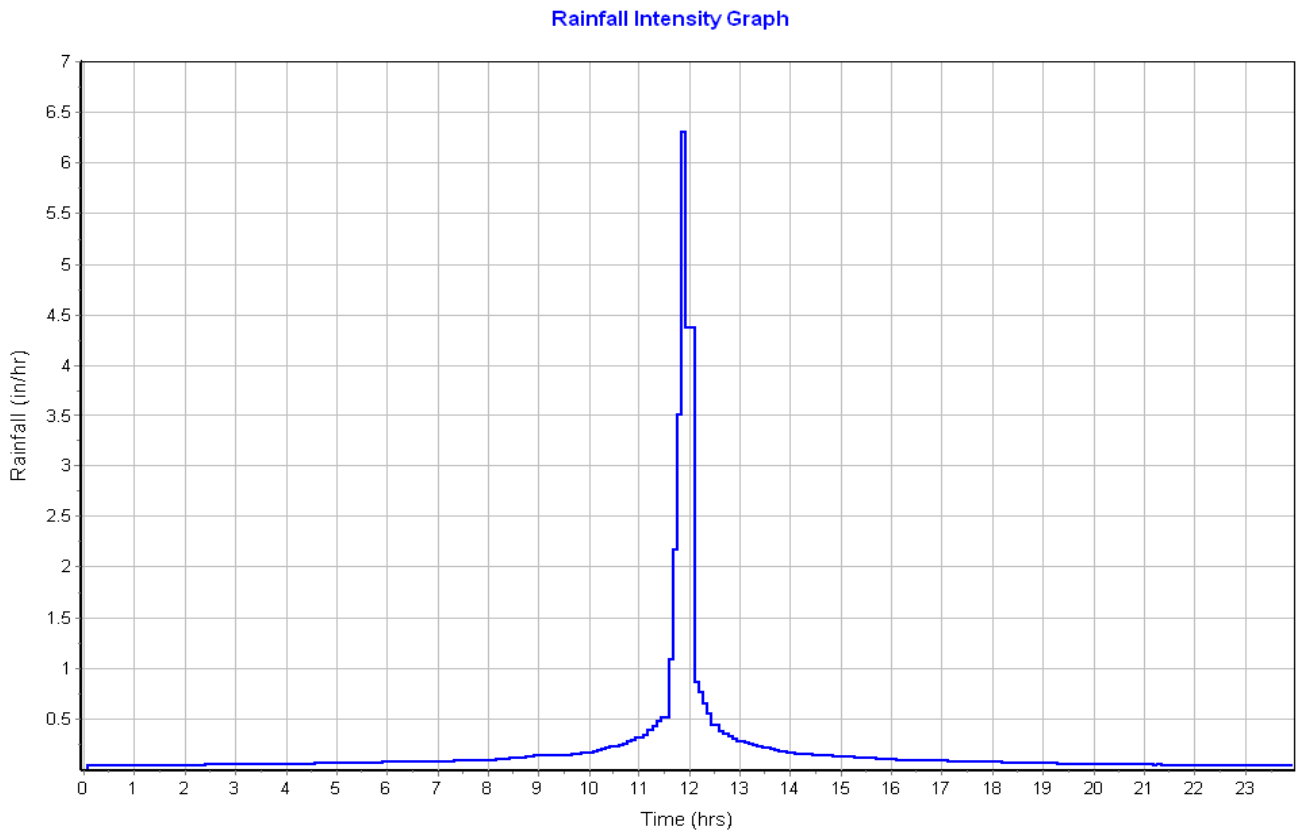
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	134	0.00	0.00
Channel Slope (%) :	5.1	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.80	0.00	0.00
Computed Flow Time (min) :	0.21	0.00	0.00

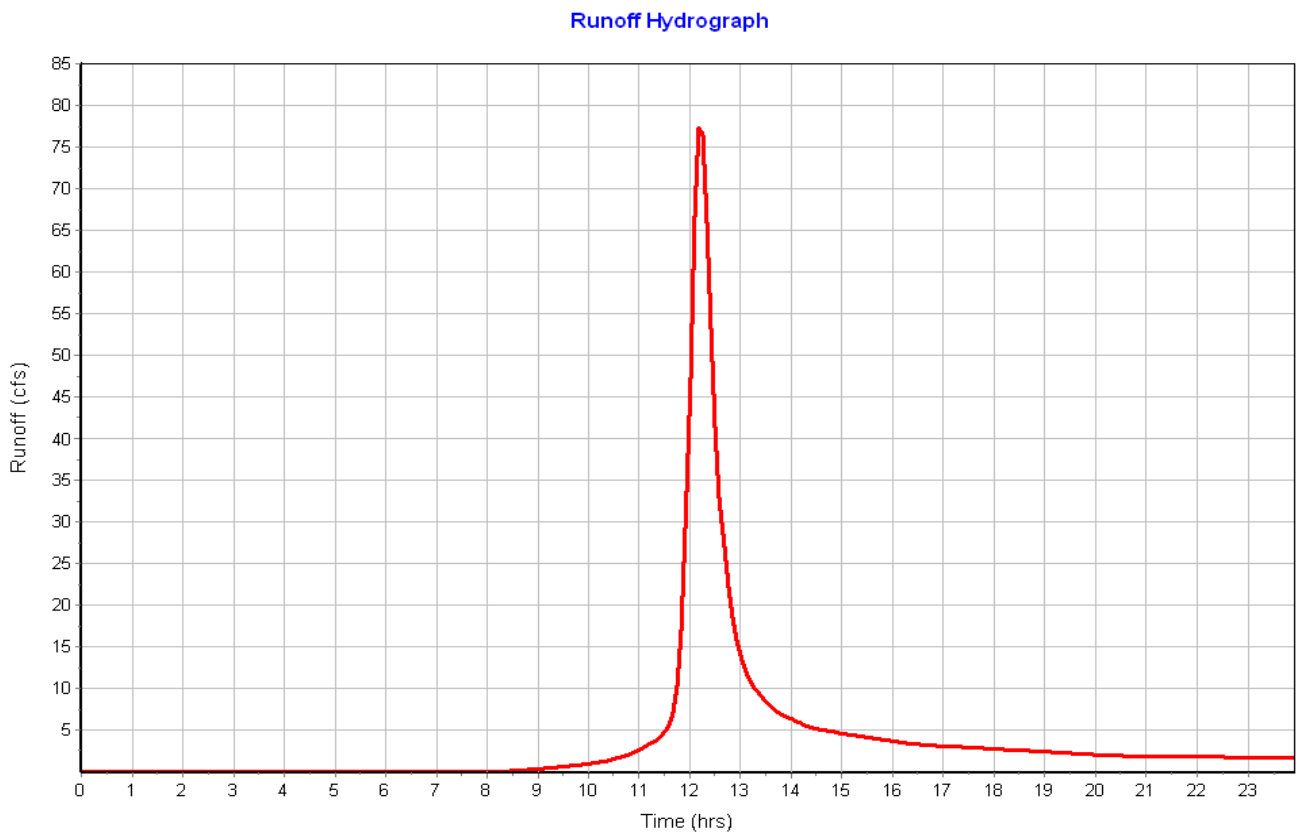
Total TOC (min) 31.81

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 2.46
Peak Runoff (cfs) 78.32
Weighted Curve Number 79.00
Time of Concentration (days hh:mm:ss) 0 00:31:49

Subbasin : I


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : J

Input Data

Area (ac) 10.10
Weighted Curve Number 69.50
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	5.05	B	60.00
Woods, Fair	5.05	D	79.00
Composite Area & Weighted CN	10.10		69.50

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	8.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	2.08	0.00	0.00
Computed Flow Time (min) :	1.60	0.00	0.00

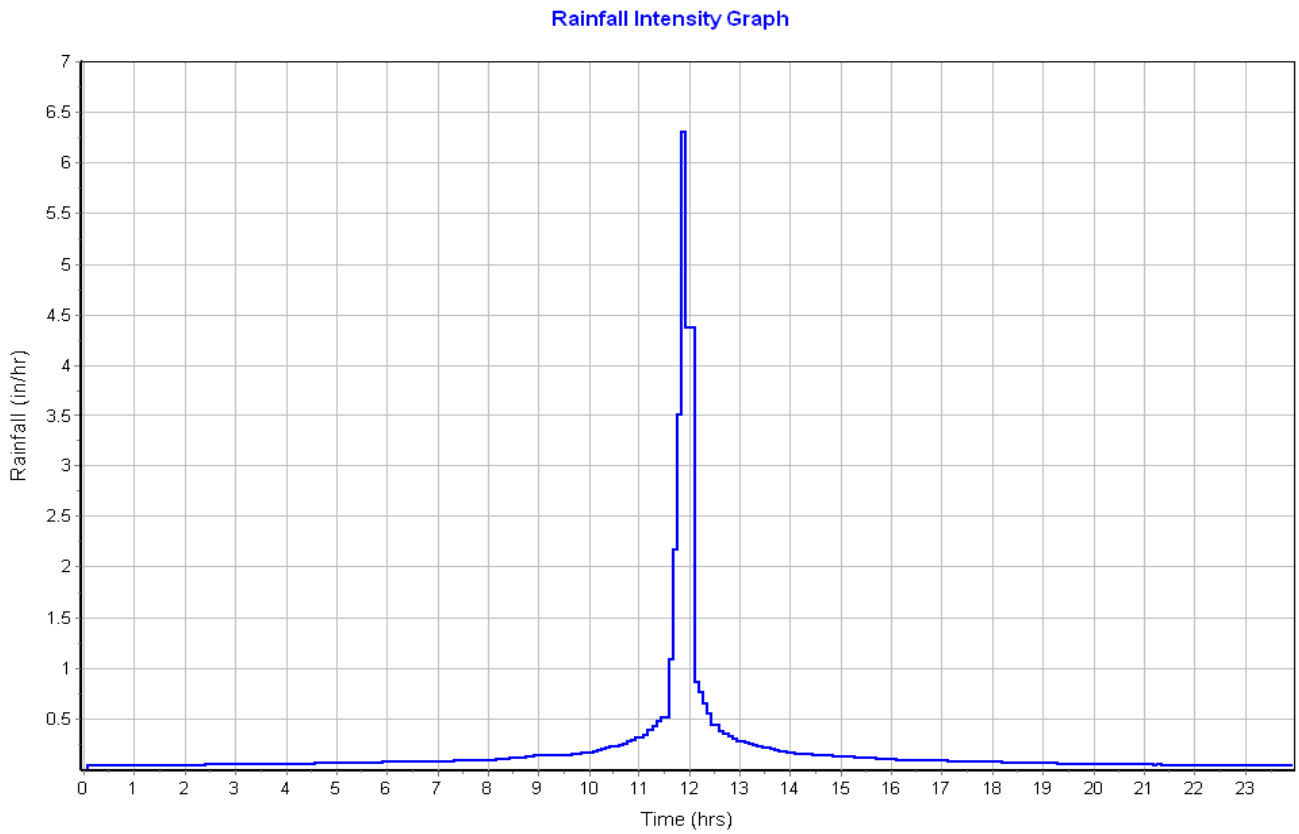
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	228	0.00	0.00
Channel Slope (%) :	8.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	14.19	0.00	0.00
Computed Flow Time (min) :	0.27	0.00	0.00

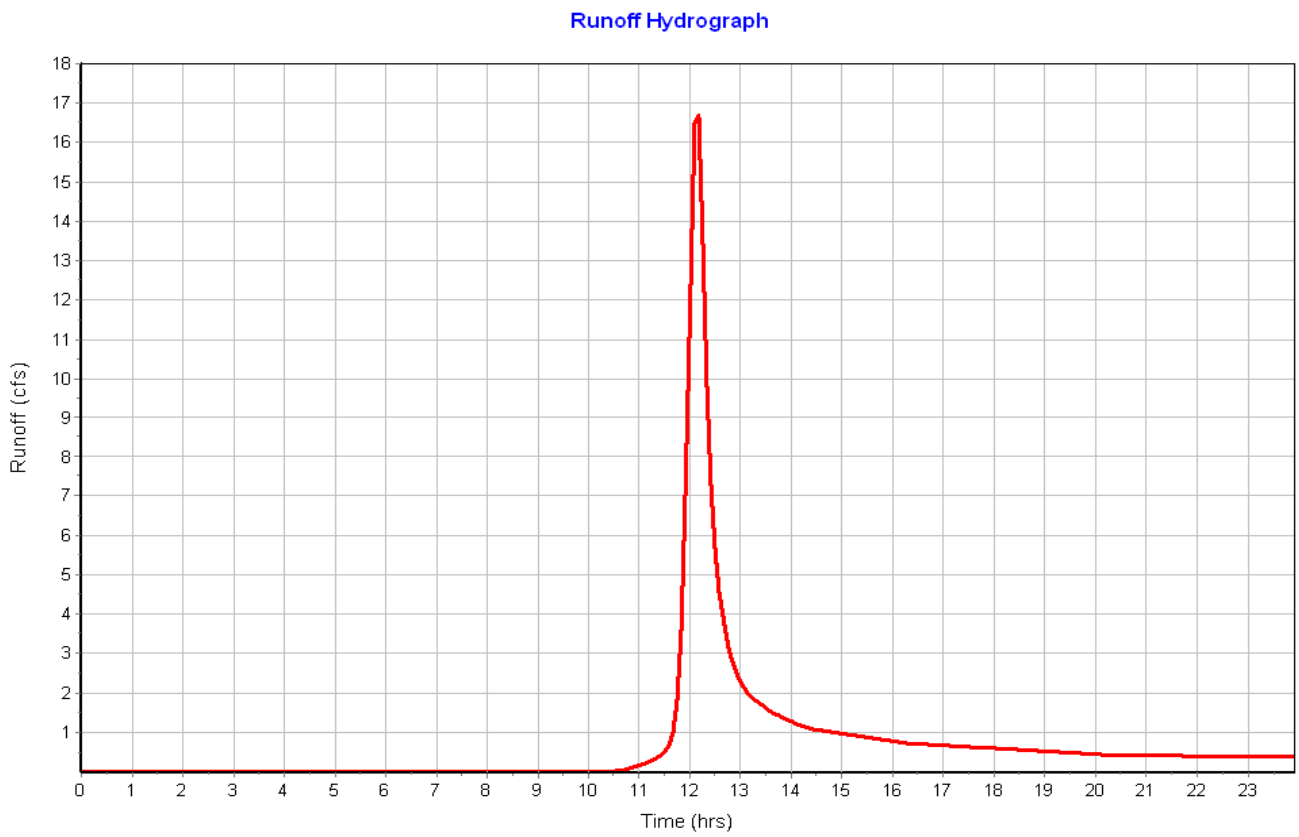
Total TOC (min) 22.93

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 1.71
Peak Runoff (cfs) 17.21
Weighted Curve Number 69.50
Time of Concentration (days hh:mm:ss) 0 00:22:56

Subbasin : J


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

Subbasin : K

Input Data

Area (ac) 17.80
Weighted Curve Number 76.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	17.80	C	76.00
Composite Area & Weighted CN	17.80		76.00

Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	3.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.38	0.00	0.00
Computed Flow Time (min) :	2.42	0.00	0.00

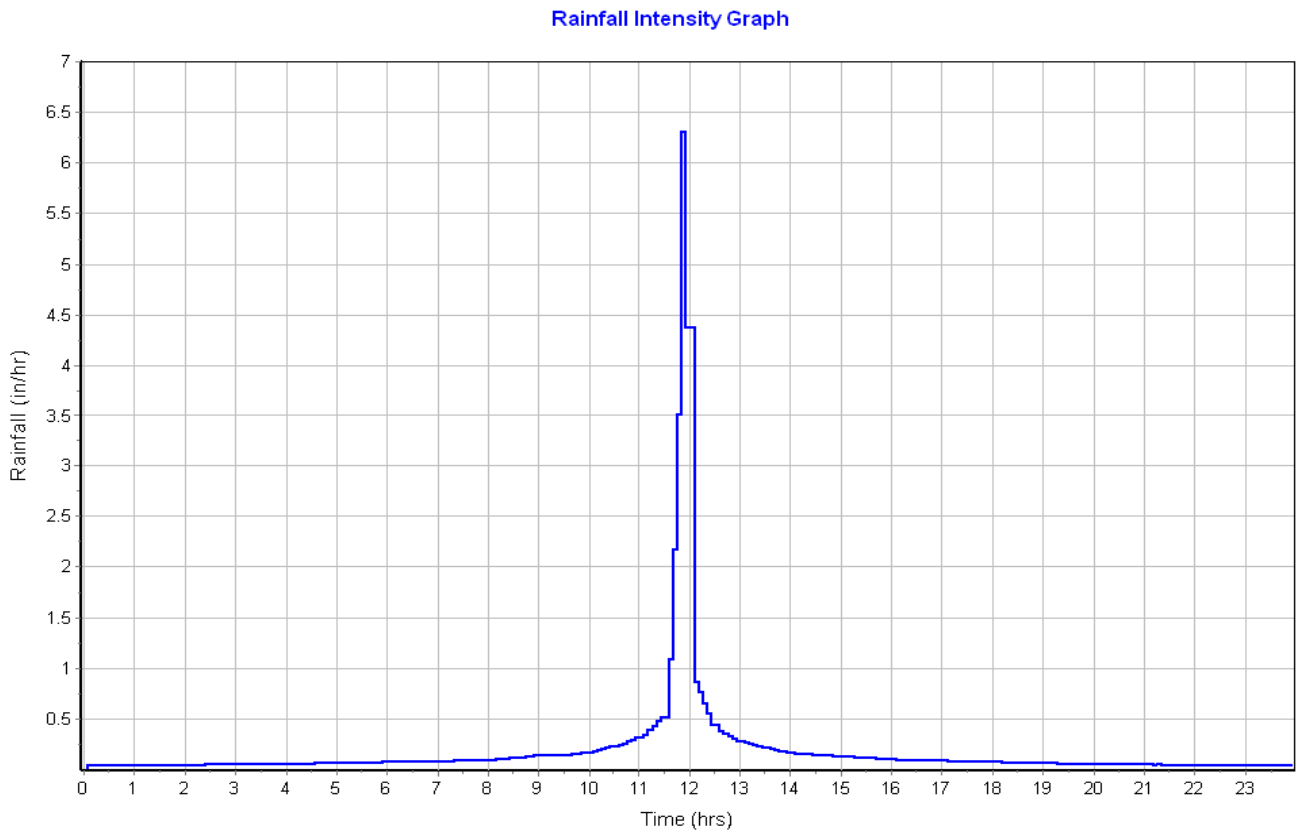
Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	354	0.00	0.00
Channel Slope (%) :	3.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.45	0.00	0.00
Computed Flow Time (min) :	0.62	0.00	0.00

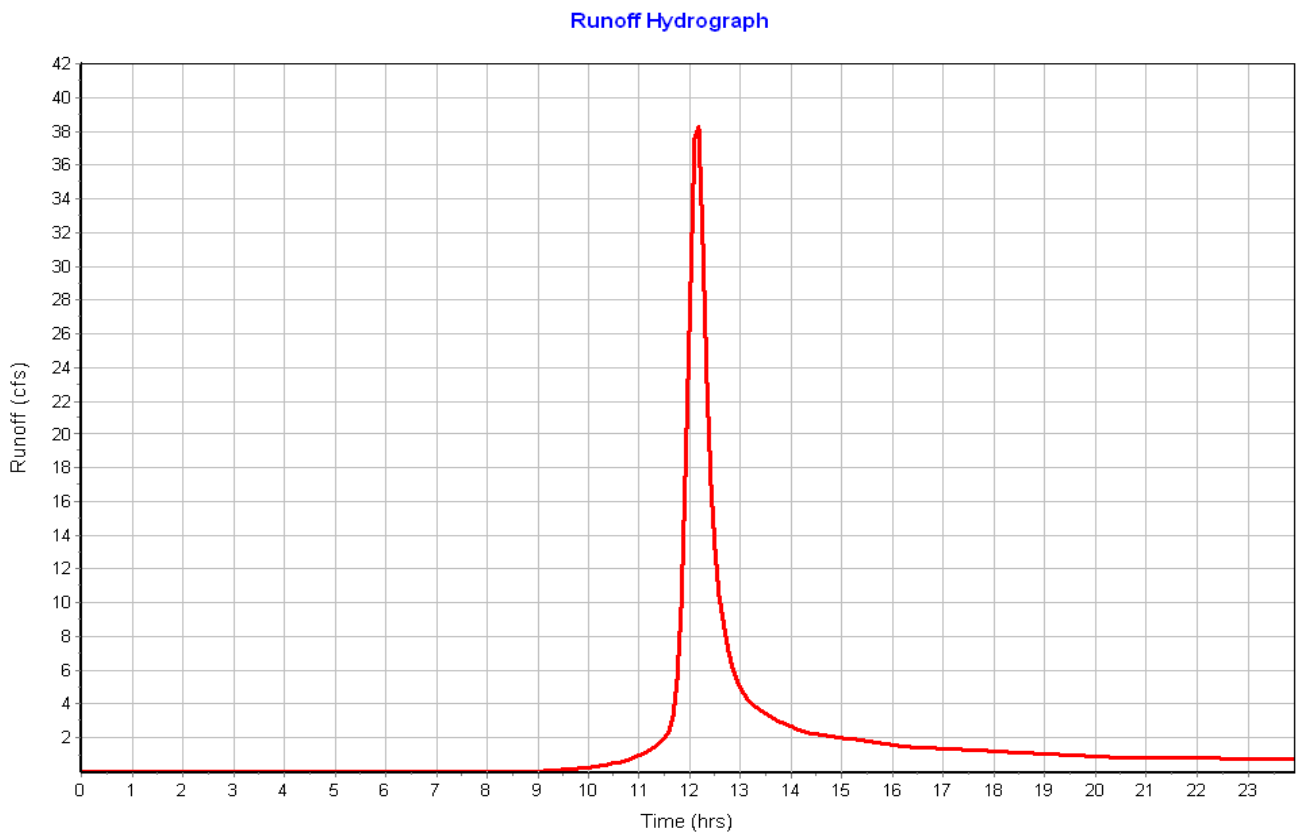
Total TOC (min) 24.10

Subbasin Runoff Results

Total Rainfall (in) 4.60
Total Runoff (in) 2.21
Peak Runoff (cfs) 39.26
Weighted Curve Number 76.00
Time of Concentration (days hh:mm:ss) 0 00:24:06

Subbasin : K


Rainfall Intensity Graph
Rainfall (in/hr)
Time (hrs)


Runoff Hydrograph
Runoff (cfs)
Time (hrs)

4.4 LAG TIME CALCULATIONS

EC Basin Lag Time

Basin	Area AC	TOC MIN	TOC HR	Lag Time HR	Lag Time MIN
A	915.40	53.01	0.88	0.53	31.81
Ba	3836.70	89.56	1.49	0.90	53.74
Bb	100.60	40.00	0.67	0.40	24.00
Ca	162.70	37.20	0.62	0.37	22.32
Cb	70.00	37.42	0.62	0.37	22.45
Da	161.30	36.99	0.62	0.37	22.19
Db	49.90	44.20	0.74	0.44	26.52
Dc	249.70	40.94	0.68	0.41	24.56
Ea	37.90	30.50	0.51	0.31	18.30
Eb	74.60	38.26	0.64	0.38	22.96
F	44.50	37.72	0.63	0.38	22.63
G	107.60	33.93	0.57	0.34	20.36
H	121.80	33.66	0.56	0.34	20.20
I	37.50	31.81	0.53	0.32	19.09
J	10.10	22.93	0.38	0.23	13.76
K	17.80	24.10	0.40	0.24	14.46
	5998.1				

Filing 1 Basin Lag Time

Basin	Area AC	TOC MIN	TOC HR	Lag Time HR	Lag Time MIN
A	915.40	53.01	0.88	0.53	31.81
B1	3836.70	89.56	1.49	0.90	53.74
B2	13.10	24.45	0.41	0.24	14.67
B3	54.90	39.35	0.66	0.39	23.61
B4	41.48	39.51	0.66	0.40	23.71
C1	162.70	37.20	0.62	0.37	22.32
C2	22.40	32.61	0.54	0.33	19.57
C3	16.10	28.38	0.47	0.28	17.03
C4	23.80	41.13	0.69	0.41	24.68
D1.1	161.30	36.99	0.62	0.37	22.19
D1.2	49.90	44.20	0.74	0.44	26.52
D2	68.70	34.83	0.58	0.35	20.90
D3.4.6	167.00	39.37	0.66	0.39	23.62
D5	12.80	30.53	0.51	0.31	18.32
Ea	37.90	30.50	0.51	0.31	18.30
Eb	74.60	38.26	0.64	0.38	22.96
F	44.50	37.72	0.63	0.38	22.63
G	107.60	33.93	0.57	0.34	20.36
H	121.80	33.66	0.56	0.34	20.20
I	37.50	31.81	0.53	0.32	19.09
J	10.10	22.93	0.38	0.23	13.76
K	17.80	24.10	0.40	0.24	14.46
	5998.08				

4.5 INITIAL ABSTRACTION CALCULATIONS

Existing Condition Initial Abstraction Summary

Basin	Area AC	Curve Number	Initial Abstraction
A	915.40	61.83	0.6173
Ba	3836.67	60.34	0.6573
Bb	100.60	69.79	0.4329
Ca	162.70	60.00	0.6667
Cb	70.00	68.70	0.4556
Da	161.30	60.00	0.6667
Db	49.90	60.00	0.6667
Dc	249.70	67.70	0.4771
Ea	37.90	60.00	0.6667
Eb	74.60	67.20	0.4881
F	44.50	69.00	0.4493
G	107.60	74.50	0.3423
H	121.80	71.76	0.3935
I	37.50	79.00	0.2658
J	10.10	69.50	0.4388
K	17.80	76.00	0.3158
	5998.05		

Ia = 0.1[(1000/CN)-10]

Filing 1 Condition Initial Abstraction Summary

Basin	Area AC	Curve Number	Initial Abstraction
A	915.40	61.83	0.6173
B1	3836.67	60.34	0.6573
B2	13.10	64.00	0.5625
B3	54.90	65.10	0.5361
B4	41.48	68.50	0.4599
C1	162.70	60.00	0.6667
C2	22.40	60.00	0.6667
C3	16.10	64.00	0.5625
C4	23.80	65.00	0.5385
D1.1	161.30	60.00	0.6667
D1.2	49.90	60.00	0.6667
D2	68.70	64.75	0.5444
D3,4,6	167.00	66.35	0.5072
D5	12.80	67.20	0.4881
Ea	37.90	60.00	0.6667
Eb	74.60	67.20	0.4881
F	44.50	69.00	0.4493
G	107.60	74.50	0.3423
H	121.80	71.76	0.3935
I	37.50	79.00	0.2658
J	10.10	69.50	0.4388
K	17.80	76.00	0.3158
	5998.05		

Ia = 0.1[(1000/CN)-10]

4.6 BASIN INPUT DETAILS

EC Basin Inputs

Basin	Initial Storage	Max Storage	Initial Abstraction	Curve Number	Impervious	Lag Time
	%	IN	IN		%	Min
A	5.00	0.035	0.617	61.83	6.55	31.80
Ba	5.00	0.035	0.657	60.34	7.00	53.74
Bb	5.00	0.035	0.433	69.79	2.00	24.00
Ca	5.00	0.035	0.667	60.00	7.00	22.32
Cb	5.00	0.035	0.456	68.70	2.00	22.45
Da	5.00	0.035	0.667	60.00	7.00	22.19
Db	5.00	0.035	0.667	60.00	7.00	26.52
Dc	5.00	0.035	0.477	67.70	2.00	24.56
Ea	5.00	0.035	0.667	60.00	7.00	18.30
Eb	5.00	0.035	0.488	67.20	3.00	22.96
F	5.00	0.035	0.449	69.00	2.00	22.63
G	5.00	0.035	0.342	74.50	2.00	20.36
H	5.00	0.035	0.394	71.76	2.00	20.19
I	5.00	0.035	0.266	79.00	2.00	19.08
J	5.00	0.035	0.439	69.50	7.00	13.76
K	5.00	0.035	0.316	76.00	7.00	14.46

Filing 1 Basin Inputs

Basin	Initial Storage	Max Storage	Initial Abstraction	Curve Number	Impervious	Lag Time
	%	IN	IN		%	Min
A	5.00	0.035	0.657	61.83	6.55	31.81
B1	5.00	0.035	0.657	60.34	7.00	53.74
B2	5.00	0.035	0.563	64.00	11.00	14.67
B3	5.00	0.035	0.536	65.10	7.00	23.61
B4	5.00	0.035	0.460	68.50	7.00	23.71
C1	5.00	0.035	0.667	60.00	7.00	22.32
C2	5.00	0.035	0.667	64.00	7.00	19.57
C3	5.00	0.035	0.563	64.00	11.00	17.02
C4	5.00	0.035	0.538	65.00	4.50	24.68
D1.1	5.00	0.035	0.667	60.00	7.00	22.19
D1.2	5.00	0.035	0.667	60.00	7.00	26.52
D2	5.00	0.035	0.544	64.75	9.00	20.89
D3,4,6	5.00	0.035	0.477	66.35	2.00	24.56
D5	5.00	0.035	0.488	67.20	3.00	18.32
Ea	5.00	0.035	0.667	60.00	7.00	18.30
Eb	5.00	0.035	0.488	67.20	3.00	22.96
F	5.00	0.035	0.449	69.00	2.00	22.63
G	5.00	0.035	0.342	74.50	2.00	20.36
H	5.00	0.035	0.394	71.76	2.00	20.19
I	5.00	0.035	0.266	79.00	2.00	19.08
J1	5.00	0.035	0.439	69.50	7.00	13.76
K1	5.00	0.035	0.316	76.00	7.00	14.46

4.7 REACH INPUT DETAILS

EC Reach Inputs

Reach	Length	Slope	Manning's	Shape	Diameter	Bottom Width	Side Slope	Invert
	FT	FT/FT	n		FT	FT	H/V	FT
1	2473.30	0.025	0.04	Trapezoid		20.00	4	7318.5
2	2839.57	0.007	0.04	Trapezoid		20.00	4	7300
3	1717.53	0.012	0.04	Trapezoid		20.00	4	7280
4	1277.36	0.003	0.04	Trapezoid		20.00	4	7280
5	70.66	0.226	0.04	Trapezoid		20.00	4	7260
6	2431.12	0.025	0.04	Triangle			7	7318.5
7	3754.60	0.023	0.04	Triangle			7	7300
8	2431.00	0.025	0.04	Triangle			7	7300
9	5201.60	0.027	0.04	Triangle			7	7276

Filing 1 Reach Inputs

Reach	Length	Slope	Manning's	Shape	Diameter	Bottom Width	Side Slope	Invert
	FT	FT/FT	n		FT	FT	H/V	FT
Reach-B1	2137.84	0.024	0.040	Trapezoid		20.00	4	7334.0
Reach-B2	1548.66	0.034	0.040	Triangle			7	7318.5
Reach-B3	1801.86	0.009	0.040	Trapezoid		20.00	4	7318.5
Reach-B4-3	155.46	0.119	0.040	Triangle			7	7318.5
Reach-C1	799.51	0.020	0.040	Triangle			7	7363.0
Reach-C2	861.57	0.022	0.040	Triangle			7	7341.0
Reach-D1.1	1827.50	0.031	0.040	Trapezoid		8.00	4	7329.0
Reach-D3	1312.44	0.031	0.040	Triangle			7	7372.0
Reach-D4	5540.00	0.029	0.040	Trapezoid		8.00	4	7308.0
Reach-D5	1270.02	0.022	0.040	Trapezoid		8.00	4	7300.0
Reach-Ea	5201.60	0.027	0.040	Triangle			7	7276.0
Reach-P3	264.79	0.026	0.040	Triangle			7	7280.0
Reach-1	866.29	0.009	0.040	Trapezoid		20.00	4	7310.0
Reach-2	1071.31	0.009	0.040	Trapezoid		20.00	4	7300.0
Reach-3	736.36	0.011	0.040	Trapezoid		20.00	4	7292.0
Reach-4	1308.67	0.009	0.040	Trapezoid		20.00	4	7280.0
Reach-5	340.25	0.010	0.040	Trapezoid		20.00	4	7276.0
EX CULV C1	100.00	0.030	0.025	Circle	2.50			7379.0
EX CULV D1.1	100.00	0.030	0.025	Circle	6.00			7385.0
EX CULV D1.2	100.00	0.040	0.025	Circle	2.50			7412.0
CULV B2	63.60	0.005	0.013	Circle	2.00			7371.0
CULV C2	125.30	0.005	0.013	Circle	4.00			7360.0
CULV C3	94.4	0.010	0.013	Circle	4.5			7335.6
CULV D2	160.8	0.006	0.013	Circle	5			7327.5
OUT-1	1089	0.010	0.040	Trapezoid		20	4	7266.0

5.1 BASIN RUNNOFF SUMMARY

Existing Condition 5 Year Storm

Basin	Area SqMiles	Area Acres	Q CFS	Time of Peak	Volume AC-FT
A	1.43031	915.40	87.10	26Feb2019, 12:24	13.50
Ba	5.99480	3836.67	271.50	26Feb2019, 12:46	60.50
Bb	0.15719	100.60	19.20	26Feb2019, 12:20	1.20
Ca	0.25422	162.70	20.70	26Feb2019, 12:14	2.60
Cb	0.10938	70.00	9.90	26Feb2019, 12:18	0.60
Da	0.25203	161.30	20.60	26Feb2019, 12:14	2.50
Db	0.07797	49.90	5.70	26Feb2019, 12:18	0.80
Dc	0.39016	249.70	28.10	26Feb2019, 12:20	2.10
Ea	0.05922	37.90	5.40	26Feb2019, 12:10	0.60
Eb	0.11656	74.60	4.00	26Feb2019, 12:14	0.50
F	0.06953	44.50	6.60	26Feb2019, 12:18	0.40
G	0.16813	107.60	45.30	26Feb2019, 12:14	2.20
H	0.19031	121.80	34.80	26Feb2019, 12:16	1.80
I	0.05859	37.50	26.40	26Feb2019, 12:14	1.20
J	0.01578	10.10	3.40	26Feb2019, 12:10	0.20
K	0.02781	17.80	12.90	26Feb2019, 12:08	0.60
		5998.08			
Reach					
1	5.99480	3836.67	271.40	26Feb2019, 12:50	60.50
2	7.94589	5085.37	348.70	26Feb2019, 12:46	78.40
3	9.02449	5775.68	397.40	26Feb2019, 12:40	87.70
4	9.02449	5775.68	397.20	26Feb2019, 12:46	87.70
(Outlet) 5	9.32840	5970.18	408.40	26Feb2019, 12:44	90.40
6	0.25422	162.70	20.20	26Feb2019, 12:22	2.60
7	0.25203	161.30	20.00	26Feb2019, 12:28	2.50
8	0.07797	49.90	5.60	26Feb2019, 12:30	0.80
9	0.05922	37.90	4.70	26Feb2019, 12:36	0.60

Existing Condition 100 Year Storm

Basin	Area SqMiles	Area Acres	Q CFS	Time of Peak	Volume AC-FT
A	1.43031	915.40	585.60	26Feb2019, 12:26	49.80
Ba	5.99480	3836.67	1448.60	26Feb2019, 12:48	202.50
Bb	0.15719	100.60	127.70	26Feb2019, 12:18	7.20
Ca	0.25422	162.70	127.80	26Feb2019, 12:16	8.50
Cb	0.10938	70.00	88.10	26Feb2019, 12:16	4.60
Da	0.25203	161.30	127.30	26Feb2019, 12:16	8.40
Db	0.07797	49.90	34.10	26Feb2019, 12:20	2.60
Dc	0.39016	249.70	275.70	26Feb2019, 12:18	15.50
Ea	0.05922	37.90	34.80	26Feb2019, 12:12	2.00
Eb	0.11656	74.60	85.80	26Feb2019, 12:16	4.70
F	0.06953	44.50	56.60	26Feb2019, 12:16	3.00
G	0.16813	107.60	199.00	26Feb2019, 12:14	12.70
H	0.19031	121.80	197.20	26Feb2019, 12:14	10.10
I	0.05859	37.50	88.40	26Feb2019, 12:12	6.30
J	0.01578	10.10	19.90	26Feb2019, 12:08	0.90
K	0.02781	17.80	45.10	26Feb2019, 12:08	2.60
		5998.08			
Reach					
1	5.99480	3836.67	1448.40	26Feb2019, 12:50	202.40
2	7.94589	5085.37	1963.80	26Feb2019, 12:42	272.40
3	9.02449	5775.68	2352.40	26Feb2019, 12:36	321.70
4	9.02449	5775.68	2351.40	26Feb2019, 12:38	321.60
(Outlet) 5	9.32840	5970.18	2469.70	26Feb2019, 12:36	337.70
6	0.25422	162.70	127.50	26Feb2019, 12:22	8.50
7	0.25203	161.30	126.30	26Feb2019, 12:26	8.40
8	0.07797	49.90	34.00	26Feb2019, 12:28	2.60
9	0.05922	37.90	33.70	26Feb2019, 12:28	2.00

Filing 1 Condition 5 Year Storm

Basin	Area SqMiles	Area Acres	Q CFS	Time of Peak	Volume AC-FT
A	1.4303	915.40	87.1	26Feb2019, 12:24	13.5
B1	5.9948	3836.67	271.5	26Feb2019, 12:46	60.5
B2	0.0205	13.10	3.3	26Feb2019, 12:06	0.3
B3	0.0858	54.90	6.7	26Feb2019, 12:16	0.9
B4	0.0648	41.48	8.8	26Feb2019, 12:18	0.8
C1	0.2542	162.70	20.7	26Feb2019, 12:14	2.6
C2	0.0350	22.40	3.1	26Feb2019, 12:12	0.4
C3	0.0252	16.10	3.7	26Feb2019, 12:08	0.4
C4	0.0372	23.80	1.8	26Feb2019, 12:16	0.2
D1.1	0.2520	161.30	20.6	26Feb2019, 12:14	2.5
D1.2	0.0780	49.90	5.7	26Feb2019, 12:18	0.8
D2	0.1073	68.70	11.7	26Feb2019, 12:12	1.4
D3,4,6 A	0.1658	106.10	3.7	26Feb2019, 12:16	0.5
D5	0.0361	23.10	1.4	26Feb2019, 12:10	0.2
Ea	0.0592	37.90	5.4	26Feb2019, 12:10	0.6
Eb	0.1956	125.20	6.7	26Feb2019, 12:14	0.8
F	0.0695	44.50	6.6	26Feb2019, 12:18	0.4
G	0.1681	107.60	45.3	26Feb2019, 12:14	2.2
H	0.1903	121.80	34.8	26Feb2019, 12:16	1.8
I	0.0586	37.50	26.4	26Feb2019, 12:14	1.2
J	0.0158	10.10	3.4	26Feb2019, 12:10	0.2
K	0.0278	17.80	12.9	26Feb2019, 12:08	0.6
		5998.04			

Reach					
OUT-1	9.3283	5970.14	383.0	26Feb2019, 12:46	91.9
EX CULV C1	0.2542	162.70	20.7	26Feb2019, 12:14	2.6
EX CULV D1.1	0.2520	161.30	20.6	26Feb2019, 12:14	2.5
EX CULV D1.2	0.0780	49.90	5.7	26Feb2019, 12:18	0.8
CULV B2	0.0205	13.10	3.3	26Feb2019, 12:06	0.3
CULV C2	0.2892	185.10	23.4	26Feb2019, 12:16	2.9
CULV C3	0.3144	201.20	26.1	26Feb2019, 12:18	3.3
CULV D2	0.3594	230.00	31.2	26Feb2019, 12:18	3.9
Reach-B1	5.9948	3836.67	271.3	26Feb2019, 12:50	60.5
Reach-B2	0.0205	13.10	3.2	26Feb2019, 12:14	0.3
Reach-B3	6.0806	3891.57	273.4	26Feb2019, 12:54	61.4
Reach-C1	0.2542	162.70	20.6	26Feb2019, 12:18	2.6
Reach-C2	0.2892	185.10	23.4	26Feb2019, 12:20	2.9
Reach-C4	0.3144	201.20	26.0	26Feb2019, 12:18	3.3
Reach-D1.1	0.2520	161.30	20.6	26Feb2019, 12:20	2.5

Filing 1 Condition 100 Year Storm

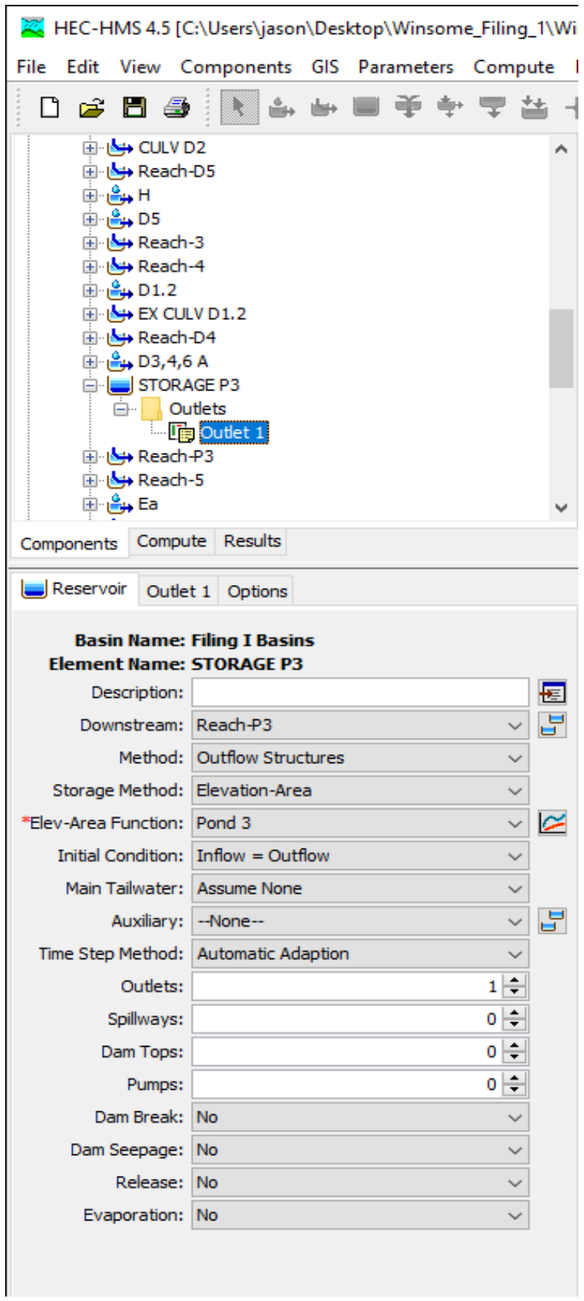
Basin	Area SqMiles	Area Acres	Q CFS	Time of Peak	Volume AC-FT
A	1.4303	915.40	585.6	26Feb2019, 12:26	49.8
B1	5.9948	3836.67	1448.6	26Feb2019, 12:48	202.5
B2	0.0205	13.10	19.9	26Feb2019, 12:08	1.0
B3	0.0858	54.90	57.9	26Feb2019, 12:18	3.7
B4	0.0648	41.48	53.1	26Feb2019, 12:18	3.4
C1	0.2542	162.70	127.8	26Feb2019, 12:16	8.5
C2	0.0350	22.40	23.7	26Feb2019, 12:14	1.3
C3	0.0252	16.10	22.1	26Feb2019, 12:10	1.3
C4	0.0372	23.80	22.9	26Feb2019, 12:18	1.4
D1.1	0.2520	161.30	127.3	26Feb2019, 12:16	8.4
D1.2	0.0780	49.90	34.1	26Feb2019, 12:20	2.6
D2	0.1073	68.70	81.2	26Feb2019, 12:14	5.0
D3,4,6 A	0.1658	106.10	111.4	26Feb2019, 12:18	6.0
D5	0.0361	23.10	31.6	26Feb2019, 12:12	1.5
Ea	0.0592	37.90	34.8	26Feb2019, 12:12	2.0
Eb	0.1956	125.20	143.9	26Feb2019, 12:16	7.9
F	0.0695	44.50	56.6	26Feb2019, 12:16	3.0
G	0.1681	107.60	199.0	26Feb2019, 12:14	12.7
H	0.1903	121.80	197.2	26Feb2019, 12:14	10.1
I	0.0586	37.50	88.4	26Feb2019, 12:12	6.3
J	0.0158	10.10	19.9	26Feb2019, 12:08	0.9
K	0.0278	17.80	45.1	26Feb2019, 12:08	2.6
		5998.04			

Reach					
OUT-1	9.3283	5970.14	2294.1	26Feb2019, 12:36	338.3
EX CULV C1	0.2542	162.70	127.7	26Feb2019, 12:16	8.5
EX CULV D1.1	0.2520	161.30	127.2	26Feb2019, 12:16	8.4
EX CULV D1.2	0.0780	49.90	34.0	26Feb2019, 12:20	2.6
CULV B2	0.0205	13.10	19.9	26Feb2019, 12:08	1.0
CULV C2	0.2892	185.10	149.7	26Feb2019, 12:18	9.8
CULV C3	0.3144	201.20	165.8	26Feb2019, 12:18	11.1
CULV D2	0.3594	230.00	203.5	26Feb2019, 12:18	13.4
Reach-B1	5.9948	3836.67	1448.5	26Feb2019, 12:50	202.5
Reach-B2	0.0205	13.10	19.7	26Feb2019, 12:14	1.0
Reach-B3	6.0806	3891.57	1460.9	26Feb2019, 12:52	206.1
Reach-C1	0.2542	162.70	127.7	26Feb2019, 12:18	8.5
Reach-C2	0.2892	185.10	149.6	26Feb2019, 12:20	9.8
Reach-C4	0.3144	201.20	165.4	26Feb2019, 12:18	11.1
Reach-D1.1	0.2520	161.30	126.7	26Feb2019, 12:20	8.4

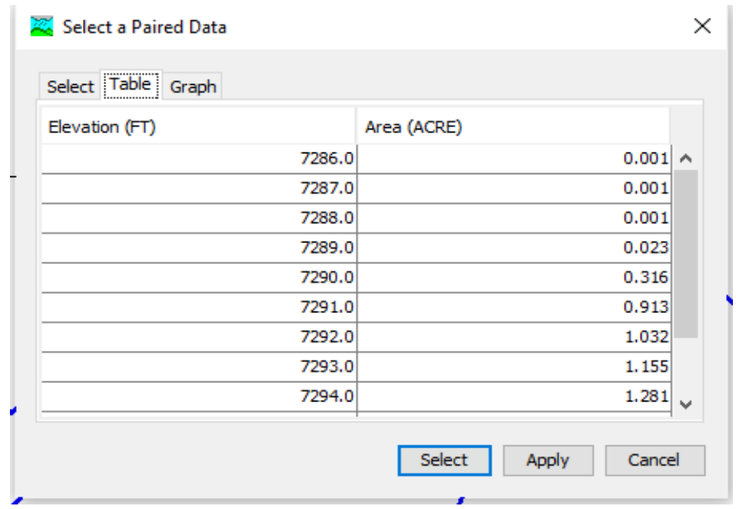
Reach-D4	0.0780	49.90	5.4	26Feb2019, 12:30	0.8
Reach-D5	0.3594	230.00	31.1	26Feb2019, 12:22	3.9
Reach-Ea	0.0592	37.90	4.8	26Feb2019, 12:38	0.6
Reach-P3	0.2437	156.00	7.0	26Feb2019, 12:38	1.3
Reach-1	7.9105	5062.75	334.8	26Feb2019, 12:46	79.4
Reach-2	8.1159	5194.15	342.8	26Feb2019, 12:46	81.8
Reach-3	8.7016	5569.04	365.5	26Feb2019, 12:44	87.6
Reach-4	8.7016	5569.04	365.4	26Feb2019, 12:46	87.6
Reach-5	8.9454	5725.04	372.0	26Feb2019, 12:46	88.9

Reach-D4	0.0780	49.90	32.30	26Feb2019, 12:38	2.6
Reach-D5	0.3594	230.00	202.9	26Feb2019, 12:20	13.4
Reach-Ea	0.0592	37.90	34.8	26Feb2019, 12:28	2.0
Reach-P3	0.2437	156.00	18.3	26Feb2019, 13:04	8.6
Reach-1	7.9105	5062.75	1872.9	26Feb2019, 12:42	271.4
Reach-2	8.1159	5194.15	1941.9	26Feb2019, 12:42	285.5
Reach-3	8.7016	5569.04	2106.5	26Feb2019, 12:38	310.4
Reach-4	8.7016	5569.04	2106.0	26Feb2019, 12:40	310.5
Reach-5	8.9454	5725.04	2123.4	26Feb2019, 12:40	319.1

Pond 3 Design Criteria

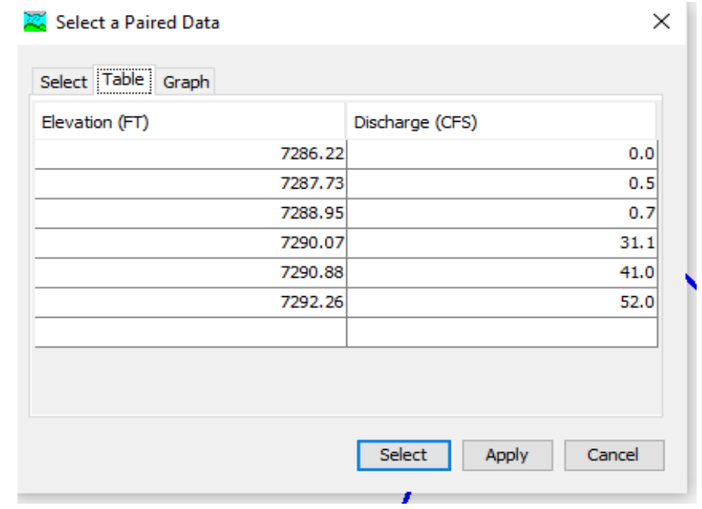


Elevation Area

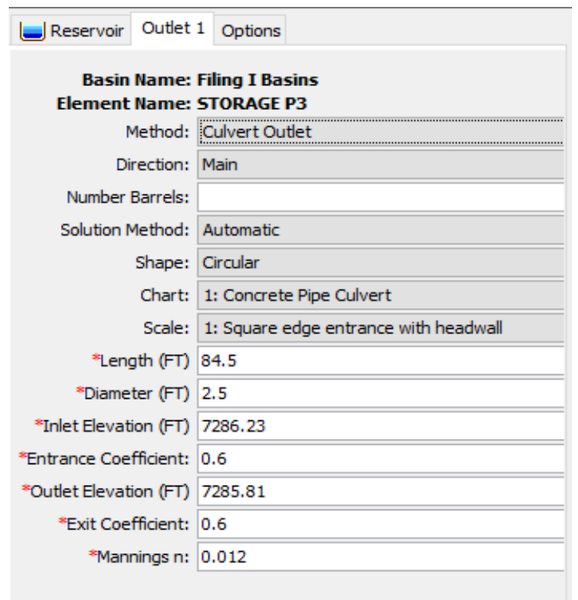


Elevation (FT)	Area (ACRE)
7286.0	0.001
7287.0	0.001
7288.0	0.001
7289.0	0.023
7290.0	0.316
7291.0	0.913
7292.0	1.032
7293.0	1.155
7294.0	1.281

Elevation Discharge

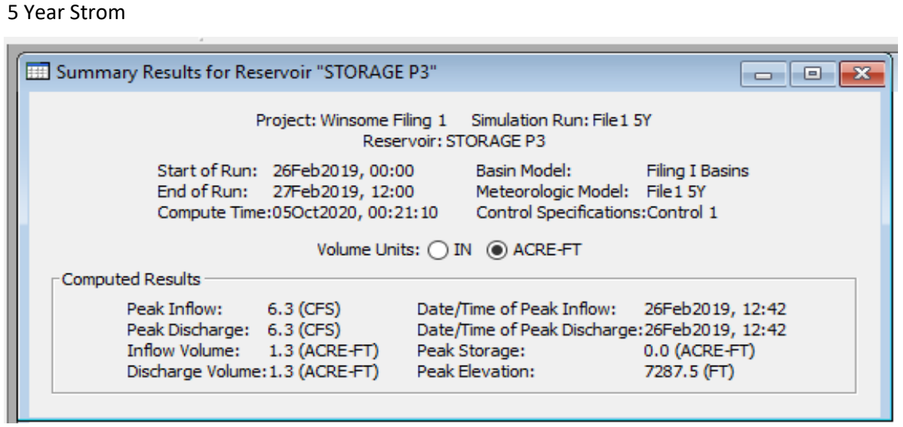


Elevation (FT)	Discharge (CFS)
7286.22	0.0
7287.73	0.5
7288.95	0.7
7290.07	31.1
7290.88	41.0
7292.26	52.0

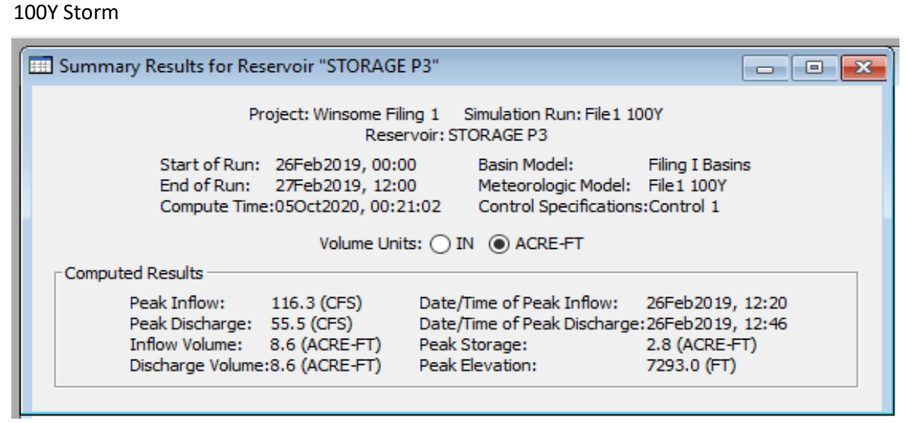


Pond 3 Performance Criteria

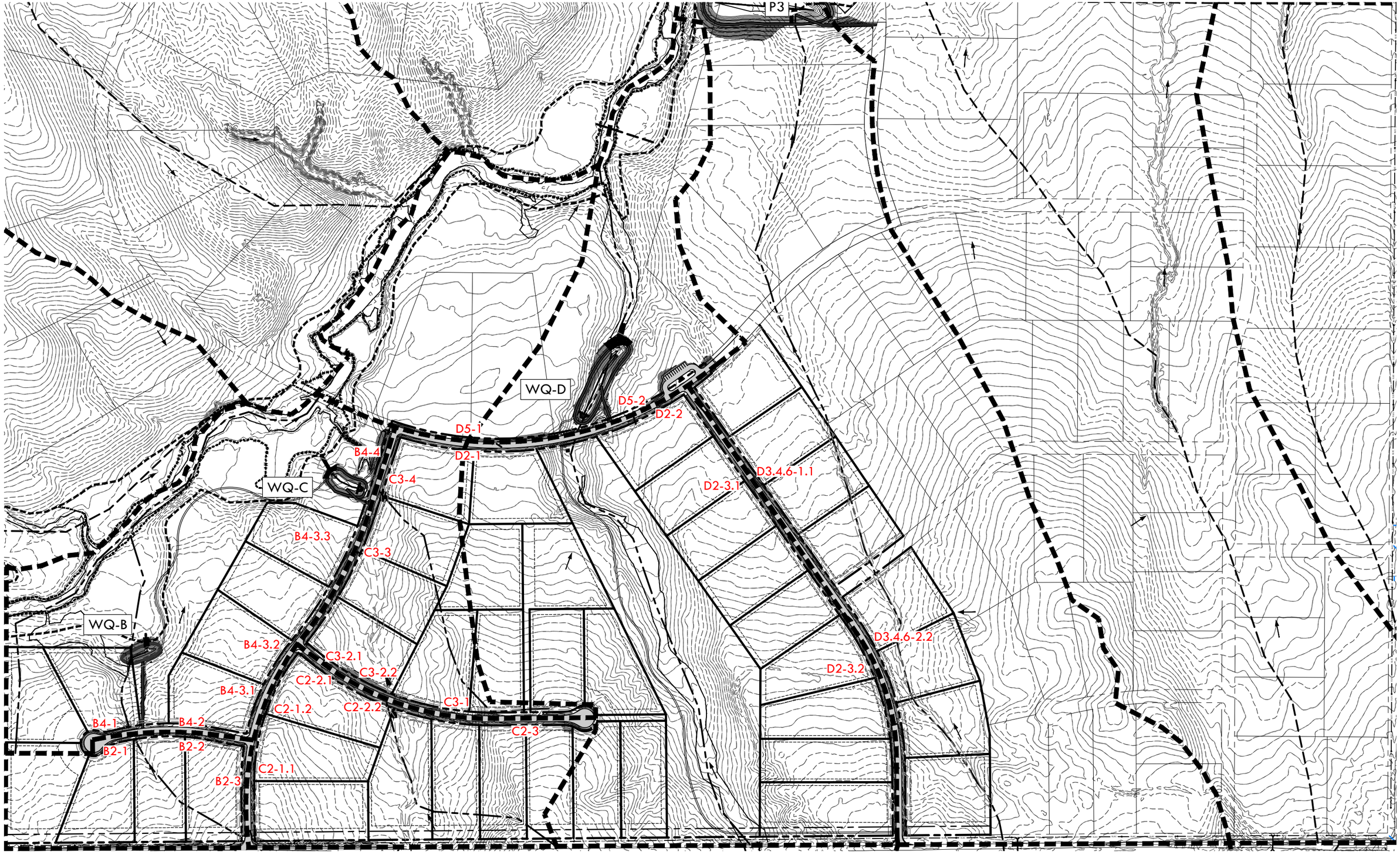
5 Year Strom



100Y Storm



6.0 DITCH CAPACITY AND VELOCITY STUDY


P3
WQ-D
D5-2
D2-2
D5-1
D2-1
B4-4
C3-4
WQ-C
D2-3.1
D3.4.6-1.1
B4-3.3
C3-3
WQ-B
D3.4.6-2.2
B4-3.2
C3-2.1
C3-2.2
D2-3.2
C2-2.1
B4-3.1
C2-1.2
C2-2.2
C3-1
B4-1
B4-2
C2-3
B2-1
B2-2
C2-1.1
B2-3

ROADSIDE DITCH Q 100Y VALUES

DITCH SECTION DESIGNATOR	START STATION (FT)	END STATION (FT)	LENGTH (FT)	GRADE %	WATER SHED FROM ROAD	FRACTION OF BASIN FLOW	BASIN DESIGNATOR	BASIN 100Y Q (CFS)	DITCH FRACTION OF Q %	DITCH 100Y Q FROM BASIN (CFS)	ROAD WATERSHED 100Y Q (CFS)	CONNECTING DITCH 100Y Q (CFS)	TOTAL 100Y Q IN DITCH SECTION (CFS)	AVERAGE VELCITY (FPS)	MAX SHEER (LB/FT^2)
WINSOME WAY															
B2-3	+32	5+14	482'	4.83%	X		B2			-	1.69		1.69	3.00	1.13
B4-3.1	5+14	6+60	146'	3.85%	X		B4			-	0.51		0.51	3.52	1.36
B4-3.2	6+60	9+50	290'	7.89%	X		B5			-	1.01	0.51	1.52	3.51	1.62
B4-3.3	9+50	18+00	850'	3.22%	X		B6			-	2.97	1.52	4.50	3.29	1.18
B4-4	18+00	20+96	296'	1.00%	X		B4			-	1.03		1.03	1.47	0.26
C2-1.1	+32	6+10	578'	3.85%	X		C2			-	2.02		2.02	2.65	1.01
C2-1.2	6+10	10+17	407'	7.89%	X		C2			-	1.42	2.02	3.44	4.30	2.90
C3-3	10+17	18+00	783'	3.22%	X		C3			-	2.74	6.45	9.19	3.93	1.54
C3-4	18+00	20+96	296'	1.00%	X		C4			-	1.03		1.03	1.47	0.26
ALAMAR WAY															
C3-5	70+00	78+93	893'	1.43%	X	X	C3	22.1	10%	2.21	3.12		5.33	2.42	0.60
D2-1	78+93	84+31	538'	3.72%	X	X	D2	81.3	2%	1.63	1.88		3.51	3.39	1.27
D5-1	78+93	84+31	538'	3.72%	X		D5			-	1.88		1.88	2.79	0.95
C4-1	70+00	78+93	893'	1.43%	X		C4			-	3.12		3.12	2.21	0.53
BISON MEADOWS COURT															
D2-3.1	+8	5+50	542'	1.37%	X	X		81.3	1%	0.81	1.90	7.29	10.00	2.92	0.79
D2-3.2	5+50	24+02	1852'	3.47%	X	X		81.3	1%	0.81	6.48		7.29	3.82	1.50
D3.4.6-1.1	5+50	24+02	1852'	3.47%	X					-	6.48		6.48	3.71	1.43
D3.4.6-2.2	+8	5+50	542'	1.37%	X					-	1.90	6.48	8.37	2.79	0.74
CLOVE HITCH COURT															
B2-1	+14	5+80	566'	5.34%			B2	19.9	10%	1.99	1.98		3.97	3.85	1.69
B2-2	5+80	7+82	202'	1.13%			B2	19.9	20%	3.98	0.71		4.69	2.37	0.57
B4-1	5+80	7+82	202'	1.13%			B4	53.1		-	0.71		0.71	1.48	0.28
B4-2	+14	5+80	566'	5.34%			B4	53.1		-	1.98		1.98	3.24	1.30
MOSEY TRAIL															
C2-2.1	+14	2+74	260'	1.43%	X	X	C2	23.7	5%	1.19	0.91		2.09	2.00	0.46
C2-2.2	2+74	5+25	251'	1.03%	X	X	C2	23.7	10%	2.37	0.88		3.25	2.16	0.50
C2-3	5+25	14+60	935'	7.03%	X	X	C2	23.7	40%	9.48	3.27		12.75	3.34	4.45
C3-1	5+25	14+60	935'	7.03%	X		C3	22.1		-	3.27		3.27	2.38	2.67
C3-2.1	2+74	5+25	251'	1.03%	X		C3	22.1		-	0.88		0.88	1.56	0.31
C3-2.2	+14	2+74	260'	1.43%	X		C3	22.1		-	0.91		0.91	2.26	0.33

Q PER FOOT FOR 1' X 20' (HALF OF ROAD SECTION TO DITCH X 1' WIDE) = 0.00349671716220391

Hydraulic Analysis Report

Project Data

Project Title: Winsome Filing 1

Designer:

Project Date: Tuesday, April 14, 2020

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Winsome Way B4-3.3

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0322 ft/ft

Manning's n: 0.0350

Flow: 4.5000 cfs

Result Parameters

Depth: 0.5848 ft

Area of Flow: 1.3681 ft^2

Wetted Perimeter: 4.8226 ft

Hydraulic Radius: 0.2837 ft

Average Velocity: 3.2893 ft/s

Top Width: 4.6786 ft

Froude Number: 1.0719

Critical Depth: 0.6013 ft

Critical Velocity: 3.1114 ft/s

Critical Slope: 0.0278 ft/ft

Critical Top Width: 4.81 ft

Calculated Max Shear Stress: 1.1751 lb/ft^2

Calculated Avg Shear Stress: 0.5700 lb/ft^2

Channel Analysis: Winsome Way B4-3.2

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0789 ft/ft

Manning's n: 0.0350

Flow: 1.5200 cfs

Result Parameters

Depth: 0.3291 ft

Area of Flow: 0.4331 ft^2

Wetted Perimeter: 2.7136 ft

Hydraulic Radius: 0.1596 ft

Average Velocity: 3.5093 ft/s

Top Width: 2.6325 ft

Froude Number: 1.5246

Critical Depth: 0.3895 ft

Critical Velocity: 2.5043 ft/s

Critical Slope: 0.0321 ft/ft

Critical Top Width: 3.12 ft

Calculated Max Shear Stress: 1.6201 lb/ft^2

Calculated Avg Shear Stress: 0.7859 lb/ft^2

Channel Analysis: Winsome Way B4-3.1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0385 ft/ft

Manning's n: 0.0350

Flow: 0.5100 cfs

Result Parameters

Depth: 0.2500 ft

Area of Flow: 0.2499 ft^2

Wetted Perimeter: 2.0612 ft

Hydraulic Radius: 0.1212 ft

Average Velocity: 2.0408 ft/s

Top Width: 1.9996 ft

Froude Number: 1.0173

Critical Depth: 0.2517 ft

Critical Velocity: 2.0129 ft/s

Critical Slope: 0.0371 ft/ft

Critical Top Width: 2.01 ft

Calculated Max Shear Stress: 0.6005 lb/ft^2

Calculated Avg Shear Stress: 0.2913 lb/ft^2

Channel Analysis: Clove Hitch Court B2-2

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0113 ft/ft

Manning's n: 0.0350

Flow: 4.6900 cfs

Result Parameters

Depth: 0.7228 ft

Area of Flow: 2.0899 ft^2

Wetted Perimeter: 5.9606 ft

Hydraulic Radius: 0.3506 ft

Average Velocity: 2.2441 ft/s

Top Width: 5.7826 ft

Froude Number: 0.6578

Critical Depth: 0.6113 ft

Critical Velocity: 3.1373 ft/s

Critical Slope: 0.0276 ft/ft

Critical Top Width: 4.89 ft

Calculated Max Shear Stress: 0.5097 lb/ft^2

Calculated Avg Shear Stress: 0.2472 lb/ft^2

Channel Analysis: Clove Hitch Court B2-1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0534 ft/ft

Manning's n: 0.0350

Flow: 3.9700 cfs

Result Parameters

Depth: 0.5075 ft

Area of Flow: 1.0302 ft^2

Wetted Perimeter: 4.1849 ft

Hydraulic Radius: 0.2462 ft

Average Velocity: 3.8537 ft/s

Top Width: 4.0599 ft

Froude Number: 1.3482

Critical Depth: 0.5719 ft

Critical Velocity: 3.0344 ft/s

Critical Slope: 0.0282 ft/ft

Critical Top Width: 4.58 ft

Calculated Max Shear Stress: 1.6910 lb/ft^2

Calculated Avg Shear Stress: 0.8203 lb/ft^2

Channel Analysis: Winsome Way B2-3

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0483 ft/ft

Manning's n: 0.0350

Flow: 1.6900 cfs

Result Parameters

Depth: 0.3754 ft

Area of Flow: 0.5637 ft^2

Wetted Perimeter: 3.0958 ft

Hydraulic Radius: 0.1821 ft

Average Velocity: 2.9978 ft/s

Top Width: 3.0033 ft

Froude Number: 1.2194

Critical Depth: 0.4064 ft

Critical Velocity: 2.5580 ft/s

Critical Slope: 0.0316 ft/ft

Critical Top Width: 3.25 ft

Calculated Max Shear Stress: 1.1315 lb/ft^2

Calculated Avg Shear Stress: 0.5488 lb/ft^2

Channel Analysis: Winsome Way C2-1.1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0385 ft/ft

Manning's n: 0.0350

Flow: 2.2000 cfs

Result Parameters

Depth: 0.4324 ft

Area of Flow: 0.7480 ft^2

Wetted Perimeter: 3.5660 ft

Hydraulic Radius: 0.2098 ft

Average Velocity: 2.9411 ft/s

Top Width: 3.4595 ft

Froude Number: 1.1146

Critical Depth: 0.4516 ft

Critical Velocity: 2.6965 ft/s

Critical Slope: 0.0305 ft/ft

Critical Top Width: 3.61 ft

Calculated Max Shear Stress: 1.0389 lb/ft^2

Calculated Avg Shear Stress: 0.5039 lb/ft^2

Channel Analysis: Winsome Way C2-1.2

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0789 ft/ft

Manning's n: 0.0350

Flow: 3.4400 cfs

Result Parameters

Depth: 0.4470 ft

Area of Flow: 0.7992 ft^2

Wetted Perimeter: 3.6860 ft

Hydraulic Radius: 0.2168 ft

Average Velocity: 4.3042 ft/s

Top Width: 3.5760 ft

Froude Number: 1.6045

Critical Depth: 0.5401 ft

Critical Velocity: 2.9487 ft/s

Critical Slope: 0.0288 ft/ft

Critical Top Width: 4.32 ft

Calculated Max Shear Stress: 2.2007 lb/ft^2

Calculated Avg Shear Stress: 1.0675 lb/ft^2

Channel Analysis: Mosey Trail C2-2.1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0143 ft/ft

Manning's n: 0.0350

Flow: 2.0900 cfs

Result Parameters

Depth: 0.5108 ft

Area of Flow: 1.0435 ft^2

Wetted Perimeter: 4.2119 ft

Hydraulic Radius: 0.2478 ft

Average Velocity: 2.0028 ft/s

Top Width: 4.0861 ft

Froude Number: 0.6984

Critical Depth: 0.4425 ft

Critical Velocity: 2.6690 ft/s

Critical Slope: 0.0308 ft/ft

Critical Top Width: 3.54 ft

Calculated Max Shear Stress: 0.4558 lb/ft^2

Calculated Avg Shear Stress: 0.2211 lb/ft^2

Channel Analysis: Mosey Trail C2-2.2

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0103 ft/ft

Manning's n: 0.0350

Flow: 3.2500 cfs

Result Parameters

Depth: 0.6410 ft

Area of Flow: 1.6434 ft^2

Wetted Perimeter: 5.2856 ft

Hydraulic Radius: 0.3109 ft

Average Velocity: 1.9776 ft/s

Top Width: 5.1278 ft

Froude Number: 0.6156

Critical Depth: 0.5279 ft

Critical Velocity: 2.9154 ft/s

Critical Slope: 0.0290 ft/ft

Critical Top Width: 4.22 ft

Calculated Max Shear Stress: 0.4120 lb/ft^2

Calculated Avg Shear Stress: 0.1998 lb/ft^2

Channel Analysis: Mosey Trail C2-3

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0703 ft/ft

Manning's n: 0.0350

Flow: 12.7500 cfs

Result Parameters

Depth: 0.7465 ft

Area of Flow: 2.2293 ft^2

Wetted Perimeter: 6.1562 ft

Hydraulic Radius: 0.3621 ft

Average Velocity: 5.7192 ft/s

Top Width: 5.9724 ft

Froude Number: 1.6497

Critical Depth: 0.9120 ft

Critical Velocity: 3.8320 ft/s

Critical Slope: 0.0242 ft/ft

Critical Top Width: 7.30 ft

Calculated Max Shear Stress: 3.2749 lb/ft^2

Calculated Avg Shear Stress: 1.5886 lb/ft^2

Channel Analysis: Winsome Way C3-3

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0322 ft/ft

Manning's n: 0.0350

Flow: 9.1900 cfs

Result Parameters

Depth: 0.7644 ft

Area of Flow: 2.3372 ft^2

Wetted Perimeter: 6.3033 ft

Hydraulic Radius: 0.3708 ft

Average Velocity: 3.9321 ft/s

Top Width: 6.1151 ft

Froude Number: 1.1209

Critical Depth: 0.8001 ft

Critical Velocity: 3.5891 ft/s

Critical Slope: 0.0252 ft/ft

Critical Top Width: 6.40 ft

Calculated Max Shear Stress: 1.5359 lb/ft^2

Calculated Avg Shear Stress: 0.7450 lb/ft^2

Channel Analysis: Winsome Way C3-4

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0350

Flow: 1.0300 cfs

Result Parameters

Depth: 0.4189 ft

Area of Flow: 0.7019 ft^2

Wetted Perimeter: 3.4543 ft

Hydraulic Radius: 0.2032 ft

Average Velocity: 1.4674 ft/s

Top Width: 3.3512 ft

Froude Number: 0.5651

Critical Depth: 0.3334 ft

Critical Velocity: 2.3168 ft/s

Critical Slope: 0.0338 ft/ft

Critical Top Width: 2.67 ft

Calculated Max Shear Stress: 0.2614 lb/ft^2

Calculated Avg Shear Stress: 0.1268 lb/ft^2

Channel Analysis: Alamar Way D2-1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0143 ft/ft

Manning's n: 0.0350

Flow: 5.1500 cfs

Result Parameters

Depth: 0.7163 ft

Area of Flow: 2.0524 ft^2

Wetted Perimeter: 5.9068 ft

Hydraulic Radius: 0.3475 ft

Average Velocity: 2.5093 ft/s

Top Width: 5.7304 ft

Froude Number: 0.7389

Critical Depth: 0.6346 ft

Critical Velocity: 3.1965 ft/s

Critical Slope: 0.0273 ft/ft

Critical Top Width: 5.08 ft

Calculated Max Shear Stress: 0.6392 lb/ft^2

Calculated Avg Shear Stress: 0.3100 lb/ft^2

Channel Analysis: Alamar Way D2-2

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0372 ft/ft

Manning's n: 0.0350

Flow: 3.5100 cfs

Result Parameters

Depth: 0.5186 ft

Area of Flow: 1.0757 ft^2

Wetted Perimeter: 4.2762 ft

Hydraulic Radius: 0.2515 ft

Average Velocity: 3.2631 ft/s

Top Width: 4.1486 ft

Froude Number: 1.1293

Critical Depth: 0.5444 ft

Critical Velocity: 2.9606 ft/s

Critical Slope: 0.0287 ft/ft

Critical Top Width: 4.36 ft

Calculated Max Shear Stress: 1.2037 lb/ft^2

Calculated Avg Shear Stress: 0.5839 lb/ft^2

Channel Analysis: Bison Meadows Court D2-3.1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0137 ft/ft

Manning's n: 0.0350

Flow: 10.1700 cfs

Result Parameters

Depth: 0.9320 ft

Area of Flow: 3.4743 ft^2

Wetted Perimeter: 7.6853 ft

Hydraulic Radius: 0.4521 ft

Average Velocity: 2.9272 ft/s

Top Width: 7.4558 ft

Froude Number: 0.7557

Critical Depth: 0.8332 ft

Critical Velocity: 3.6625 ft/s

Critical Slope: 0.0249 ft/ft

Critical Top Width: 6.67 ft

Calculated Max Shear Stress: 0.7967 lb/ft^2

Calculated Avg Shear Stress: 0.3865 lb/ft^2

Channel Analysis: Bison Meadows Court D2-3.2

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0347 ft/ft

Manning's n: 0.0350

Flow: 7.2900 cfs

Result Parameters

Depth: 0.6910 ft

Area of Flow: 1.9102 ft^2

Wetted Perimeter: 5.6985 ft

Hydraulic Radius: 0.3352 ft

Average Velocity: 3.8164 ft/s

Top Width: 5.5284 ft

Froude Number: 1.1442

Critical Depth: 0.7293 ft

Critical Velocity: 3.4266 ft/s

Critical Slope: 0.0260 ft/ft

Critical Top Width: 5.83 ft

Calculated Max Shear Stress: 1.4963 lb/ft^2

Calculated Avg Shear Stress: 0.7258 lb/ft^2

Channel Analysis: Bison Meadows Court D3.4.6-1.1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0347 ft/ft

Manning's n: 0.0350

Flow: 6.4800 cfs

Result Parameters

Depth: 0.6612 ft

Area of Flow: 1.7487 ft^2

Wetted Perimeter: 5.4523 ft

Hydraulic Radius: 0.3207 ft

Average Velocity: 3.7057 ft/s

Top Width: 5.2895 ft

Froude Number: 1.1358

Critical Depth: 0.6957 ft

Critical Velocity: 3.3468 ft/s

Critical Slope: 0.0264 ft/ft

Critical Top Width: 5.57 ft

Calculated Max Shear Stress: 1.4317 lb/ft^2

Calculated Avg Shear Stress: 0.6945 lb/ft^2

Channel Analysis: Bison Meadows Court D3.4.6-2.2

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0137 ft/ft

Manning's n: 0.0350

Flow: 8.5500 cfs

Result Parameters

Depth: 0.8733 ft

Area of Flow: 3.0504 ft^2

Wetted Perimeter: 7.2011 ft

Hydraulic Radius: 0.4236 ft

Average Velocity: 2.8029 ft/s

Top Width: 6.9861 ft

Froude Number: 0.7475

Critical Depth: 0.7773 ft

Critical Velocity: 3.5376 ft/s

Critical Slope: 0.0255 ft/ft

Critical Top Width: 6.22 ft

Calculated Max Shear Stress: 0.7465 lb/ft^2

Calculated Avg Shear Stress: 0.3621 lb/ft^2

Channel Analysis: Winsome Way B4-4

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0350

Flow: 1.0300 cfs

Result Parameters

Depth: 0.4189 ft

Area of Flow: 0.7019 ft^2

Wetted Perimeter: 3.4543 ft

Hydraulic Radius: 0.2032 ft

Average Velocity: 1.4674 ft/s

Top Width: 3.3512 ft

Froude Number: 0.5651

Critical Depth: 0.3334 ft

Critical Velocity: 2.3168 ft/s

Critical Slope: 0.0338 ft/ft

Critical Top Width: 2.67 ft

Calculated Max Shear Stress: 0.2614 lb/ft^2

Calculated Avg Shear Stress: 0.1268 lb/ft^2

7.1 DRIVEWAY CULVERT ANALYSIS

DRIVEWAY CULVERT SIZING							
LOT	STREET NAME	DITCH SECTION DESIGNATOR	START STATION	END STATION	GRADE	TOTAL 100Y Q IN DITCH SECTION	REQUIRED CULVERT SIZE (INCH)
			(FT)	(FT)	%	(CFS)	
1	WINSOME WAY	B4-3.3	9+50	18+00	3.22%	0.00	18
2	WINSOME WAY	B4-3.3	9+50	18+00	3.22%	0.00	18
3	WINSOME WAY	B4-3.2	6+60	9+50	7.89%	0.00	18
		B4-3.3	9+50	18+00	3.22%	0.00	18
4	WINSOME WAY	B4-3.1	5+14	6+60	3.85%	0.00	18
		B4-3.2	6+60	9+50	7.89%	0.00	18
	CLOVE HITCH COURT	N/A	5+80	7+82	1.13%		N/A
		N/A	+14	5+80	5.34%		N/A
5	CLOVE HITCH COURT	N/A	5+80	7+82	1.13%		N/A
6	CLOVE HITCH COURT	N/A	5+80	7+82	1.13%		N/A
7	CLOVE HITCH COURT	B2-2	5+80	7+82	1.13%	3.98	18
8	CLOVE HITCH COURT	B2-2	5+80	7+82	1.13%	3.98	18
9*	CLOVE HITCH COURT	B2-1	+14	5+80	5.34%	1.99	18
10	WINSOME WAY	B2-3	+32	5+14	4.83%	0.00	18
	CLOVE HITCH COURT	B2-1	+14	5+80	5.34%	1.99	18
11	WINSOME WAY	C2-1.1	+32	6+10	3.85%	0.00	18
12	WINSOME WAY	C2-1.1	+32	6+10	3.85%	0.00	18
	WINSOME WAY	C2-1.2	6+10	10+17	7.89%	0.00	18
13	WINSOME WAY	C2-1.2	6+10	10+17	7.89%	0.00	18
	MOSEY TRAIL	C2-2.1	+14	2+74	1.43%	1.19	18
14*	MOSEY TRAIL	C2-2.2	2+74	5+25	1.03%	2.37	18
15	MOSEY TRAIL	C2-3	5+25	14+60	7.03%	9.48	18
16	MOSEY TRAIL	C2-3	5+25	14+60	7.03%	9.48	18
17	MOSEY TRAIL	C2-3	5+25	14+60	7.03%	9.48	18
18	MOSEY TRAIL	C2-3	5+25	14+60	7.03%	9.48	18
19	MOSEY TRAIL	C2-3	5+25	14+60	7.03%	9.48	18
20	MOSEY TRAIL	N/A	5+25	14+60	7.03%		N/A
21	MOSEY TRAIL	N/A	5+25	14+60	7.03%		N/A
23	MOSEY TRAIL	N/A	5+25	14+60	7.03%		N/A
		N/A	2+74	5+25	1.03%		N/A
24*	WINSOME WAY	C3-3	10+17	18+00	3.22%	1.19	18
	MOSEY TRAIL	N/A	2+74	5+25	1.03%		N/A
		N/A	+14	2+74	1.43%		N/A
25*	WINSOME WAY	C3-3	10+17	18+00	3.22%	1.19	18
26*	WINSOME WAY	C3-3	10+17	18+00	3.22%	1.19	18
27	WINSOME WAY	C3-3	10+17	18+00	3.22%	1.19	18
		C3-4	18+00	20+96	1.00%	0.00	18
	ALAMAR WAY	D2-1	70+52	78+93	1.43%	2.21	18
28	ALAMAR WAY	D2-1	70+52	78+93	1.43%	2.21	18
31	ALAMAR WAY	D2-2	78+93	84+31	3.72%	1.63	18
	BISON MEADOWS COURT	D2-3.1	+8	6+00	1.37%	1.63	18
32	BISON MEADOWS COURT	D2-3.1	+8	6+00	1.37%	1.63	18
33	BISON MEADOWS COURT	D2-3.1	+8	6+00	1.37%	1.63	18
		D2-3.2	5+50	24+02	3.47%	0.81	18
34	BISON MEADOWS COURT	D2-3.2	5+50	24+02	3.47%	0.81	18
35	BISON MEADOWS COURT	D2-3.2	5+50	24+02	3.47%	0.81	18
36	BISON MEADOWS COURT	D2-3.2	5+50	24+02	3.47%	0.81	18
37	BISON MEADOWS COURT	D2-3.2	5+50	24+02	3.47%	0.81	18
38	BISON MEADOWS COURT	D2-3.2	5+50	24+02	3.47%	0.81	18
39	BISON MEADOWS COURT	D2-3.2	5+50	24+02	3.47%	0.81	18
40	BISON MEADOWS COURT	D3.4.6-1.1	5+50	24+02	3.47%	0.00	18
41*	BISON MEADOWS COURT	D3.4.6-1.1	5+50	24+02	3.47%	0.00	18
42*	BISON MEADOWS COURT	D3.4.6-1.1	5+50	24+02	3.47%	0.00	18
43*	BISON MEADOWS COURT	D3.4.6-1.1	5+50	24+02	3.47%	0.00	18
44*	BISON MEADOWS COURT	D3.4.6-1.1	5+50	24+02	3.47%	0.00	18
45	BISON MEADOWS COURT	D3.4.6-1.1	5+50	24+02	3.47%	0.00	18
		D3.4.6-2.2	+8	6+00	1.37%	0.00	18
46	BISON MEADOWS COURT	D3.4.6-2.2	+8	6+00	1.37%	0.00	18
47	BISON MEADOWS COURT	D3.4.6-2.2	+8	6+00	1.37%	0.00	18
no lot	WINSOME WAY	B4-4	18+00	20+96	1.00%		N/A
no lot	ALAMAR WAY	N/A	70+52	78+93	3.72%		N/A
no lot	ALAMAR WAY	N/A	78+93	84+31	1.43%		N/A

* Culvert sizing is based on flows in roadside ditch. If driveways cross natural channels an engineered site plan would be required.

7.2.1 CULVERT SIZING CALCULATIONS AND HGL TABLES

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 19.9 cfs

Maximum Flow: 19.9 cfs

Table 1 - Summary of Culvert Flows at Crossing: CLOVE HITCH

Headwater Elevation (ft)	Total Discharge (cfs)	CLOVE HITCH Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7371.00	0.00	0.00	0.00	1
7371.66	1.99	1.99	0.00	1
7371.96	3.98	3.98	0.00	1
7372.21	5.97	5.97	0.00	1
7372.43	7.96	7.96	0.00	1
7372.68	9.95	9.95	0.00	1
7372.87	11.94	11.94	0.00	1
7373.06	13.93	13.93	0.00	1
7373.25	15.92	15.92	0.00	1
7373.46	17.91	17.91	0.00	1
7373.69	19.90	19.90	0.00	1
7375.60	30.83	30.83	0.00	Overtopping

Rating Curve Plot for Crossing: CLOVE HITCH

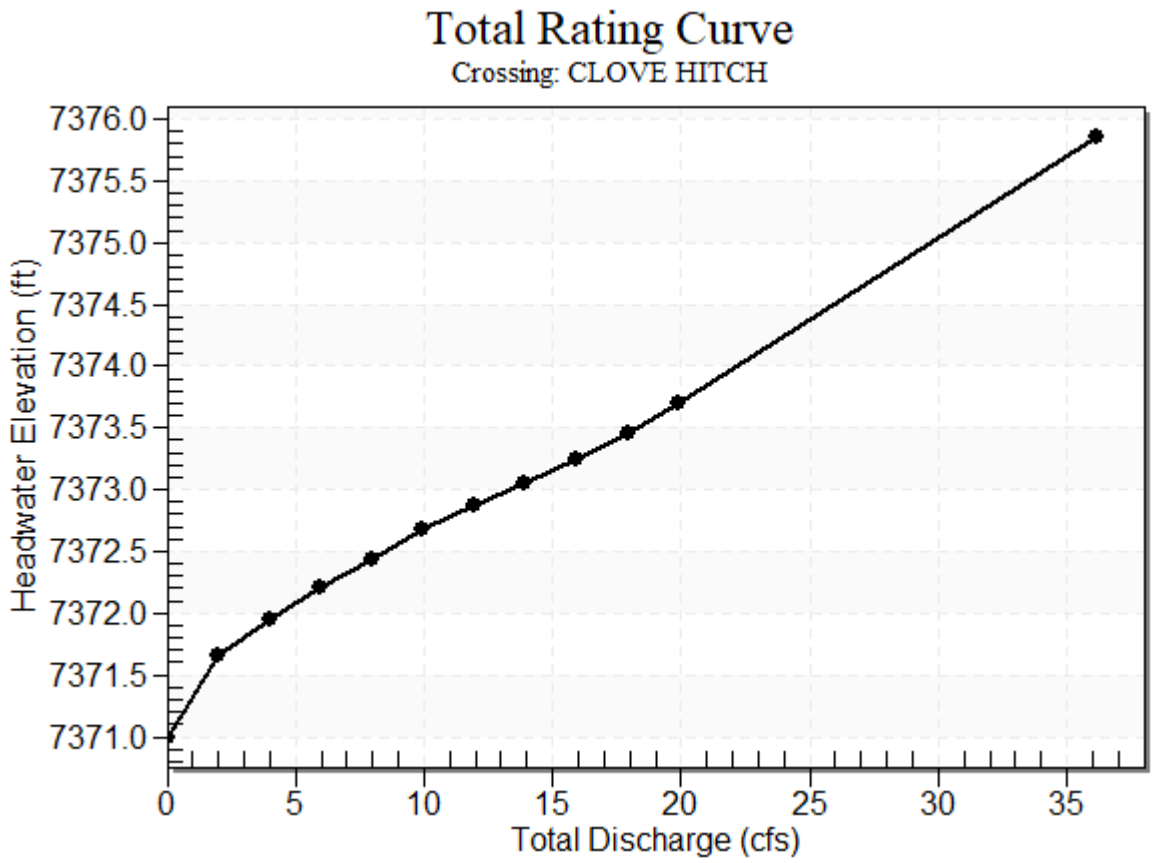


Table 2 - Culvert Summary Table: CLOVE HITCH

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)
0.00	0.00	7371.00	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
1.99	1.99	7371.66	0.663	0.182	1-S2n	0.475	0.489	0.475	0.128	3.484	1.476
3.98	3.98	7371.96	0.956	0.429	1-S2n	0.678	0.700	0.678	0.193	4.243	1.911
5.97	5.97	7372.21	1.213	0.655	1-S2n	0.844	0.864	0.844	0.245	4.739	2.216
7.96	7.96	7372.43	1.432	0.882	1-S2n	0.994	1.004	0.994	0.290	5.104	2.455
9.95	9.95	7372.68	1.627	1.680	2-M2c	1.139	1.128	1.128	0.331	5.446	2.656
11.94	11.94	7372.87	1.811	1.869	2-M2c	1.284	1.241	1.241	0.368	5.829	2.830
13.93	13.93	7373.06	1.997	2.057	7-M2c	1.438	1.344	1.344	0.402	6.205	2.985
15.92	15.92	7373.25	2.194	2.250	7-M2c	1.623	1.438	1.438	0.434	6.582	3.124
17.91	17.91	7373.46	2.408	2.457	7-M2c	2.000	1.524	1.524	0.465	6.970	3.250
19.90	19.90	7373.69	2.645	2.692	7-M2c	2.000	1.602	1.602	0.494	7.376	3.367

****

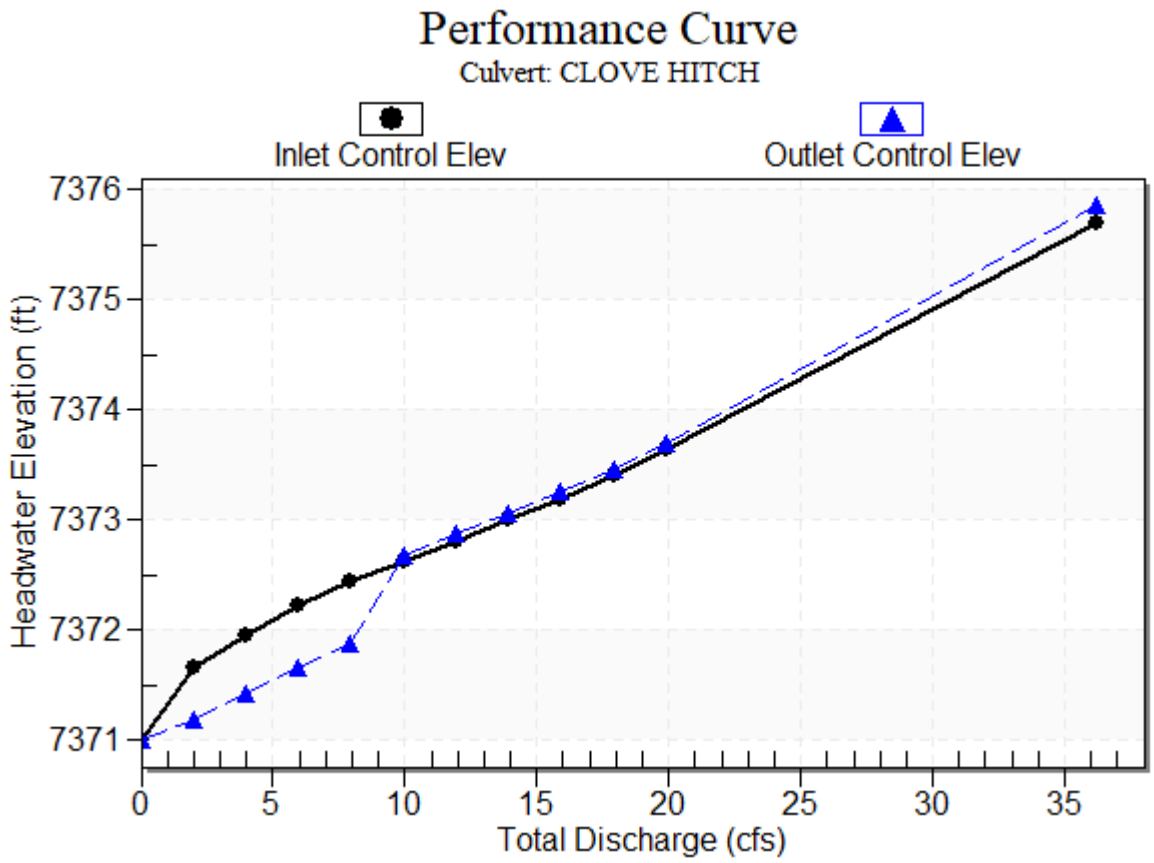
Straight Culvert

Inlet Elevation (invert): 7371.00 ft, Outlet Elevation (invert): 7370.68 ft

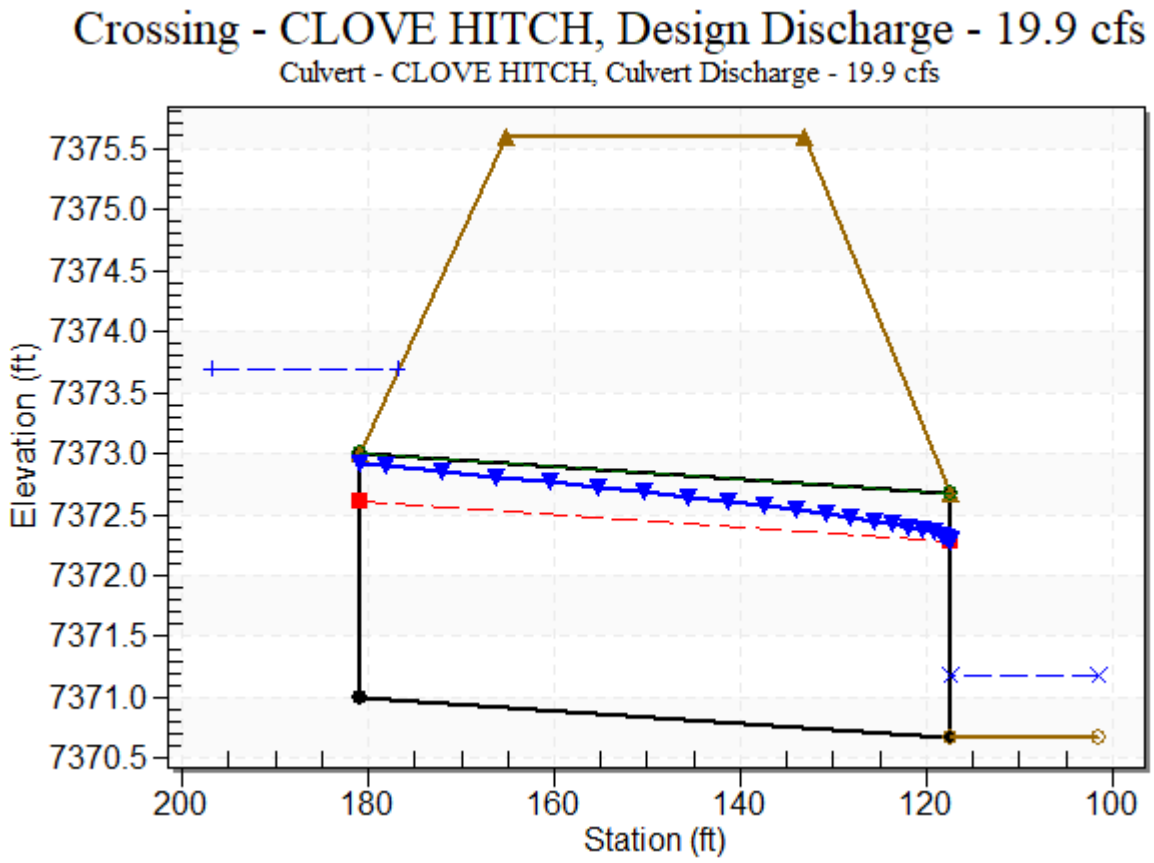
Culvert Length: 63.65 ft, Culvert Slope: 0.0050

****

Culvert Performance Curve Plot: CLOVE HITCH



Water Surface Profile Plot for Culvert: CLOVE HITCH



Site Data - CLOVE HITCH

Site Data Option: Culvert Invert Data

Inlet Station: 180.95 ft

Inlet Elevation: 7371.00 ft

Outlet Station: 117.30 ft

Outlet Elevation: 7370.68 ft

Number of Barrels: 1

Culvert Data Summary - CLOVE HITCH

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: CLOVE HITCH)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7370.68	0.00	0.00	0.00	0.00
1.99	7370.81	0.13	1.48	0.16	0.74
3.98	7370.87	0.19	1.91	0.24	0.79
5.97	7370.93	0.25	2.22	0.31	0.82
7.96	7370.97	0.29	2.46	0.36	0.84
9.95	7371.01	0.33	2.66	0.41	0.86
11.94	7371.05	0.37	2.83	0.46	0.87
13.93	7371.08	0.40	2.99	0.50	0.89
15.92	7371.11	0.43	3.12	0.54	0.90
17.91	7371.14	0.46	3.25	0.58	0.90
19.90	7371.17	0.49	3.37	0.62	0.91

Tailwater Channel Data - CLOVE HITCH

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 7370.68 ft

Roadway Data for Crossing: CLOVE HITCH

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 7375.60 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 10 cfs

Maximum Flow: 10 cfs

Table 4 - Summary of Culvert Flows at Crossing: MOSEY TRAIL 1

Headwater Elevation (ft)	Total Discharge (cfs)	MOSEY TRAIL 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7363.00	0.00	0.00	0.00	1
7363.49	1.00	1.00	0.00	1
7363.71	2.00	2.00	0.00	1
7363.91	3.00	3.00	0.00	1
7364.07	4.00	4.00	0.00	1
7364.22	5.00	5.00	0.00	1
7364.36	6.00	6.00	0.00	1
7364.51	7.00	7.00	0.00	1
7364.66	8.00	8.00	0.00	1
7364.83	9.00	9.00	0.00	1
7365.02	10.00	10.00	0.00	1
7367.72	19.02	19.02	0.00	Overtopping

Rating Curve Plot for Crossing: MOSEY TRAIL 1

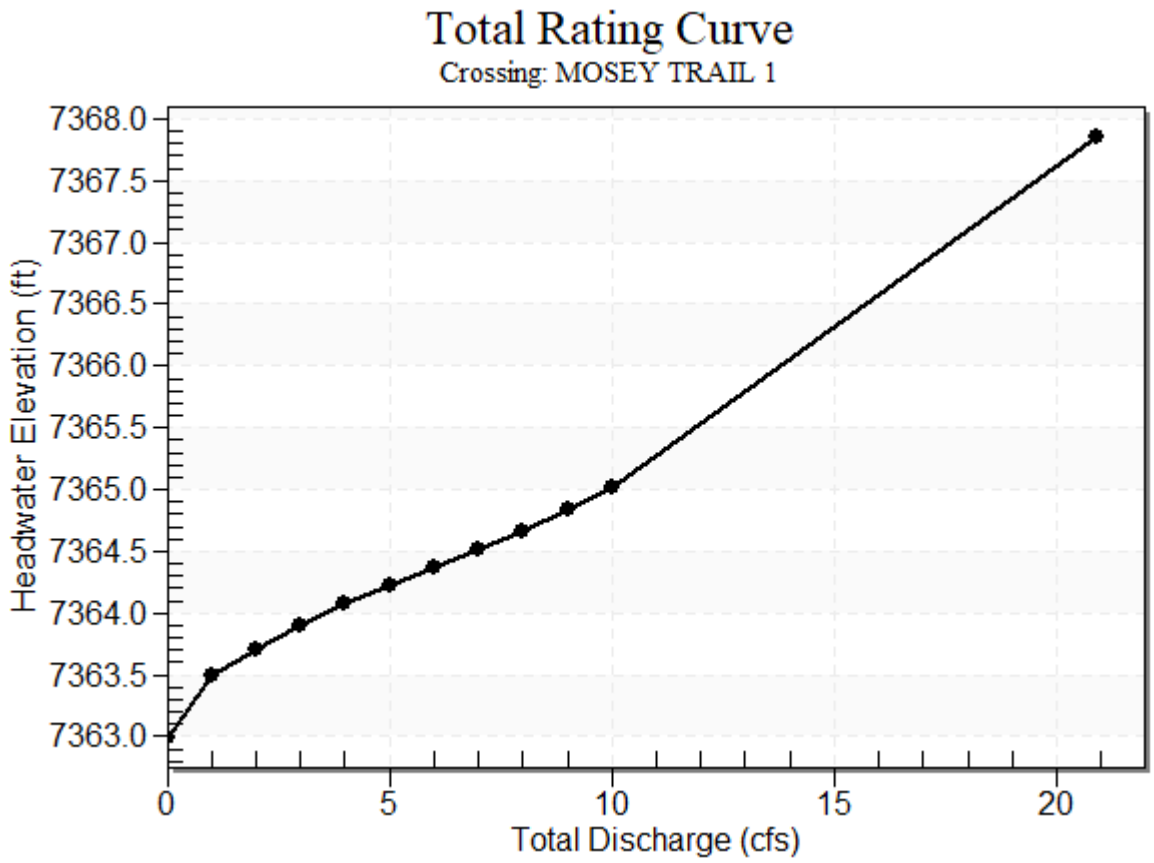


Table 5 - Culvert Summary Table: MOSEY TRAIL 1

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)
0.00	0.00	7363.00	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
1.00	1.00	7363.49	0.494	0.0*	1-S2n	0.235	0.373	0.235	0.364	5.655	1.889
2.00	2.00	7363.71	0.712	0.0*	1-S2n	0.330	0.533	0.330	0.472	6.938	2.246
3.00	3.00	7363.91	0.906	0.0*	1-S2n	0.405	0.658	0.405	0.549	7.798	2.486
4.00	4.00	7364.07	1.073	0.0*	1-S2n	0.469	0.765	0.477	0.612	8.286	2.671
5.00	5.00	7364.22	1.222	0.0*	1-S2n	0.528	0.860	0.541	0.665	8.712	2.825
6.00	6.00	7364.36	1.364	0.0*	1-S2n	0.582	0.946	0.600	0.712	9.095	2.956
7.00	7.00	7364.51	1.509	0.0*	5-S2n	0.634	1.024	0.655	0.755	9.445	3.073
8.00	8.00	7364.66	1.664	0.011	5-S2n	0.683	1.096	0.709	0.793	9.735	3.177
9.00	9.00	7364.83	1.834	0.433	5-S2n	0.731	1.161	0.760	0.829	10.009	3.272
10.00	10.00	7365.02	2.023	0.671	5-S2n	0.778	1.219	0.816	0.863	10.179	3.359

* Full Flow Headwater elevation is below inlet invert.

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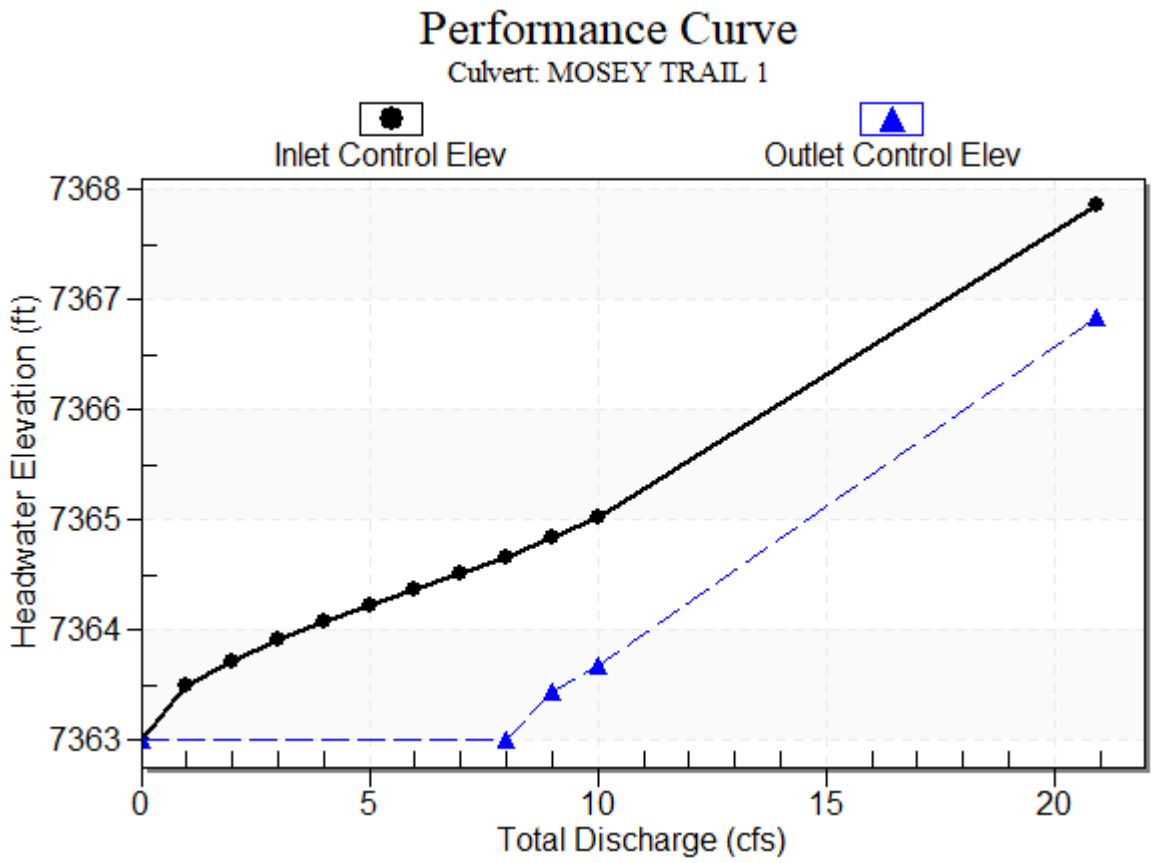
Straight Culvert

Inlet Elevation (invert): 7363.00 ft, Outlet Elevation (invert): 7361.21 ft

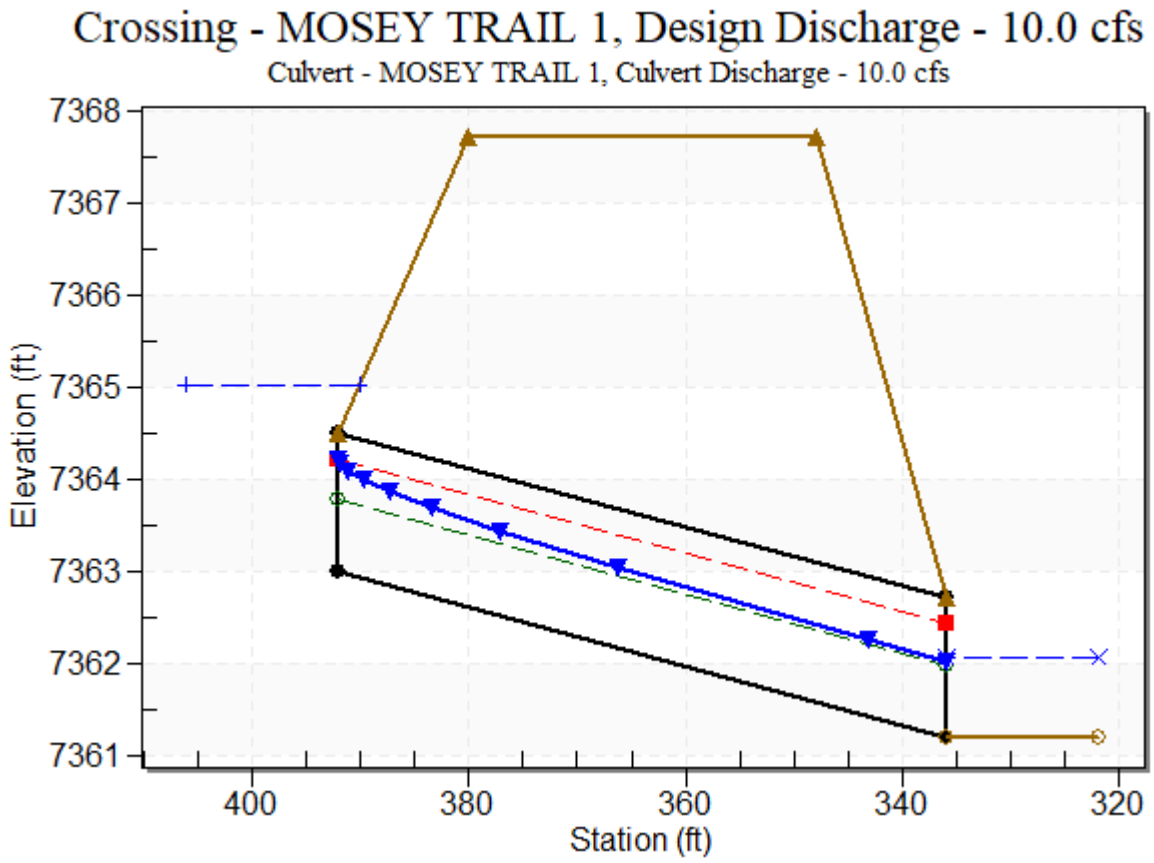
Culvert Length: 56.08 ft, Culvert Slope: 0.0319

****

Culvert Performance Curve Plot: MOSEY TRAIL 1



Water Surface Profile Plot for Culvert: MOSEY TRAIL 1



Site Data - MOSEY TRAIL 1

Site Data Option: Culvert Invert Data

Inlet Station: 392.02 ft

Inlet Elevation: 7363.00 ft

Outlet Station: 335.97 ft

Outlet Elevation: 7361.21 ft

Number of Barrels: 1

Culvert Data Summary - MOSEY TRAIL 1

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Table 6 - Downstream Channel Rating Curve (Crossing: MOSEY TRAIL 1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7361.21	0.00	0.00	0.00	0.00
1.00	7361.57	0.36	1.89	0.45	0.78
2.00	7361.68	0.47	2.25	0.59	0.82
3.00	7361.76	0.55	2.49	0.69	0.84
4.00	7361.82	0.61	2.67	0.76	0.85
5.00	7361.88	0.67	2.82	0.83	0.86
6.00	7361.92	0.71	2.96	0.89	0.87
7.00	7361.96	0.75	3.07	0.94	0.88
8.00	7362.00	0.79	3.18	0.99	0.89
9.00	7362.04	0.83	3.27	1.03	0.90
10.00	7362.07	0.86	3.36	1.08	0.90

Tailwater Channel Data - MOSEY TRAIL 1

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 7361.21 ft

Roadway Data for Crossing: MOSEY TRAIL 1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 7367.72 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 149.8 cfs

Maximum Flow: 149.8 cfs

Table 7 - Summary of Culvert Flows at Crossing: MOSEY TRAIL 2

Headwater Elevation (ft)	Total Discharge (cfs)	MOSEY TRAIL 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7360.00	0.00	0.00	0.00	1
7361.54	14.98	14.98	0.00	1
7362.26	29.96	29.96	0.00	1
7362.86	44.94	44.94	0.00	1
7363.37	59.92	59.92	0.00	1
7363.86	74.90	74.90	0.00	1
7364.48	89.88	89.88	0.00	1
7364.97	104.86	104.86	0.00	1
7365.62	119.84	119.84	0.00	1
7366.38	134.82	134.82	0.00	1
7367.24	149.80	149.80	0.00	1
7367.62	155.83	155.83	0.00	Overtopping

Rating Curve Plot for Crossing: MOSEY TRAIL 2

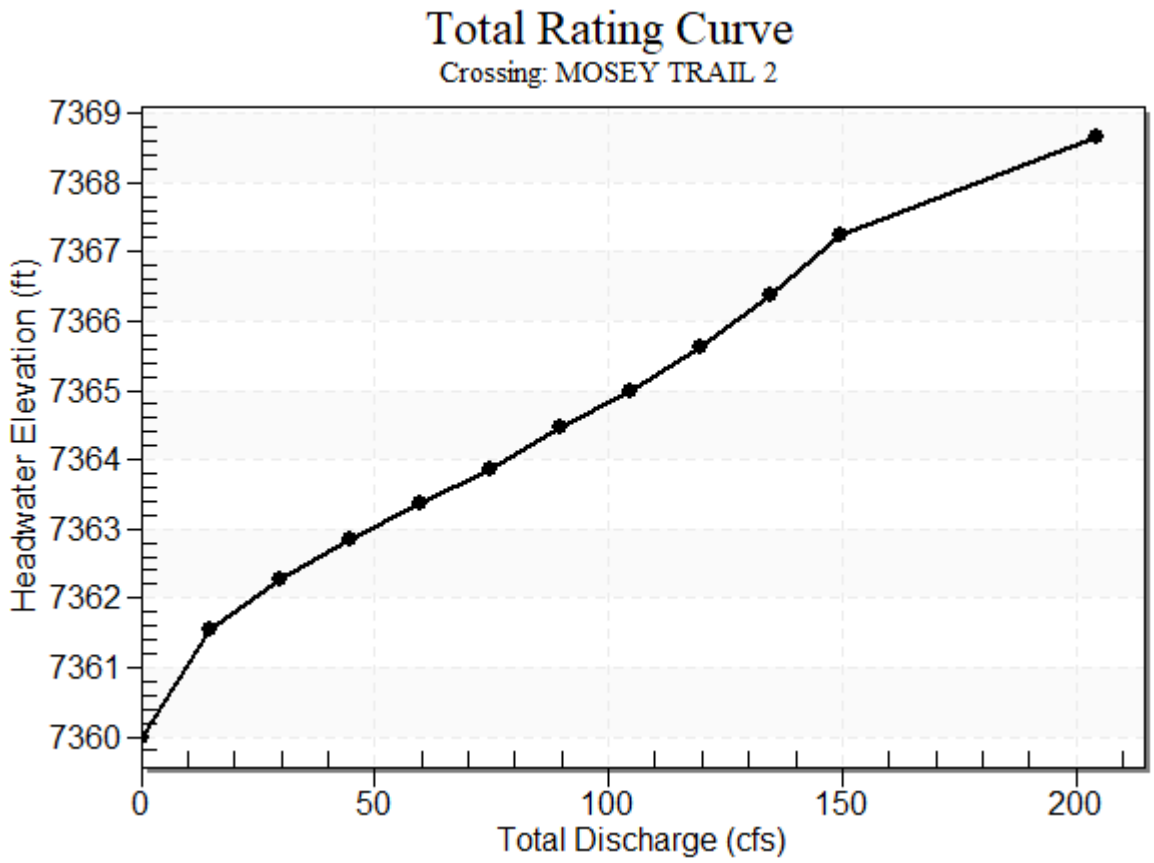


Table 8 - Culvert Summary Table: MOSEY TRAIL 2

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)
0.00	0.00	7360.00	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
14.98	14.98	7361.54	1.540	0.612	1-S2n	1.037	1.133	1.037	0.284	5.789	2.499
29.96	29.96	7362.26	2.260	1.217	1-S2n	1.488	1.623	1.488	0.427	7.038	3.229
44.94	44.94	7362.86	2.861	1.794	1-S2n	1.862	2.006	1.868	0.542	7.806	3.739
59.92	59.92	7363.37	3.374	2.390	1-S2n	2.209	2.332	2.213	0.642	8.401	4.139
74.90	74.90	7363.86	3.864	3.025	1-S2n	2.554	2.619	2.554	0.730	8.844	4.474
89.88	89.88	7364.48	4.381	4.479	7-M2c	2.925	2.874	2.874	0.812	9.300	4.764
104.86	104.86	7364.97	4.960	4.973	7-M2c	3.408	3.100	3.100	0.887	10.035	5.021
119.84	119.84	7365.62	5.623	5.543	7-M2c	4.000	3.296	3.296	0.958	10.819	5.252
134.82	134.82	7366.38	6.383	6.289	7-M2c	4.000	3.461	3.461	1.024	11.669	5.462
149.80	149.80	7367.24	7.244	7.124	7-M2c	4.000	3.594	3.594	1.088	12.591	5.656

****

Straight Culvert

Inlet Elevation (invert): 7360.00 ft, Outlet Elevation (invert): 7359.44 ft

Culvert Length: 112.35 ft, Culvert Slope: 0.0050

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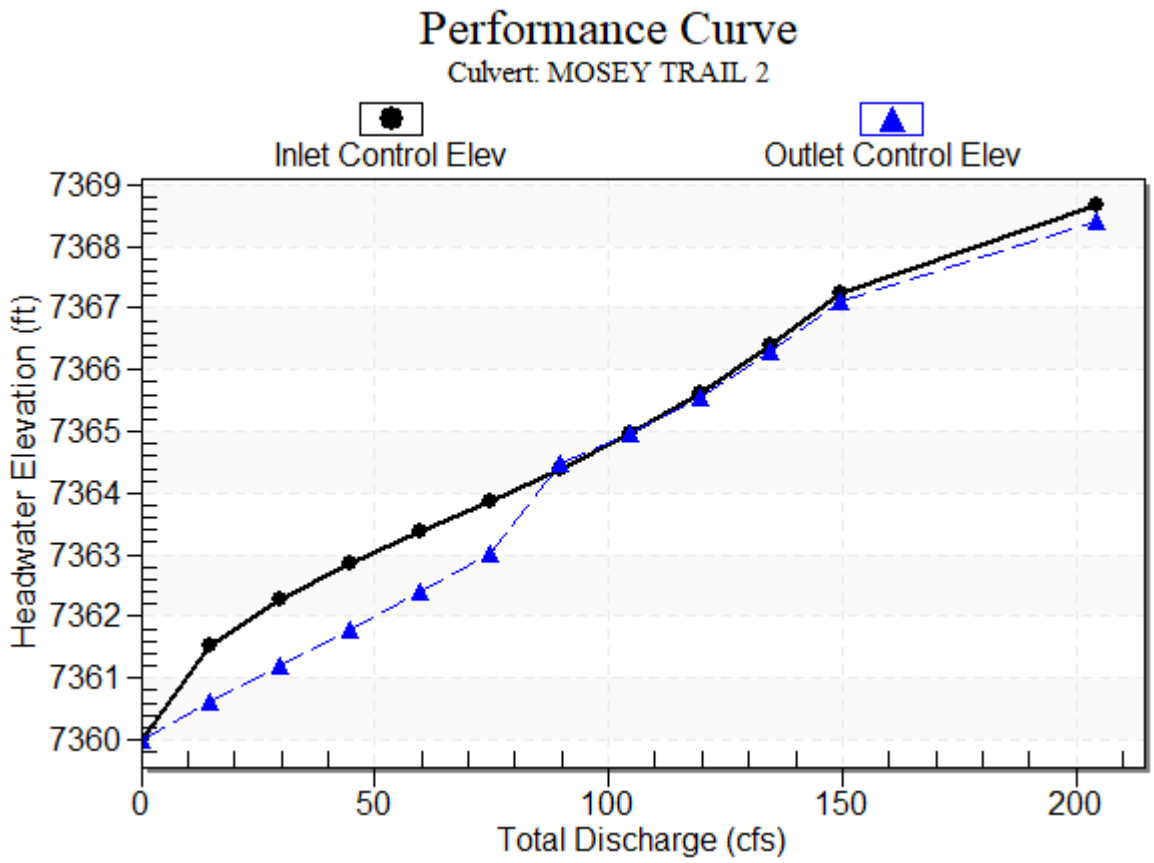
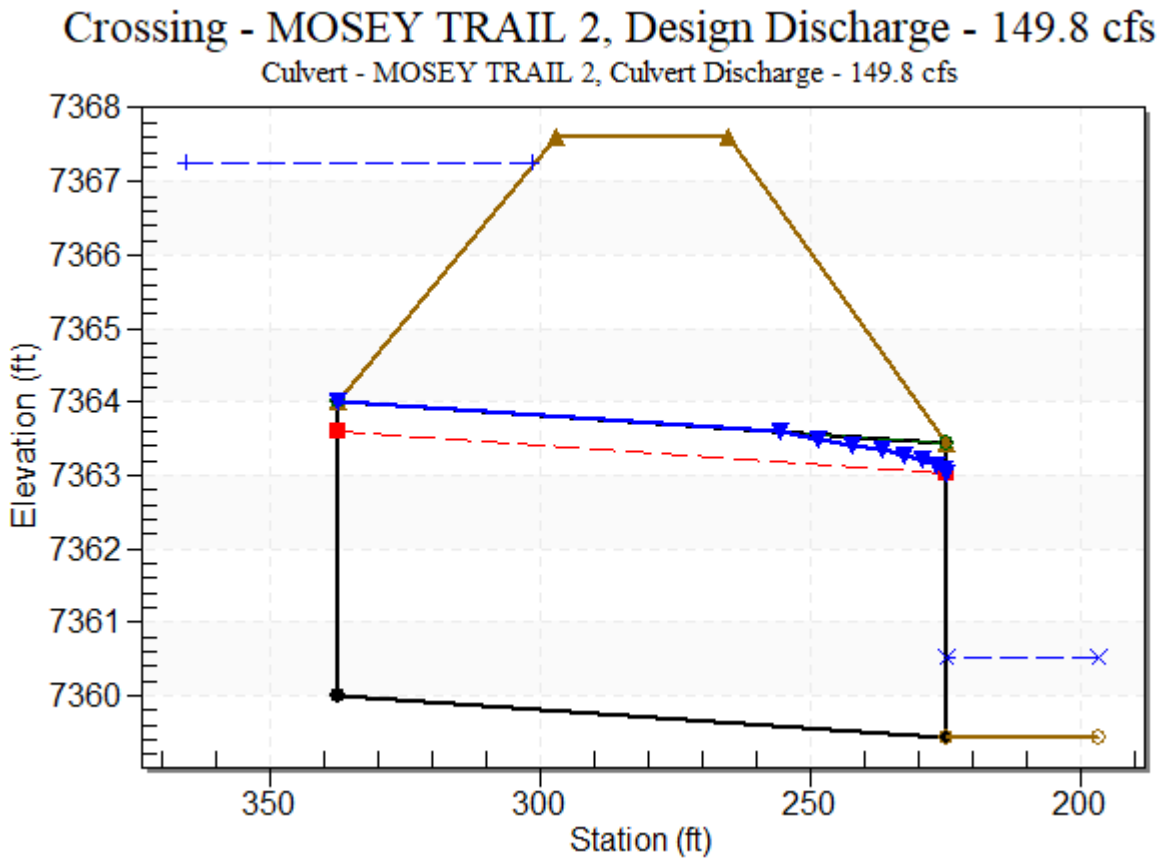
Culvert Performance Curve Plot: MOSEY TRAIL 2



Water Surface Profile Plot for Culvert: MOSEY TRAIL 2



Site Data - MOSEY TRAIL 2

Site Data Option: Culvert Invert Data

Inlet Station: 337.37 ft

Inlet Elevation: 7360.00 ft

Outlet Station: 225.02 ft

Outlet Elevation: 7359.44 ft

Number of Barrels: 1

Culvert Data Summary - MOSEY TRAIL 2

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Table 9 - Downstream Channel Rating Curve (Crossing: MOSEY TRAIL 2)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7359.44	0.00	0.00	0.00	0.00
14.98	7359.72	0.28	2.50	0.35	0.85
29.96	7359.87	0.43	3.23	0.53	0.90
44.94	7359.98	0.54	3.74	0.68	0.94
59.92	7360.08	0.64	4.14	0.80	0.96
74.90	7360.17	0.73	4.47	0.91	0.98
89.88	7360.25	0.81	4.76	1.01	0.99
104.86	7360.33	0.89	5.02	1.11	1.01
119.84	7360.40	0.96	5.25	1.20	1.02
134.82	7360.46	1.02	5.46	1.28	1.03
149.80	7360.53	1.09	5.66	1.36	1.04

Tailwater Channel Data - MOSEY TRAIL 2

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 7359.44 ft

Roadway Data for Crossing: MOSEY TRAIL 2

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 7367.62 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 166.2 cfs

Maximum Flow: 166.2 cfs

Table 10 - Summary of Culvert Flows at Crossing: WINSOME WAY

Headwater Elevation (ft)	Total Discharge (cfs)	WINSOME WAY Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7335.64	0.00	0.00	0.00	1
7337.20	16.62	16.62	0.00	1
7337.90	33.24	33.24	0.00	1
7338.51	49.86	49.86	0.00	1
7339.03	66.48	66.48	0.00	1
7339.50	83.10	83.10	0.00	1
7339.95	99.72	99.72	0.00	1
7340.43	116.34	116.34	0.00	1
7340.95	132.96	132.96	0.00	1
7341.52	149.58	149.58	0.00	1
7342.17	166.20	166.20	0.00	1
7343.77	200.91	200.91	0.00	Overtopping

Rating Curve Plot for Crossing: WINSOME WAY

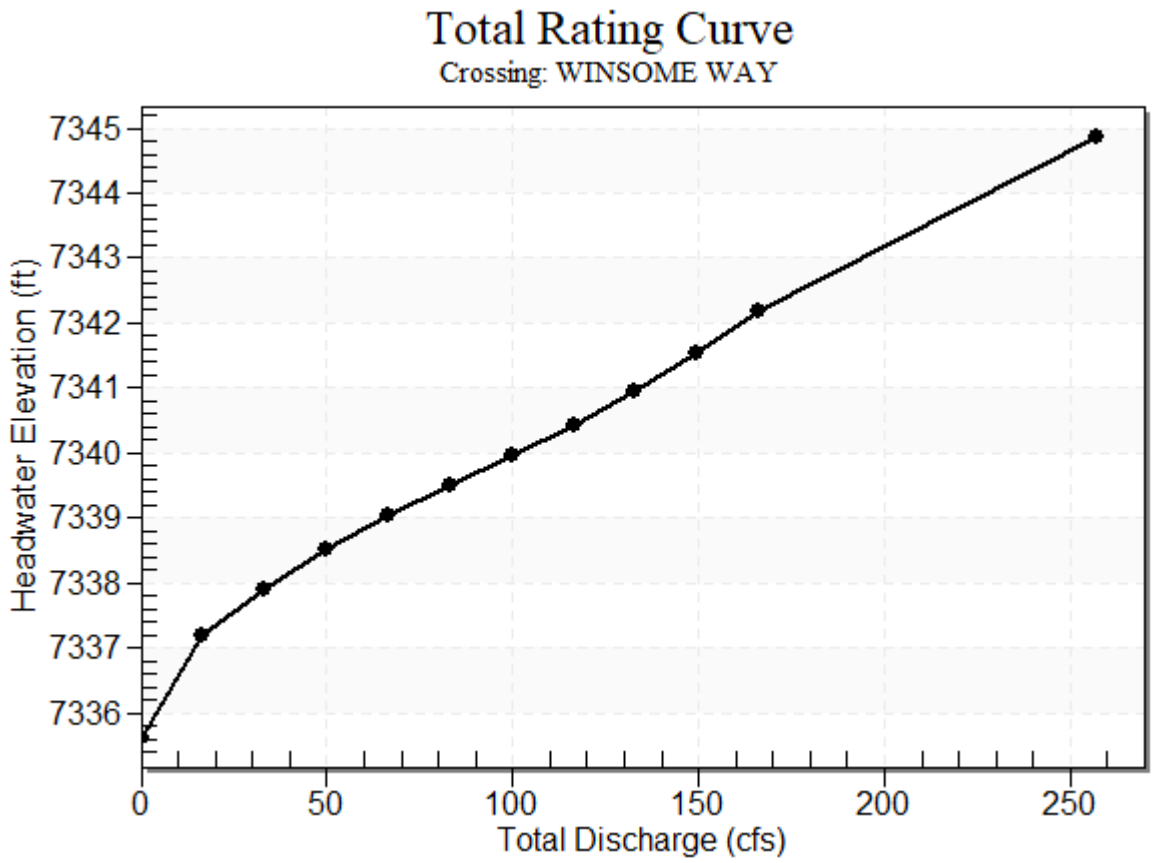


Table 11 - Culvert Summary Table: WINSOME WAY

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)
0.00	0.00	7335.64	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
16.62	16.62	7337.20	1.561	0.243	1-S2n	0.883	1.156	0.896	0.356	7.376	2.843
33.24	33.24	7337.90	2.256	0.822	1-S2n	1.251	1.654	1.287	0.534	8.850	3.636
49.86	49.86	7338.51	2.874	1.346	1-S2n	1.544	2.043	1.610	0.674	9.755	4.178
66.48	66.48	7339.03	3.391	1.867	1-S2n	1.803	2.374	1.893	0.795	10.468	4.600
83.10	83.10	7339.50	3.858	2.405	1-S2n	2.042	2.668	2.153	0.902	11.056	4.949
99.72	99.72	7339.95	4.313	2.968	1-S2n	2.269	2.934	2.397	1.000	11.576	5.249
116.34	116.34	7340.43	4.788	3.560	5-S2n	2.491	3.174	2.631	1.090	12.045	5.513
132.96	132.96	7340.95	5.305	4.738	5-S2n	2.712	3.392	2.860	1.174	12.468	5.749
149.58	149.58	7341.52	5.883	5.296	5-S2n	2.937	3.588	3.084	1.253	12.878	5.964
166.20	166.20	7342.17	6.530	5.896	5-S2n	3.174	3.760	3.309	1.328	13.262	6.161

****

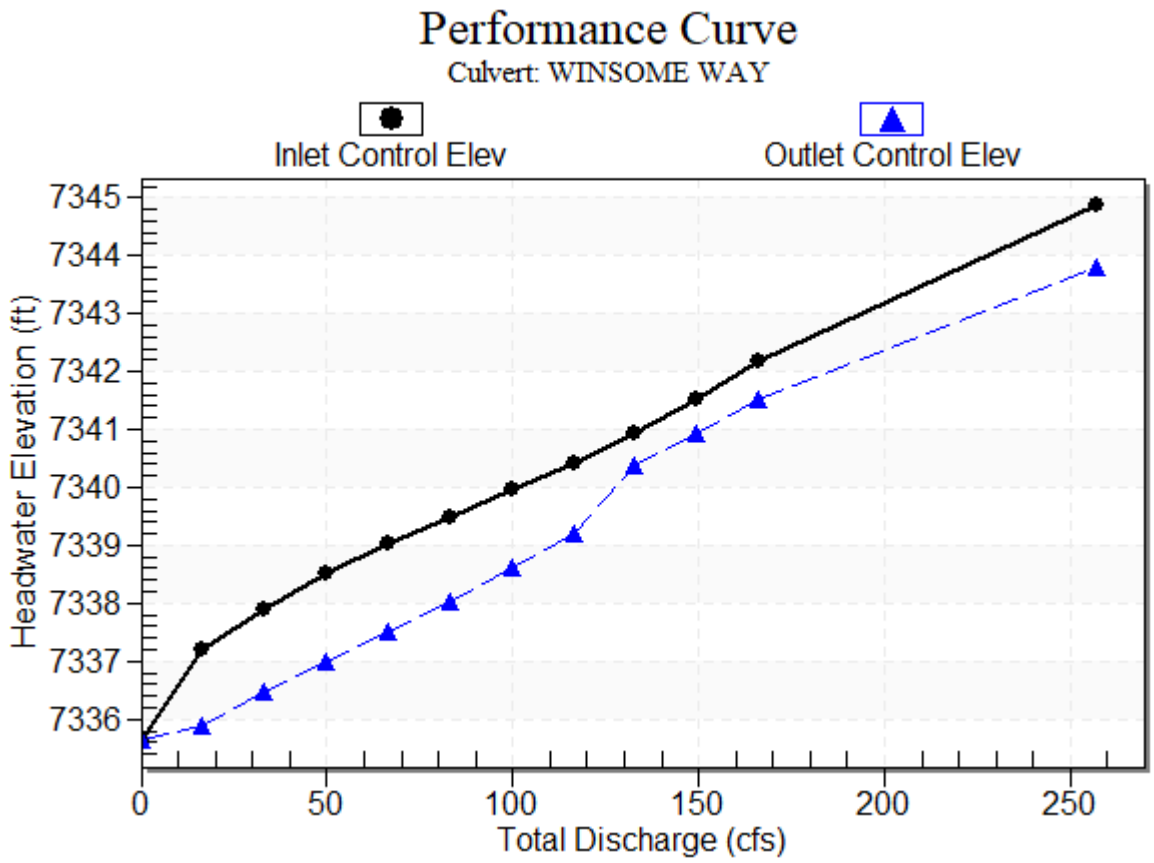
Straight Culvert

Inlet Elevation (invert): 7335.64 ft, Outlet Elevation (invert): 7334.70 ft

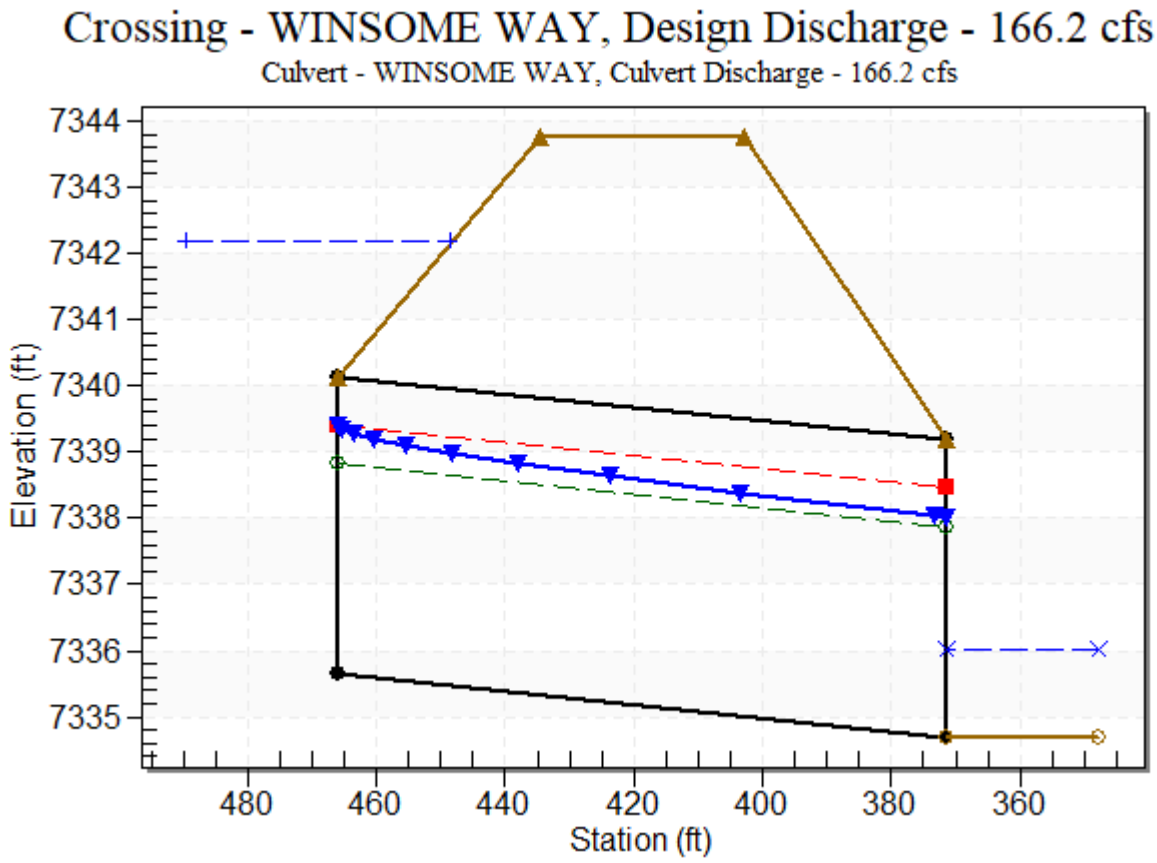
Culvert Length: 94.43 ft, Culvert Slope: 0.0100

****

Culvert Performance Curve Plot: WINSOME WAY



Water Surface Profile Plot for Culvert: WINSOME WAY



Site Data - WINSOME WAY

Site Data Option: Culvert Invert Data

Inlet Station: 465.90 ft

Inlet Elevation: 7335.64 ft

Outlet Station: 371.47 ft

Outlet Elevation: 7334.70 ft

Number of Barrels: 1

Culvert Data Summary - WINSOME WAY

Barrel Shape: Circular

Barrel Diameter: 4.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Table 12 - Downstream Channel Rating Curve (Crossing: WINSOME WAY)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7334.70	0.00	0.00	0.00	0.00
16.62	7335.06	0.36	2.84	0.44	0.88
33.24	7335.23	0.53	3.64	0.67	0.93
49.86	7335.37	0.67	4.18	0.84	0.96
66.48	7335.49	0.79	4.60	0.99	0.99
83.10	7335.60	0.90	4.95	1.13	1.00
99.72	7335.70	1.00	5.25	1.25	1.02
116.34	7335.79	1.09	5.51	1.36	1.03
132.96	7335.87	1.17	5.75	1.47	1.04
149.58	7335.95	1.25	5.96	1.56	1.05
166.20	7336.03	1.33	6.16	1.66	1.06

Tailwater Channel Data - WINSOME WAY

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 15.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 7334.70 ft

Roadway Data for Crossing: WINSOME WAY

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 7343.77 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 203.7 cfs

Maximum Flow: 203.7 cfs

Table 13 - Summary of Culvert Flows at Crossing: ALAMAR WAY

Headwater Elevation (ft)	Total Discharge (cfs)	ALAMAR WAY Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7327.48	0.00	0.00	0.00	1
7329.17	20.37	20.37	0.00	1
7329.91	40.74	40.74	0.00	1
7330.57	61.11	61.11	0.00	1
7331.13	81.48	81.48	0.00	1
7331.63	101.85	101.85	0.00	1
7332.10	122.22	122.22	0.00	1
7332.59	142.59	142.59	0.00	1
7333.11	162.96	162.96	0.00	1
7333.68	183.33	183.33	0.00	1
7334.32	203.70	203.70	0.00	1
7335.58	238.70	238.70	0.00	Overtopping

Rating Curve Plot for Crossing: ALAMAR WAY

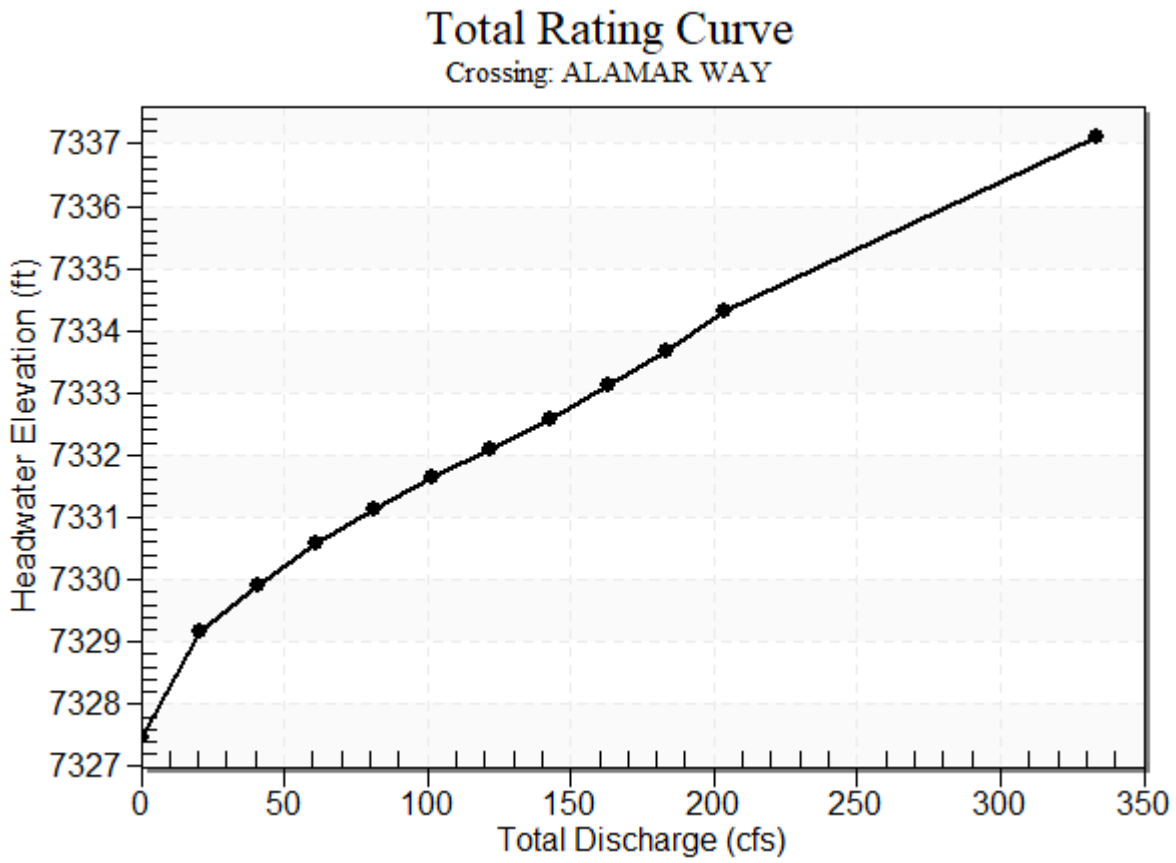


Table 14 - Culvert Summary Table: ALAMAR WAY

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)
0.00	0.00	7327.48	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
20.37	20.37	7329.17	1.686	0.295	1-S2n	1.066	1.246	1.066	0.340	6.643	2.802
40.74	40.74	7329.91	2.434	0.920	1-S2n	1.516	1.781	1.522	0.512	8.056	3.610
61.11	61.11	7330.57	3.093	1.488	1-S2n	1.877	2.200	1.893	0.649	8.971	4.168
81.48	81.48	7331.13	3.651	2.054	1-S2n	2.199	2.557	2.220	0.767	9.677	4.606
101.85	101.85	7331.63	4.148	2.639	1-S2n	2.499	2.874	2.525	0.872	10.246	4.972
122.22	122.22	7332.10	4.624	3.254	1-S2n	2.791	3.160	2.818	0.968	10.720	5.286
142.59	142.59	7332.59	5.110	3.903	5-S2n	3.082	3.421	3.105	1.058	11.127	5.565
162.96	162.96	7333.11	5.629	4.589	5-S2n	3.383	3.660	3.400	1.141	11.462	5.815
183.33	183.33	7333.68	6.201	5.875	5-S2n	3.708	3.876	3.718	1.220	11.709	6.042
203.70	203.70	7334.32	6.837	6.706	7-M2c	4.097	4.070	4.070	1.294	11.901	6.252

****

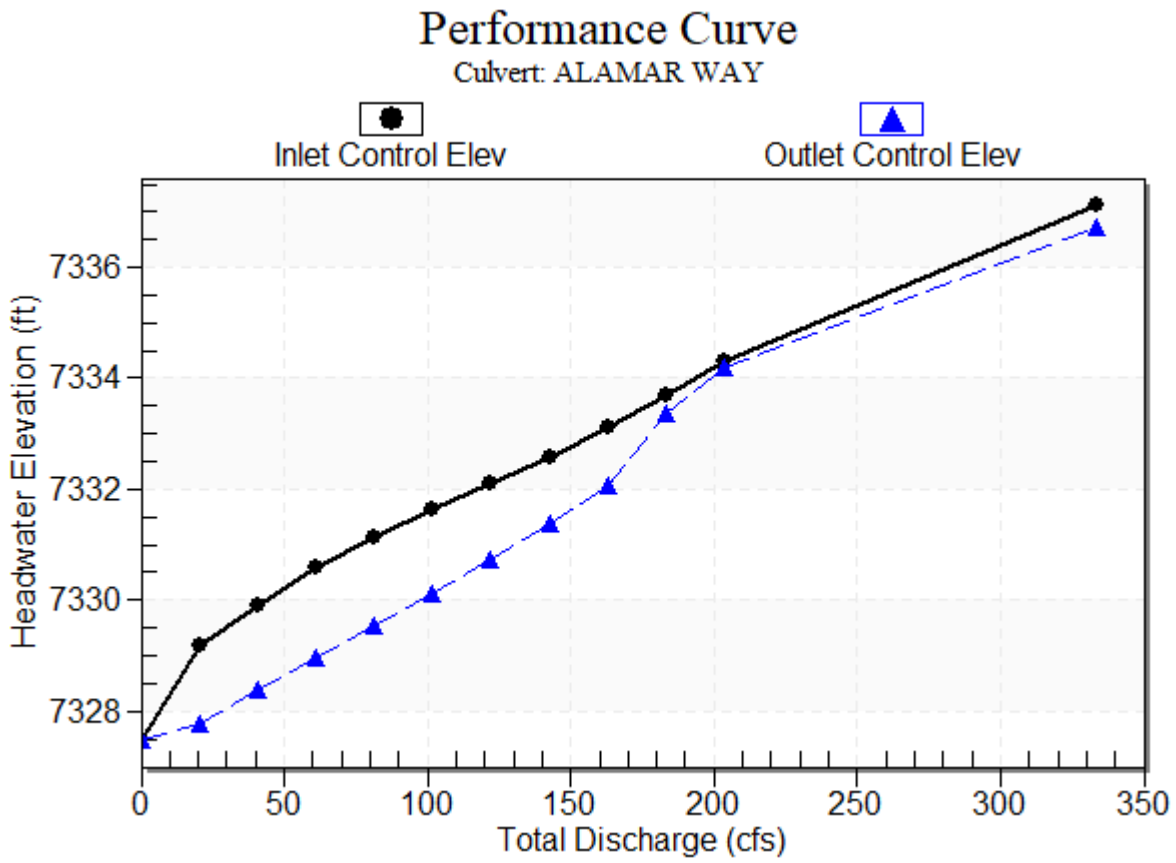
Straight Culvert

Inlet Elevation (invert): 7327.48 ft, Outlet Elevation (invert): 7326.50 ft

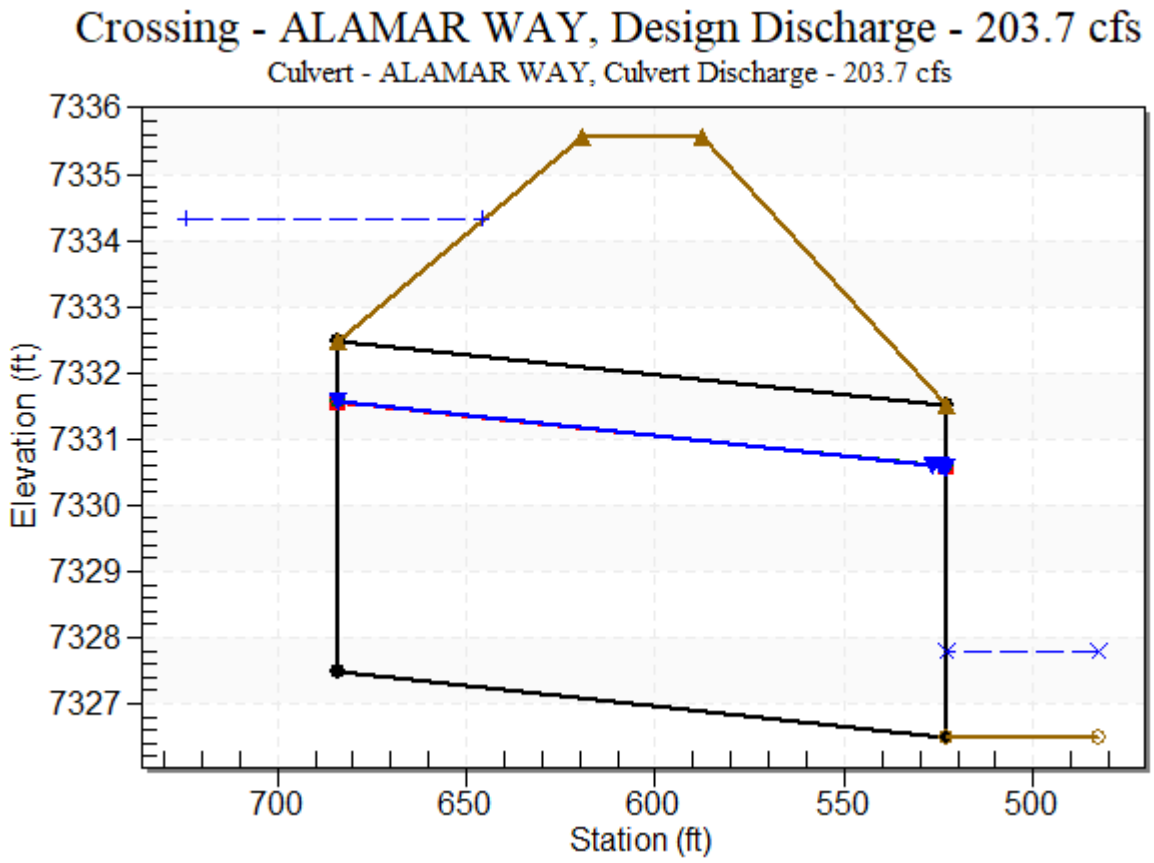
Culvert Length: 160.76 ft, Culvert Slope: 0.0061

****

Culvert Performance Curve Plot: ALAMAR WAY



Water Surface Profile Plot for Culvert: ALAMAR WAY



Site Data - ALAMAR WAY

Site Data Option: Culvert Invert Data

Inlet Station: 683.82 ft

Inlet Elevation: 7327.48 ft

Outlet Station: 523.06 ft

Outlet Elevation: 7326.50 ft

Number of Barrels: 1

Culvert Data Summary - ALAMAR WAY

Barrel Shape: Circular

Barrel Diameter: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: None

Table 15 - Downstream Channel Rating Curve (Crossing: ALAMAR WAY)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	7326.50	0.00	0.00	0.00	0.00
20.37	7326.84	0.34	2.80	0.42	0.87
40.74	7327.01	0.51	3.61	0.64	0.93
61.11	7327.15	0.65	4.17	0.81	0.96
81.48	7327.27	0.77	4.61	0.96	0.99
101.85	7327.37	0.87	4.97	1.09	1.01
122.22	7327.47	0.97	5.29	1.21	1.02
142.59	7327.56	1.06	5.56	1.32	1.03
162.96	7327.64	1.14	5.81	1.42	1.04
183.33	7327.72	1.22	6.04	1.52	1.05
203.70	7327.79	1.29	6.25	1.62	1.06

Tailwater Channel Data - ALAMAR WAY

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 7326.50 ft

Roadway Data for Crossing: ALAMAR WAY

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 10.00 ft

Crest Elevation: 7335.58 ft

Roadway Surface: Paved

Roadway Top Width: 32.00 ft

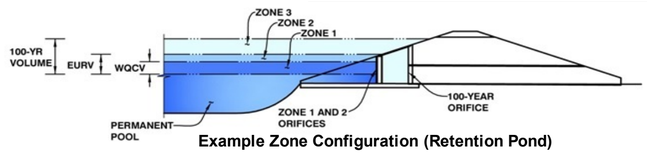
8.2 WATER QUALITY VOLUME SIZING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Winsome Filing 1 - Water Quality Pond B (Water Quality Area)**

Basin ID: **WQ Pond B (WQ Area Only)**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**		
Watershed Area =	0.41	acres	**Note: L / W Ratio > 8**
Watershed Length =	1,852	ft	**L / W Ratio = 192**
Watershed Slope =	0.019	ft/ft	
Watershed Imperviousness =	100.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.017	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.046	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.040	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.052	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.062	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.071	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.079	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.090	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.038	acre-feet	
Approximate 5-yr Detention Volume =	0.049	acre-feet	
Approximate 10-yr Detention Volume =	0.059	acre-feet	
Approximate 25-yr Detention Volume =	0.063	acre-feet	
Approximate 50-yr Detention Volume =	0.065	acre-feet	
Approximate 100-yr Detention Volume =	0.067	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.017	acre-feet	
Select Zone 2 Storage Volume (Optional) =		acre-feet	**Total detention volume is less than 100-year volume.**
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	0.017	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

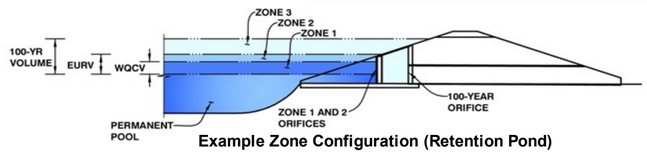
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	1,064	0.024		
	--	1.00	--	--	--	2,091	0.048	1,557	0.036
	--	2.00	--	--	--	3,221	0.074	4,201	0.096
Spillway Invert	--	3.00	--	--	--	4,547	0.104	8,117	0.186
	--	4.00	--	--	--	5,974	0.137	13,378	0.307
Freeboard	--	5.00	--	--	--	7,498	0.172	20,114	0.462

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Water Quality Pond C (Water Quality Area)

Basin ID: WQ Pond C (WQ Area Only)



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**		
Watershed Area =	1.14	acres	**Note: L / W Ratio > 8**
Watershed Length =	2,144	ft	**L / W Ratio = 92.6**
Watershed Slope =	0.032	ft/ft	
Watershed Imperviousness =	100.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.048	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.129	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.111	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.144	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.172	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.198	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.221	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.250	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.104	acre-feet	
Approximate 5-yr Detention Volume =	0.135	acre-feet	
Approximate 10-yr Detention Volume =	0.164	acre-feet	
Approximate 25-yr Detention Volume =	0.176	acre-feet	
Approximate 50-yr Detention Volume =	0.182	acre-feet	
Approximate 100-yr Detention Volume =	0.187	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.048	acre-feet	
Select Zone 2 Storage Volume (Optional) =		acre-feet	**Total detention volume is less than 100-year volume.**
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	0.048	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

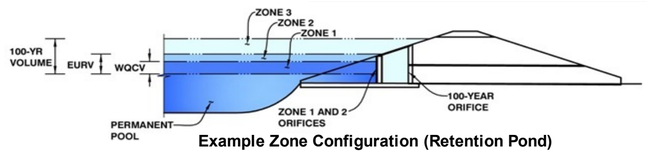
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	201	0.005		
	--	1.00	--	--	--	2,759	0.063	1,453	0.033
	--	2.00	--	--	--	5,929	0.136	5,765	0.132
	--	3.00	--	--	--	7,754	0.178	12,665	0.291
Spillway Invert	--	4.00	--	--	--	9,565	0.220	21,325	0.490
	--	5.00	--	--	--	11,263	0.259	31,739	0.729
Top	--	6.00	--	--	--	13,282	0.305	44,011	1.010

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Winsome Filing 1 - Water Quality Pond D (Water Quality Area)**

Basin ID: **WQ Pond D (WQ Area Only)**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type = **EDB**
Watershed Area = 1.22 acres
Watershed Length = 2,915 ft
Watershed Slope = 0.034 ft/ft
Watershed Imperviousness = 100.00% percent
Percentage Hydrologic Soil Group A = 0.0% percent
Percentage Hydrologic Soil Group B = 100.0% percent
Percentage Hydrologic Soil Groups C/D = 0.0% percent
Desired WQCV Drain Time = 40.0 hours
Location for 1-hr Rainfall Depths = User Input

Note: L / W Ratio > 8
L / W Ratio = 159.9

			Optional User Override 1-hr Precipitation	
Water Quality Capture Volume (WQCV) =	0.051	acre-feet		
Excess Urban Runoff Volume (EURV) =	0.138	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.119	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.154	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.184	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.212	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.236	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.267	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.112	acre-feet		
Approximate 5-yr Detention Volume =	0.145	acre-feet		
Approximate 10-yr Detention Volume =	0.175	acre-feet		
Approximate 25-yr Detention Volume =	0.188	acre-feet		
Approximate 50-yr Detention Volume =	0.195	acre-feet		
Approximate 100-yr Detention Volume =	0.200	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) = 0.051 acre-feet
Select Zone 2 Storage Volume (Optional) = acre-feet
Select Zone 3 Storage Volume (Optional) = acre-feet
Total Detention Basin Volume = 0.051 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

Total detention volume is less than 100-year volume.

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

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	--	--	--	1,897	0.044		
	--	1.00	--	--	--	4,904	0.113	3,352	0.077
	--	2.00	--	--	--	10,182	0.234	10,842	0.249
	--	3.00	--	--	--	15,560	0.357	23,814	0.547
	--	4.00	--	--	--	19,241	0.442	41,215	0.946
Spillway	--	5.00	--	--	--	23,109	0.531	62,390	1.432
	--	6.00	--	--	--	25,546	0.586	86,717	1.991
Top	--	7.00	--	--	--	27,750	0.637	113,365	2.603
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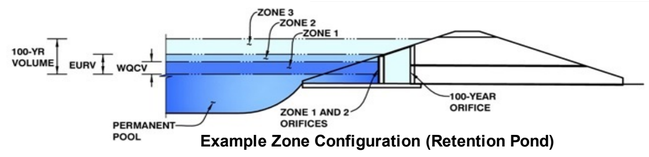
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Pond 3 (Water Quality Area)

Basin ID: Pond 3 (WQ Area Only)



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**		
Watershed Area =	1.15	acres	**Note: L / W Ratio > 8**
Watershed Length =	1,855	ft	**L / W Ratio = 68.7**
Watershed Slope =	0.029	ft/ft	
Watershed Imperviousness =	100.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	97.5%	percent	
Percentage Hydrologic Soil Groups C/D =	2.5%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.048	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.130	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.112	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.145	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.173	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.200	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.223	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.252	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.105	acre-feet	
Approximate 5-yr Detention Volume =	0.136	acre-feet	
Approximate 10-yr Detention Volume =	0.165	acre-feet	
Approximate 25-yr Detention Volume =	0.177	acre-feet	
Approximate 50-yr Detention Volume =	0.183	acre-feet	
Approximate 100-yr Detention Volume =	0.188	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.048	acre-feet	
Select Zone 2 Storage Volume (Optional) =		acre-feet	**Total detention volume is less than 100-year volume.**
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	0.048	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	--	--	--	989	0.023		
	--	1.00	--	--	--	13,752	0.316	7,233	0.166
	--	2.00	--	--	--	39,772	0.913	33,736	0.774
	--	3.00	--	--	--	44,956	1.032	76,496	1.756
	--	4.00	--	--	--	50,317	1.155	124,133	2.850
	--	5.00	--	--	--	55,782	1.281	177,182	4.068
	--	6.00	--	--	--	61,372	1.409	235,759	5.412
Spillway Invert	--	7.00	--	--	--	67,078	1.540	299,984	6.887
	--	8.00	--	--	--	73,314	1.683	370,180	8.498
Freeboard	--	9.00	--	--	--	78,198	1.795	445,936	10.237

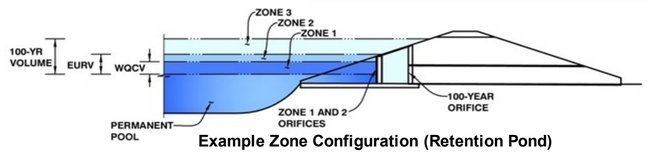
8.3 OUTLET STRUCTURE SIZING

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Water Quality Pond B

Basin ID: WQ Pond B with Manual WQ Area



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**	
Watershed Area =	11.00	acres
Watershed Length =	1,048	ft
Watershed Slope =	0.019	ft/ft
Watershed Imperviousness =	11.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.067	acre-feet
Excess Urban Runoff Volume (EURV) =	0.115	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.080	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.123	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.268	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.680	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.939	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.277	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.074	acre-feet
Approximate 5-yr Detention Volume =	0.115	acre-feet
Approximate 10-yr Detention Volume =	0.229	acre-feet
Approximate 25-yr Detention Volume =	0.315	acre-feet
Approximate 50-yr Detention Volume =	0.330	acre-feet
Approximate 100-yr Detention Volume =	0.425	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (User Defined) =	0.017	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.017	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

WQCV not provided!

Total detention volume is less than 100-year volume.

Depth Increment = ft

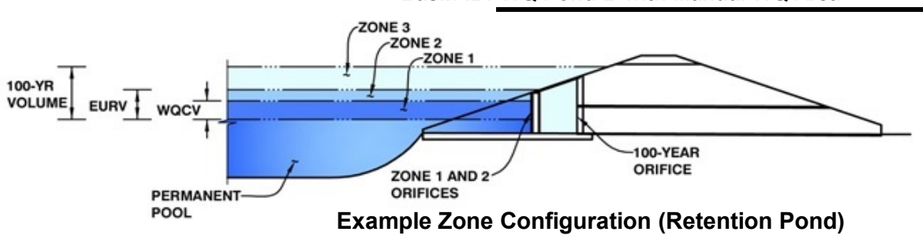
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	1,064	0.024		
	--	1.00	--	--	--	2,091	0.048	1,557	0.036
	--	2.00	--	--	--	3,221	0.074	4,201	0.096
Spillway Invert	--	3.00	--	--	--	4,547	0.104	8,117	0.186
	--	4.00	--	--	--	5,974	0.137	13,378	0.307
Freeboard	--	5.00	--	--	--	7,498	0.172	20,114	0.462

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Water Quality Pond B

Basin ID: WQ Pond B with Manual WQ Area



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (User)	0.55	0.017	Orifice Plate
Zone 2			Weir&Pipe (Circular)
Zone 3			
		0.017	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.00	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	5.00	inches
Orifice Plate: Orifice Area per Row =	0.30	sq. inches (diameter = 5/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.083E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.40	0.80					
Orifice Area (sq. inches)	0.30	0.30	0.30					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =			inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =			ft^2
Vertical Orifice Centroid =			feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.00		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00		feet
Overflow Grate Open Area % =	85%		%, grate open area/total area
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.00		feet
Over Flow Weir Slope Length =	3.00		feet
Grate Open Area / 100-yr Orifice Area =	5.77		should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	10.20		ft^2
Overflow Grate Open Area w/ Debris =	5.10		ft^2

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

	Zone 2 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	2.50		ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Not Selected	
Outlet Orifice Area =	1.77		ft^2
Outlet Orifice Centroid =	0.75		feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	7.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

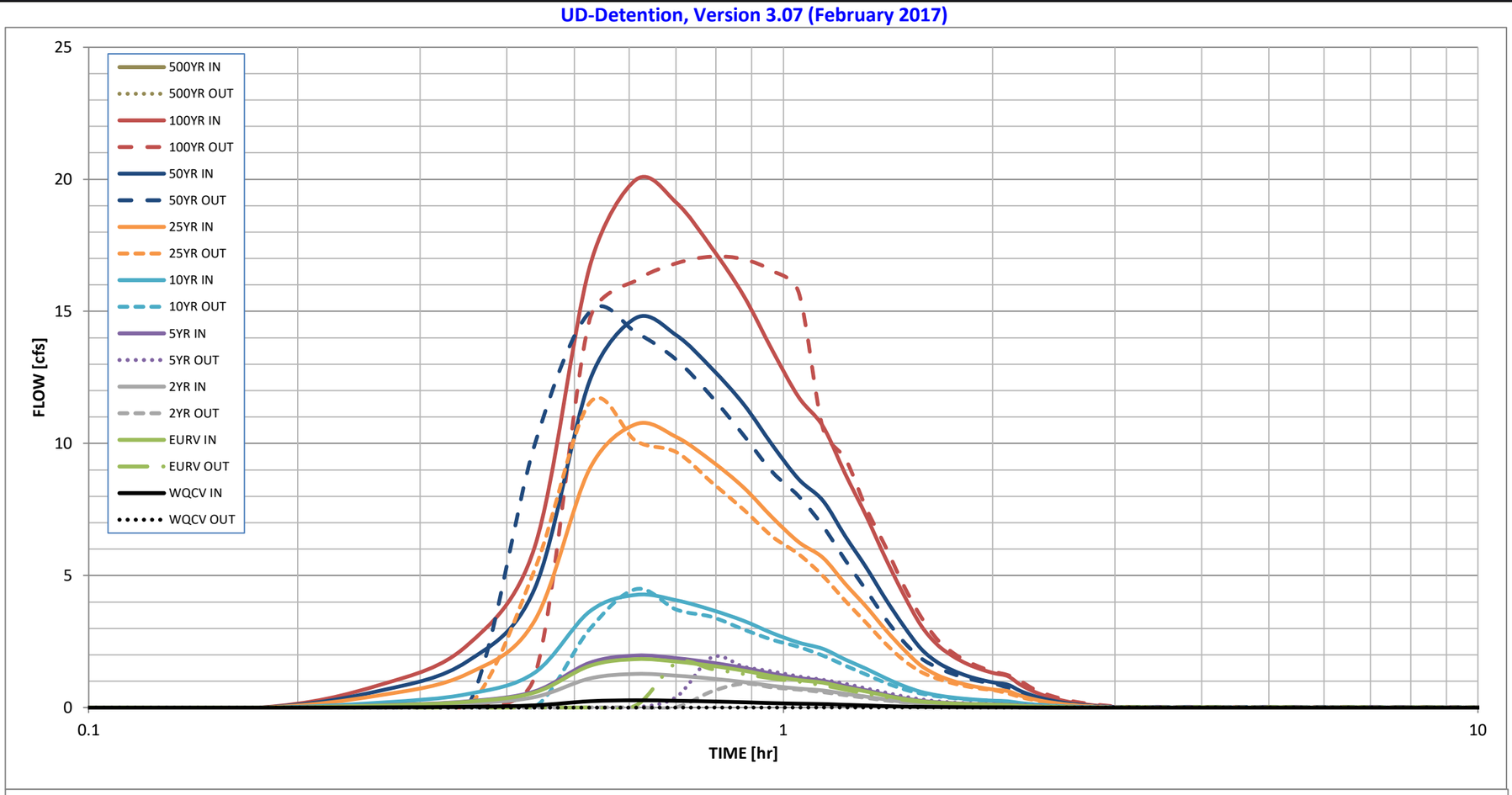
Spillway Design Flow Depth=	0.78	feet
Stage at Top of Freeboard =	4.78	feet
Basin Area at Top of Freeboard =	0.16	acres

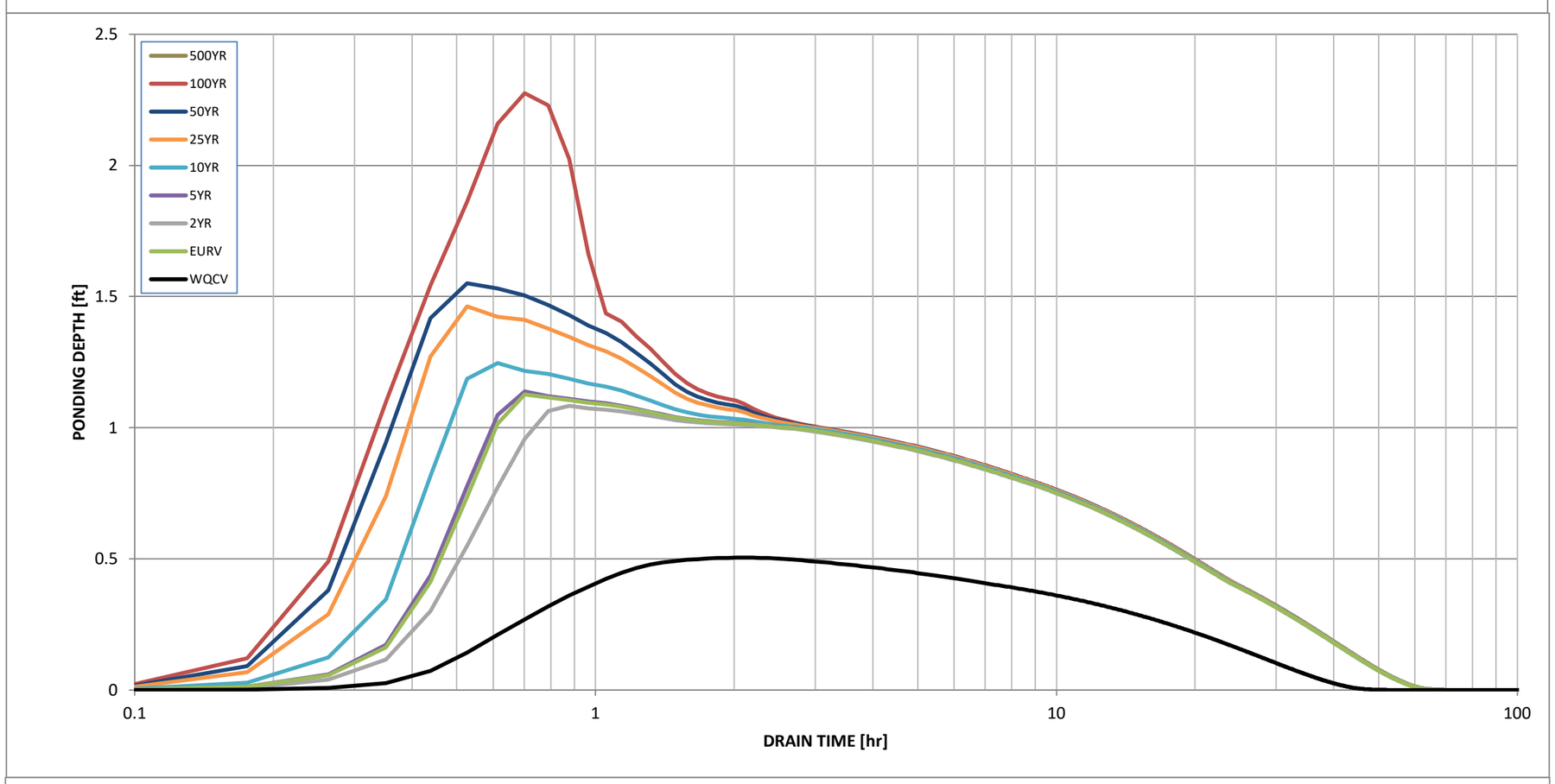
Routed Hydrograph Results

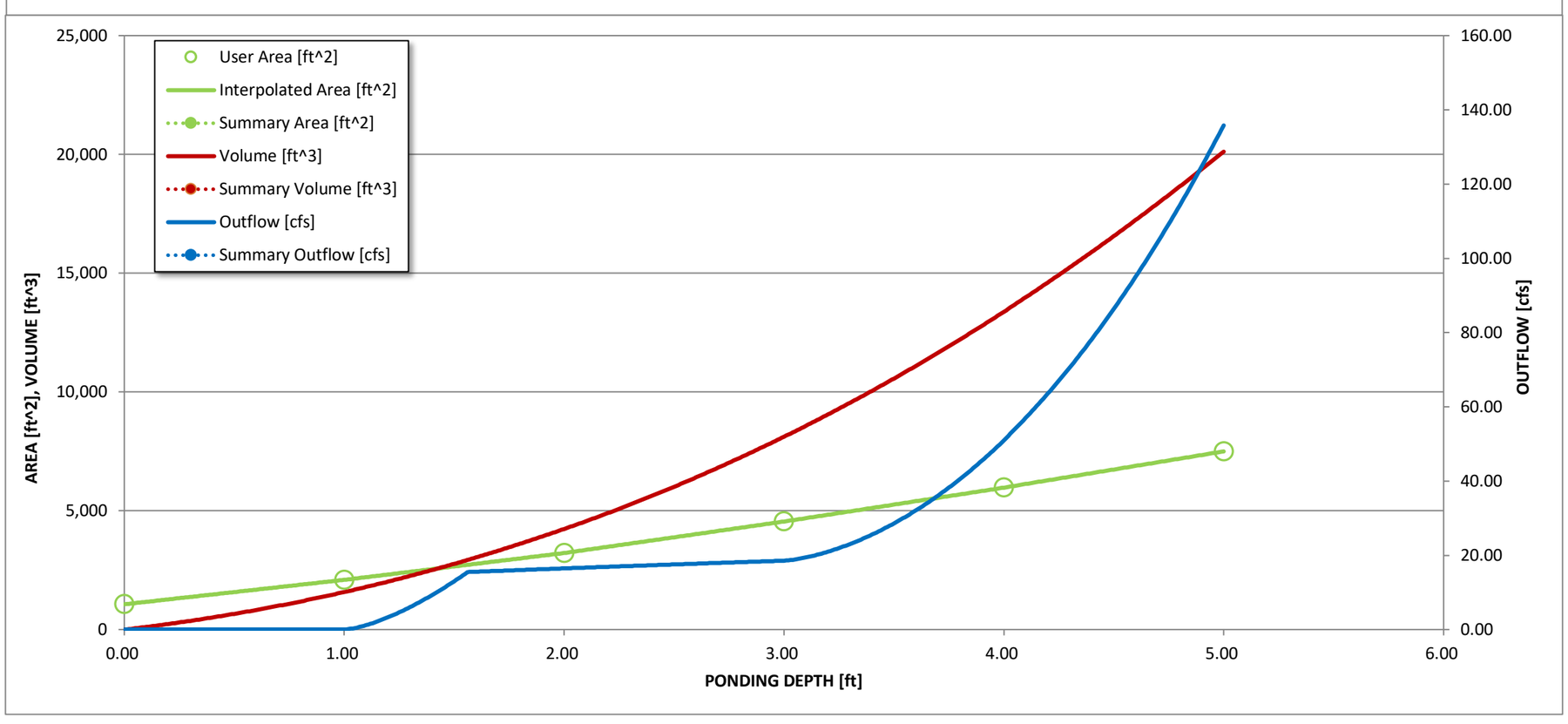
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.067	0.115	0.080	0.123	0.268	0.680	0.939	1.277	0.000
OPTIONAL Override Runoff Volume (acre-ft) =	0.017								
Inflow Hydrograph Volume (acre-ft) =	0.017	0.114	0.079	0.122	0.268	0.680	0.939	1.276	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.19	0.63	0.87	1.17	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.2	2.1	6.9	9.5	12.8	0.0
Peak Inflow Q (cfs) =	0.3	1.8	1.3	2.0	4.3	10.7	14.8	20.0	#N/A
Peak Outflow Q (cfs) =	0.0	1.7	0.9	1.9	4.5	11.5	15.0	17.1	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	8.9	2.2	1.7	1.6	1.3	#N/A
Structure Controlling Flow =	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	0.15	0.07	0.2	0.4	1.1	1.4	1.7	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	41	44	48	43	32	15	8	3	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**45**	54	56	53	47	35	29	23	#N/A
Maximum Ponding Depth (ft) =	0.51	1.13	1.08	1.14	1.25	1.46	1.55	2.28	#N/A
Area at Maximum Ponding Depth (acres) =	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.08	#N/A
Maximum Volume Stored (acre-ft) =	0.015	0.042	0.040	0.043	0.048	0.061	0.066	0.118	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

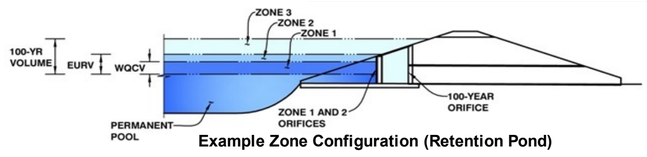
	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.26 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:05:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:10:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:15:47	0.01	0.08	0.06	0.09	0.19	0.48	0.65	0.87	#N/A
0.951	0:21:02	0.03	0.22	0.16	0.24	0.51	1.28	1.75	2.36	#N/A
	0:26:18	0.09	0.57	0.40	0.62	1.32	3.29	4.50	6.07	#N/A
	0:31:34	0.24	1.58	1.10	1.70	3.64	9.04	12.36	16.67	#N/A
	0:36:49	0.28	1.84	1.28	1.97	4.27	10.73	14.75	19.99	#N/A
	0:42:05	0.26	1.74	1.21	1.87	4.07	10.24	14.09	19.11	#N/A
	0:47:20	0.24	1.59	1.10	1.70	3.70	9.33	12.83	17.40	#N/A
	0:52:36	0.21	1.40	0.97	1.51	3.29	8.33	11.48	15.59	#N/A
	0:57:52	0.17	1.20	0.83	1.29	2.82	7.20	9.94	13.52	#N/A
	1:03:07	0.15	1.05	0.72	1.13	2.46	6.27	8.65	11.75	#N/A
	1:08:23	0.14	0.95	0.65	1.02	2.23	5.68	7.84	10.66	#N/A
	1:13:38	0.11	0.77	0.53	0.82	1.82	4.69	6.49	8.85	#N/A
	1:18:54	0.08	0.61	0.42	0.66	1.48	3.83	5.32	7.27	#N/A
	1:24:10	0.06	0.46	0.31	0.49	1.12	2.95	4.12	5.66	#N/A
	1:29:25	0.04	0.33	0.22	0.36	0.82	2.20	3.09	4.27	#N/A
	1:34:41	0.03	0.24	0.17	0.26	0.60	1.59	2.23	3.11	#N/A
	1:39:56	0.03	0.19	0.13	0.21	0.47	1.23	1.72	2.38	#N/A
	1:45:12	0.02	0.16	0.11	0.17	0.39	1.01	1.41	1.95	#N/A
	1:50:28	0.02	0.14	0.09	0.15	0.33	0.86	1.20	1.65	#N/A
	1:55:43	0.02	0.12	0.08	0.13	0.29	0.76	1.05	1.45	#N/A
	2:00:59	0.02	0.11	0.07	0.12	0.26	0.68	0.95	1.30	#N/A
	2:06:14	0.01	0.10	0.07	0.11	0.24	0.63	0.87	1.19	#N/A
	2:11:30	0.01	0.07	0.05	0.08	0.18	0.46	0.64	0.88	#N/A
	2:16:46	0.01	0.05	0.04	0.06	0.13	0.34	0.47	0.64	#N/A
	2:22:01	0.01	0.04	0.03	0.04	0.10	0.25	0.34	0.47	#N/A
	2:27:17	0.00	0.03	0.02	0.03	0.07	0.18	0.25	0.35	#N/A
	2:32:32	0.00	0.02	0.01	0.02	0.05	0.13	0.18	0.25	#N/A
	2:37:48	0.00	0.01	0.01	0.02	0.03	0.09	0.13	0.18	#N/A
	2:43:04	0.00	0.01	0.01	0.01	0.02	0.07	0.09	0.13	#N/A
	2:48:19	0.00	0.01	0.00	0.01	0.02	0.04	0.06	0.09	#N/A
	2:53:35	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.05	#N/A
	2:58:50	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	#N/A
	3:04:06	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	#N/A
	3:09:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:14:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:19:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:25:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:30:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:35:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:40:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:46:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:51:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:56:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:01:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:07:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:12:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:17:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:23:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:28:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:33:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:38:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:44:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:49:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:54:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:59:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:05:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:10:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:15:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:20:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:26:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:31:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:36:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:41:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:47:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:52:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:57:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:02:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:08:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:13:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:18:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Water Quality Pond C

Basin ID: Basin C1+C2+C3 with Manual WQ Area



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**	
Watershed Area =	136.50	acres
Watershed Length =	6,193	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	3.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.310	acre-feet
Excess Urban Runoff Volume (EURV) =	0.438	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.273	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.461	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	1.910	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	7.188	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	10.442	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	14.689	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.252	acre-feet
Approximate 5-yr Detention Volume =	0.430	acre-feet
Approximate 10-yr Detention Volume =	1.559	acre-feet
Approximate 25-yr Detention Volume =	2.421	acre-feet
Approximate 50-yr Detention Volume =	2.420	acre-feet
Approximate 100-yr Detention Volume =	3.266	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (User Defined) =	0.048	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.048	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

WQCV not provided!

Total detention volume is less than 100-year volume.

Depth Increment = ft

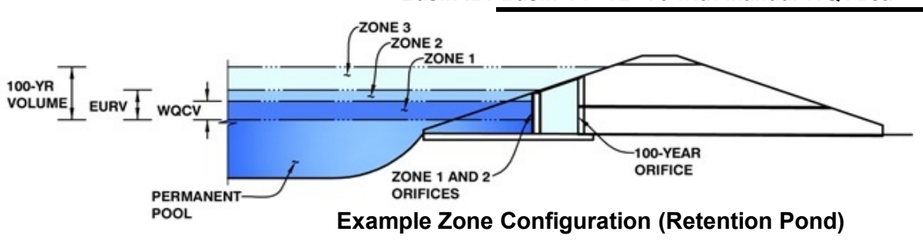
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	2,847	0.065		
	--	1.00	--	--	--	4,198	0.096	3,481	0.080
	--	2.00	--	--	--	5,625	0.129	8,378	0.192
	--	3.00	--	--	--	7,312	0.168	14,902	0.342
Spillway Invert	--	4.00	--	--	--	9,122	0.209	23,120	0.531
	--	5.00	--	--	--	10,981	0.252	33,171	0.762
Top	--	6.00	--	--	--	12,982	0.298	45,153	1.037

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Water Quality Pond C

Basin ID: Basin C1+C2+C3 with Manual WQ Area



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (User)	0.64	0.048	Orifice Plate
Zone 2			Weir&Pipe (Circular)
Zone 3			
		0.048	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.00	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	5.00	inches
Orifice Plate: Orifice Area per Row =	0.80	sq. inches (diameter = 1 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.556E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.40	0.80					
Orifice Area (sq. inches)	0.80	0.80	0.80					

	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)

	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =			inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =			ft^2
Vertical Orifice Centroid =			feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.00		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	14.00		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00		feet
Overflow Grate Open Area % =	85%		%, grate open area/total area
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.00		feet
Over Flow Weir Slope Length =	3.00		feet
Grate Open Area / 100-yr Orifice Area =	2.24		should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	35.70		ft^2
Overflow Grate Open Area w/ Debris =	17.85		ft^2

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

	Zone 2 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	4.00		ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	54.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Not Selected	
Outlet Orifice Area =	15.90		ft^2
Outlet Orifice Centroid =	2.25		feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	56.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

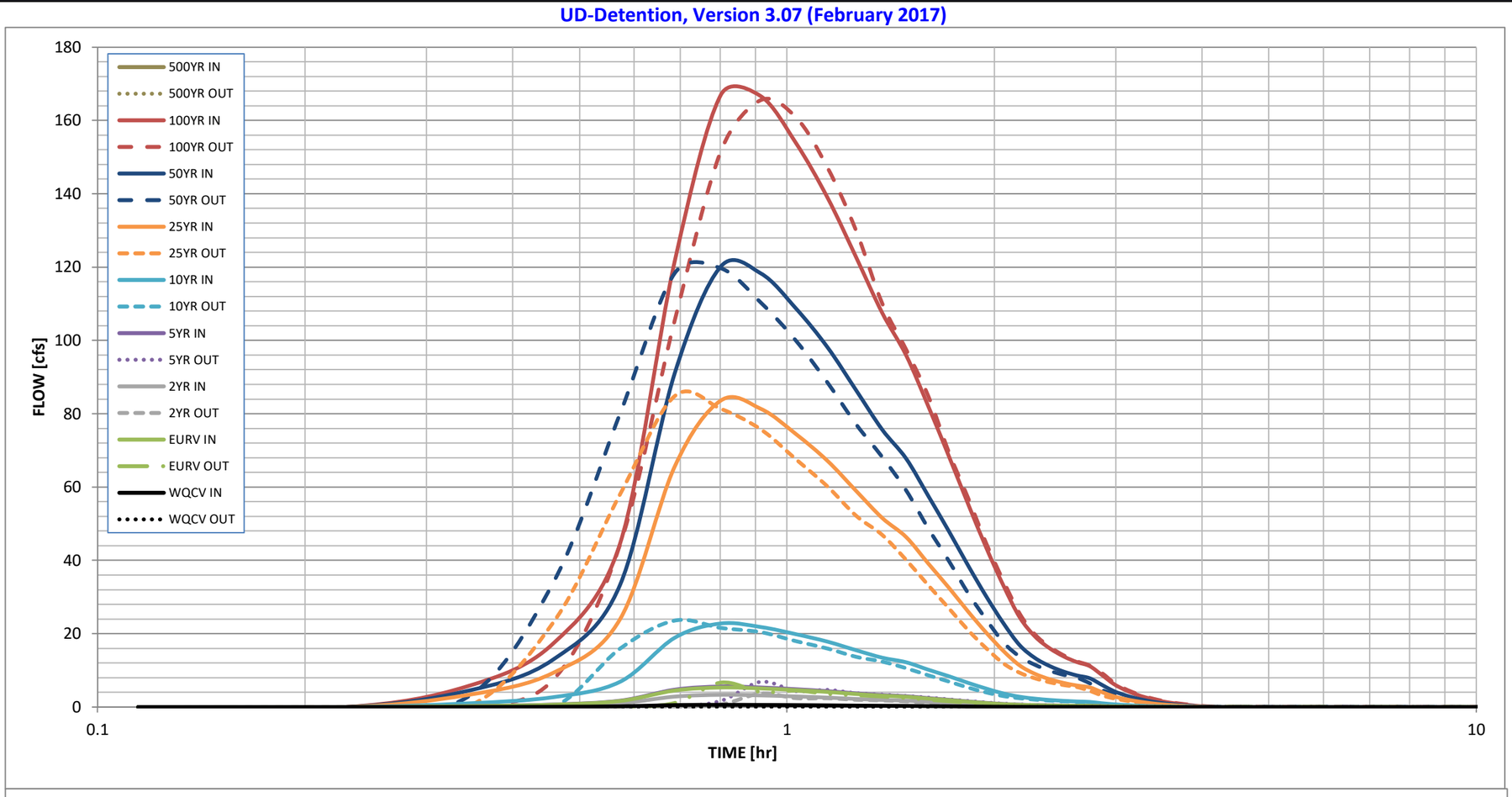
Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	5.96	feet
Basin Area at Top of Freeboard =	0.30	acres

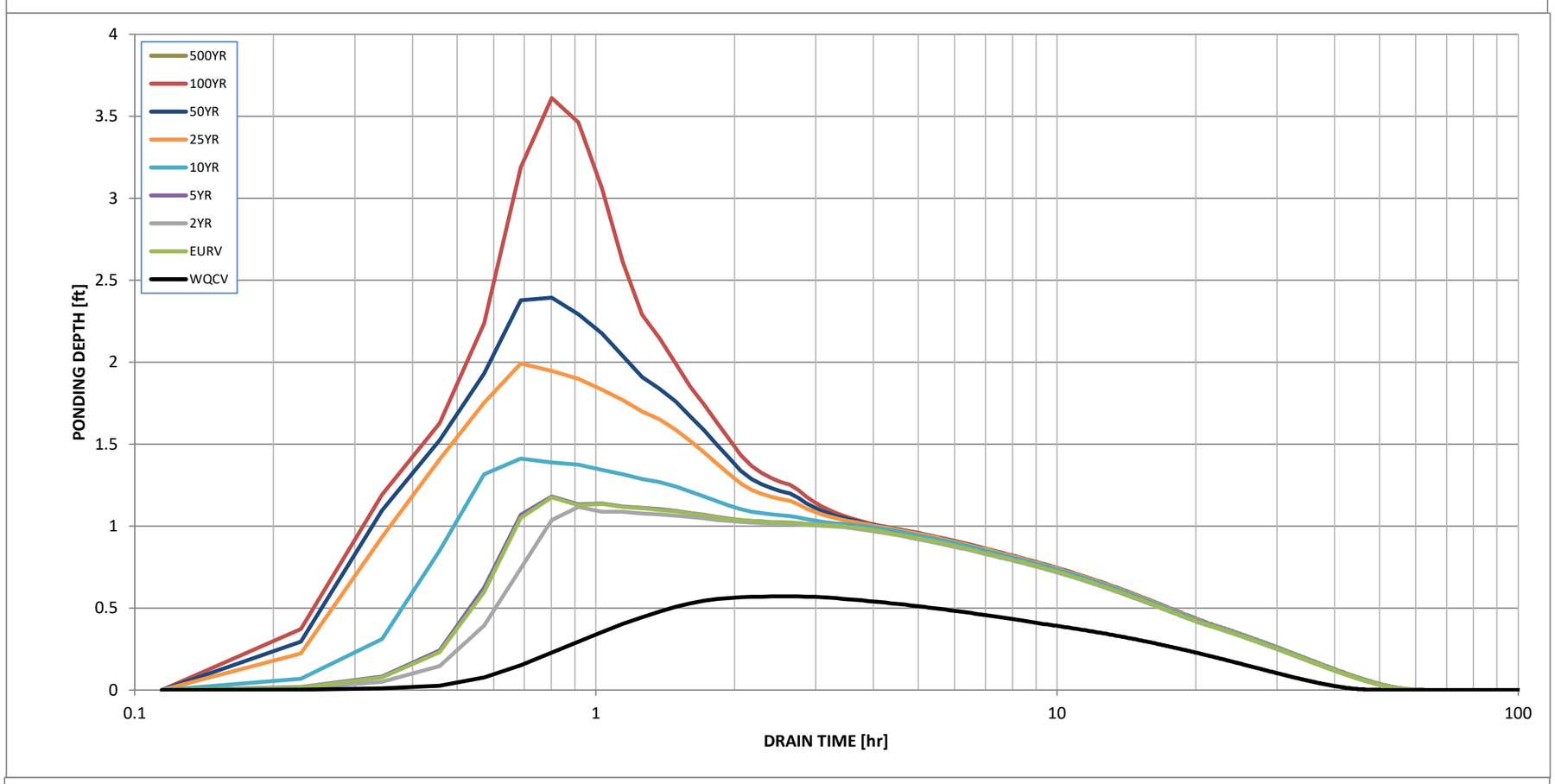
Routed Hydrograph Results

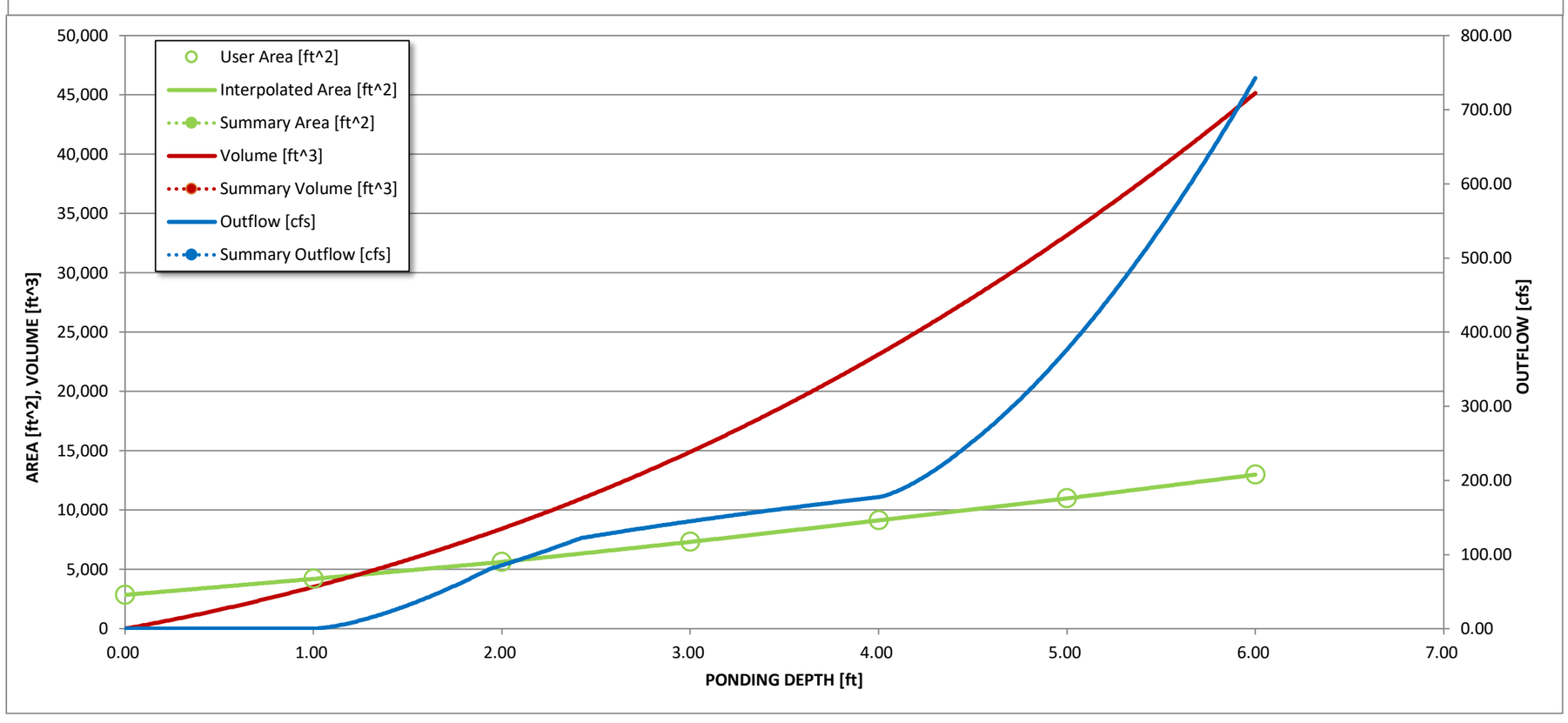
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.310	0.438	0.273	0.461	1.910	7.188	10.442	14.689	0.000
OPTIONAL Override Runoff Volume (acre-ft) =	0.048								
Inflow Hydrograph Volume (acre-ft) =	0.048	0.438	0.272	0.460	1.909	7.179	10.433	14.682	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.01	0.13	0.46	0.64	0.88	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.1	1.9	17.8	63.0	87.5	119.5	0.0
Peak Inflow Q (cfs) =	0.6	5.3	3.3	5.6	22.8	83.6	120.1	166.9	#N/A
Peak Outflow Q (cfs) =	0.0	6.6	3.7	6.9	23.6	84.8	119.7	165.5	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.6	1.3	1.3	1.4	1.4	#N/A
Structure Controlling Flow =	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	0.17	0.09	0.2	0.6	2.3	3.3	4.6	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	41	34	40	33	10	1	1	1	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**44**	46	49	45	29	6	2	2	#N/A
Maximum Ponding Depth (ft) =	0.57	1.18	1.12	1.18	1.41	1.99	2.39	3.61	#N/A
Area at Maximum Ponding Depth (acres) =	0.08	0.10	0.10	0.10	0.11	0.13	0.14	0.19	#N/A
Maximum Volume Stored (acre-ft) =	0.042	0.098	0.092	0.099	0.123	0.192	0.247	0.450	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

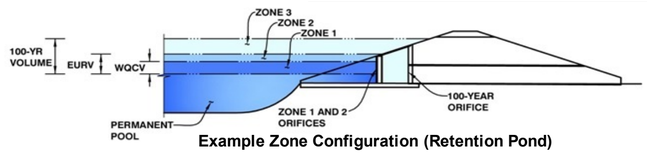
	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
6.87 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:06:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:13:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:20:37	0.03	0.24	0.15	0.25	0.98	3.25	4.38	5.63	#N/A
0.728	0:27:29	0.07	0.64	0.40	0.67	2.68	9.32	12.95	17.32	#N/A
	0:34:21	0.19	1.64	1.03	1.72	6.88	23.94	33.29	44.55	#N/A
	0:41:13	0.52	4.50	2.83	4.72	18.87	65.53	90.94	121.46	#N/A
	0:48:05	0.60	5.32	3.33	5.58	22.78	83.58	120.14	166.93	#N/A
	0:54:58	0.56	5.07	3.17	5.32	21.81	81.34	118.29	166.62	#N/A
	1:01:50	0.51	4.61	2.88	4.84	19.85	74.43	108.69	153.81	#N/A
	1:08:42	0.45	4.11	2.56	4.32	17.82	67.12	98.10	138.91	#N/A
	1:15:34	0.38	3.54	2.20	3.72	15.49	58.96	86.41	122.70	#N/A
	1:22:26	0.33	3.09	1.92	3.24	13.45	51.58	75.68	107.54	#N/A
	1:29:19	0.30	2.80	1.74	2.94	12.20	46.36	67.78	95.95	#N/A
	1:36:11	0.24	2.30	1.42	2.42	10.17	39.13	57.57	82.03	#N/A
	1:43:03	0.19	1.87	1.15	1.97	8.38	32.51	47.91	68.36	#N/A
	1:49:55	0.14	1.43	0.87	1.51	6.57	25.98	38.51	55.26	#N/A
	1:56:47	0.10	1.06	0.64	1.12	5.00	20.21	30.09	43.33	#N/A
	2:03:40	0.07	0.77	0.47	0.81	3.68	15.24	22.81	33.05	#N/A
	2:10:32	0.06	0.60	0.37	0.63	2.79	11.33	16.84	24.45	#N/A
	2:17:24	0.05	0.49	0.30	0.52	2.27	9.03	13.35	19.21	#N/A
	2:24:16	0.04	0.42	0.26	0.44	1.92	7.58	11.18	16.01	#N/A
	2:31:08	0.04	0.37	0.23	0.39	1.68	6.57	9.66	13.79	#N/A
	2:38:01	0.03	0.33	0.20	0.35	1.50	5.86	8.60	12.25	#N/A
	2:44:53	0.03	0.31	0.19	0.32	1.38	5.35	7.85	11.15	#N/A
	2:51:45	0.02	0.23	0.14	0.24	1.02	4.06	6.04	8.74	#N/A
	2:58:37	0.02	0.17	0.10	0.17	0.74	2.93	4.35	6.30	#N/A
	3:05:29	0.01	0.12	0.07	0.13	0.55	2.17	3.23	4.67	#N/A
	3:12:22	0.01	0.09	0.05	0.09	0.41	1.61	2.40	3.46	#N/A
	3:19:14	0.01	0.06	0.04	0.07	0.29	1.19	1.77	2.57	#N/A
	3:26:06	0.00	0.04	0.03	0.05	0.21	0.86	1.28	1.86	#N/A
	3:32:58	0.00	0.03	0.02	0.03	0.15	0.62	0.93	1.35	#N/A
	3:39:50	0.00	0.02	0.01	0.02	0.10	0.44	0.66	0.97	#N/A
	3:46:43	0.00	0.01	0.01	0.01	0.06	0.29	0.44	0.65	#N/A
	3:53:35	0.00	0.01	0.00	0.01	0.04	0.17	0.26	0.40	#N/A
	4:00:27	0.00	0.00	0.00	0.00	0.01	0.08	0.13	0.20	#N/A
	4:07:19	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.07	#N/A
	4:14:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	#N/A
	4:21:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:27:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:34:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:41:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:48:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:55:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:02:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:09:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:16:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:22:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:29:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:36:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:43:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:50:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:57:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:04:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:10:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:17:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:24:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:31:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:38:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:45:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:52:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:59:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:05:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:12:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:19:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:26:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:33:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:40:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:47:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:54:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:00:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:07:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:14:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Winsome Filing 1 - Water Quality Pond D**

Basin ID: **Basin D1.1+D2 with Manual WQ Area**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	127.00	acres		
Watershed Length =	4,370	ft		
Watershed Slope =	0.034	ft/ft		
Watershed Imperviousness =	7.60%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.559	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.887	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.594	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.945	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.479	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.312	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	10.317	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	14.240	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.550	acre-feet		
Approximate 5-yr Detention Volume =	0.884	acre-feet		
Approximate 10-yr Detention Volume =	2.088	acre-feet		
Approximate 25-yr Detention Volume =	3.038	acre-feet		
Approximate 50-yr Detention Volume =	3.149	acre-feet		
Approximate 100-yr Detention Volume =	4.132	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (User Defined) =	0.051	acre-feet	**WQCV not provided!**
Select Zone 2 Storage Volume (Optional) =		acre-feet	**Total detention volume is less than 100-year volume.**
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	0.051	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

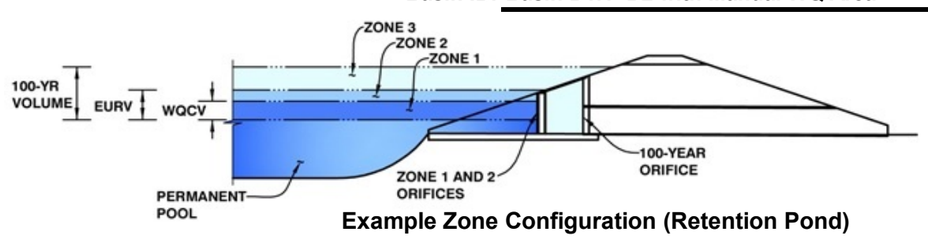
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	669	0.015		
	--	1.00	--	--	--	2,636	0.061	1,626	0.037
	--	2.00	--	--	--	5,388	0.124	5,611	0.129
	--	3.00	--	--	--	8,175	0.188	12,446	0.286
	--	4.00	--	--	--	9,394	0.216	21,230	0.487
Spillway	--	5.00	--	--	--	10,603	0.243	31,229	0.717
	--	6.00	--	--	--	12,119	0.278	42,590	0.978
Top	--	7.00	--	--	--	18,516	0.425	57,907	1.329

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Water Quality Pond

Basin ID: Basin D1.1+D2 with Manual WQ Area



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (User)	1.20	0.051	Orifice Plate
Zone 2			Weir&Pipe (Circular)
Zone 3			
		0.051	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	6.00	inches
Orifice Plate: Orifice Area per Row =	0.40	sq. inches (diameter = 11/16 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.778E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00					
Orifice Area (sq. inches)	0.40	0.40	0.40					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =			inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =			ft^2
Vertical Orifice Centroid =			feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.50		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	15.00		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00		feet
Overflow Grate Open Area % =	85%		%, grate open area/total area
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.50		feet
Over Flow Weir Slope Length =	3.00		feet
Grate Open Area / 100-yr Orifice Area =	1.99		should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	38.25		ft^2
Overflow Grate Open Area w/ Debris =	19.13		ft^2

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

	Zone 2 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	2.50		ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	59.39		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Not Selected	
Outlet Orifice Area =	19.24		ft^2
Outlet Orifice Centroid =	2.47		feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	68.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

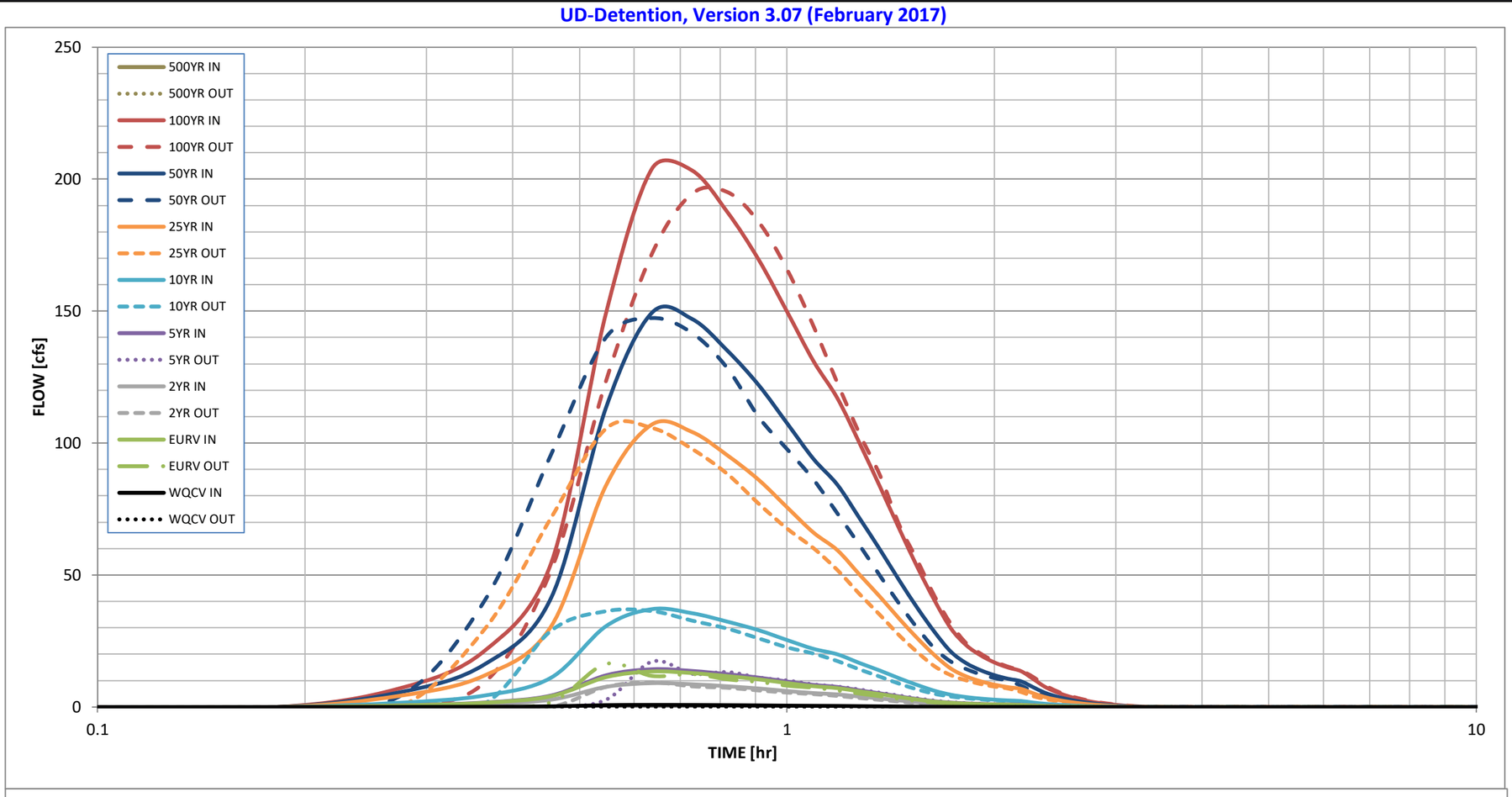
Spillway Design Flow Depth=	0.97	feet
Stage at Top of Freeboard =	6.97	feet
Basin Area at Top of Freeboard =	0.42	acres

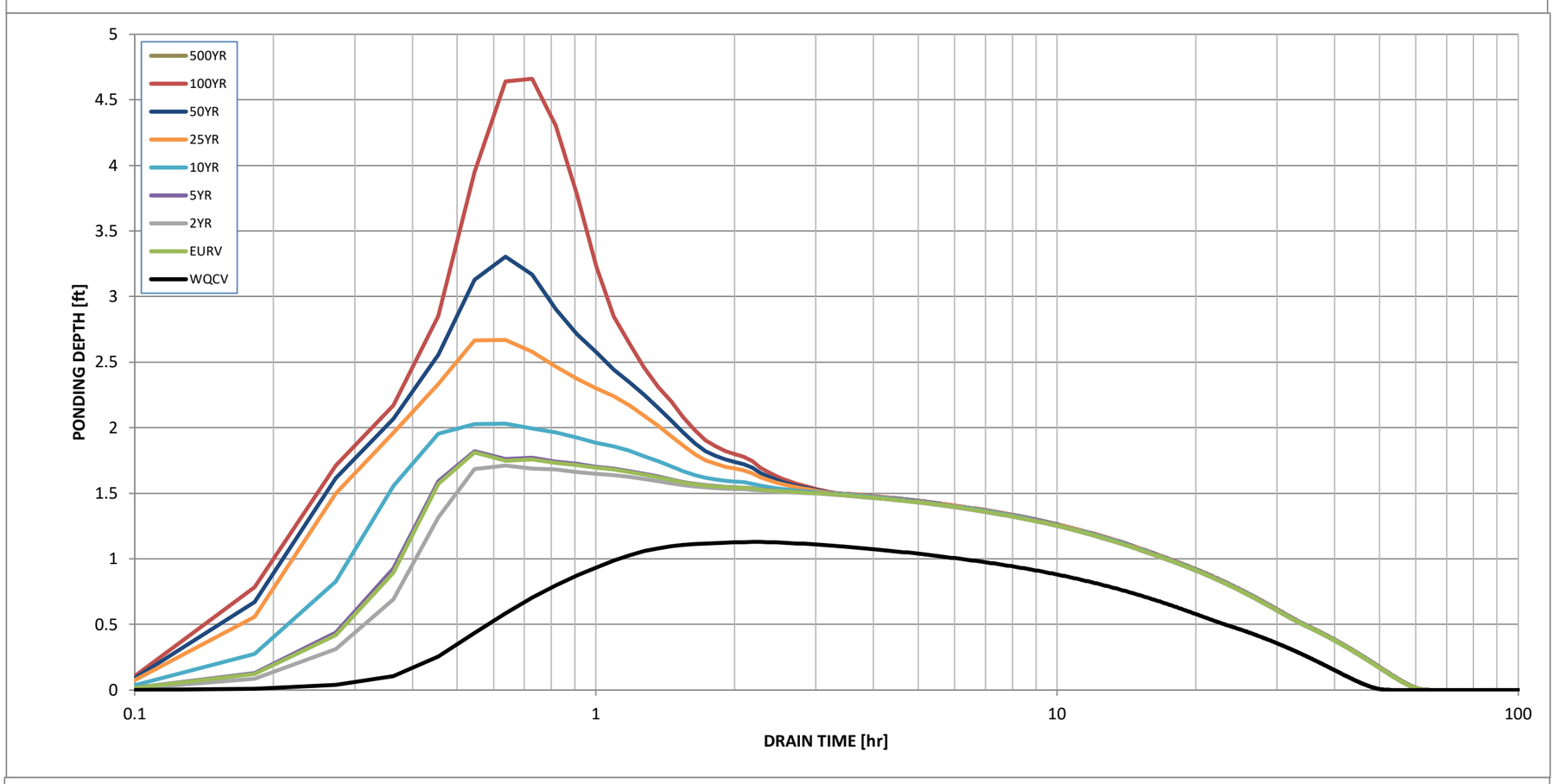
Routed Hydrograph Results

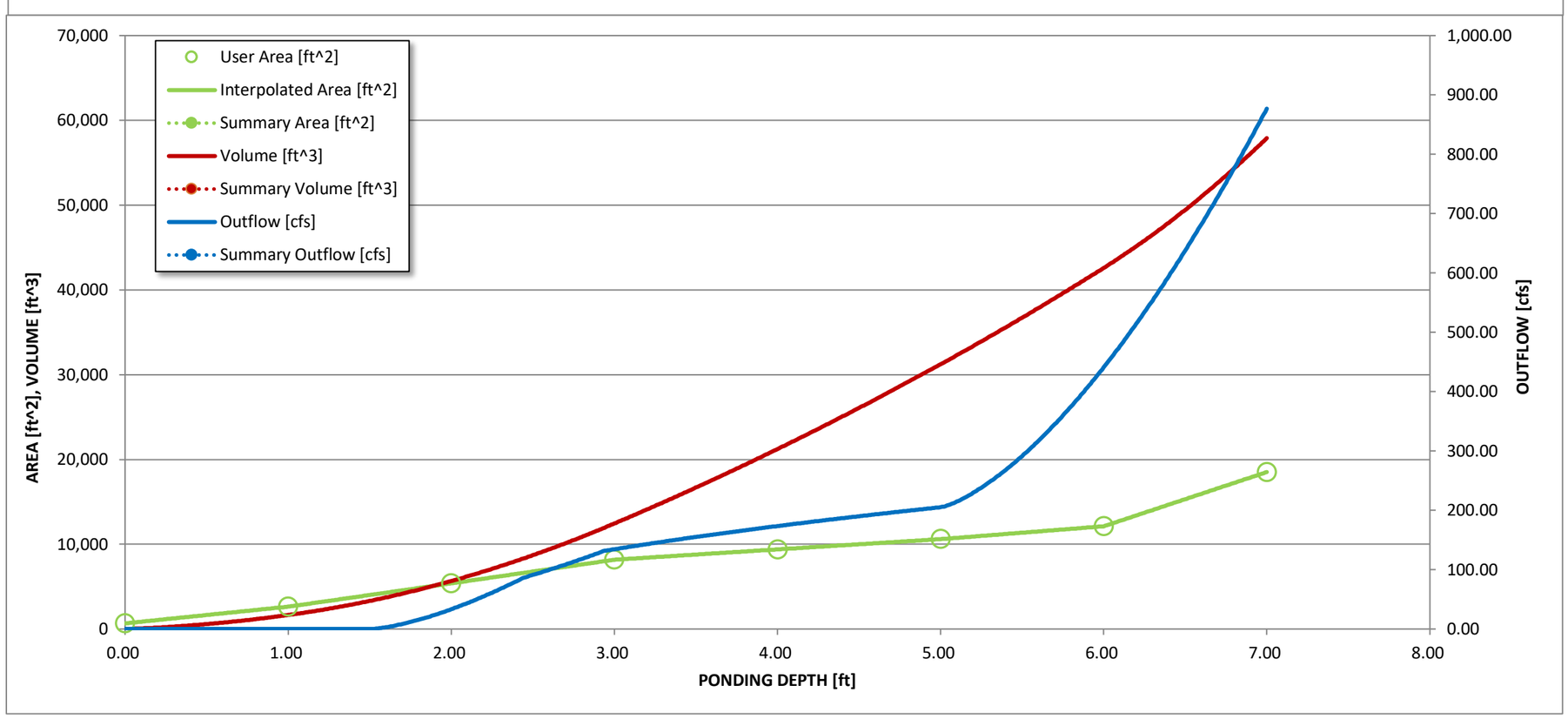
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.559	0.887	0.594	0.945	2.479	7.312	10.317	14.240	0.000
OPTIONAL Override Runoff Volume (acre-ft) =	0.051								
Inflow Hydrograph Volume (acre-ft) =	0.050	0.887	0.594	0.944	2.479	7.310	10.306	14.238	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.18	0.60	0.82	1.11	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.4	2.4	22.3	75.6	104.6	141.5	0.0
Peak Inflow Q (cfs) =	0.8	13.4	9.0	14.3	37.1	107.0	149.4	203.9	#N/A
Peak Outflow Q (cfs) =	0.0	16.3	9.3	17.2	36.3	105.7	147.3	195.1	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	7.3	1.6	1.4	1.4	1.4	#N/A
Structure Controlling Flow =	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	0.40	0.22	0.4	0.9	2.8	3.8	5.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	44	24	30	23	4	1	1	1	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**47**	40	45	39	25	4	2	2	#N/A
Maximum Ponding Depth (ft) =	1.13	1.81	1.71	1.82	2.03	2.67	3.30	4.66	#N/A
Area at Maximum Ponding Depth (acres) =	0.07	0.11	0.11	0.11	0.12	0.17	0.20	0.23	#N/A
Maximum Volume Stored (acre-ft) =	0.046	0.107	0.097	0.109	0.133	0.226	0.343	0.636	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

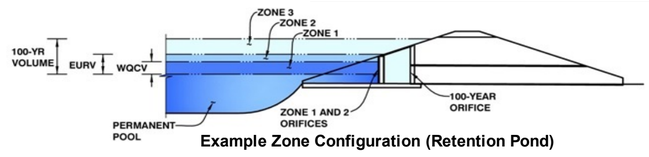
	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.46 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:05:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:10:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:16:23	0.04	0.59	0.40	0.63	1.58	4.16	5.46	6.93	#N/A
0.916	0:21:50	0.10	1.60	1.08	1.70	4.34	11.92	16.13	21.24	#N/A
	0:27:18	0.25	4.11	2.77	4.36	11.14	30.62	41.44	54.63	#N/A
	0:32:46	0.69	11.28	7.62	11.98	30.57	83.80	113.23	148.96	#N/A
	0:38:13	0.80	13.45	9.04	14.29	37.08	107.04	149.38	203.94	#N/A
	0:43:41	0.75	12.84	8.62	13.66	35.54	104.21	147.01	203.29	#N/A
	0:49:08	0.68	11.69	7.85	12.43	32.34	95.38	135.07	187.58	#N/A
	0:54:36	0.60	10.46	7.01	11.13	29.07	86.02	121.90	169.39	#N/A
	1:00:04	0.51	9.05	6.05	9.63	25.32	75.56	107.37	149.59	#N/A
	1:05:31	0.45	7.88	5.27	8.38	22.04	66.11	94.03	131.10	#N/A
	1:10:59	0.40	7.14	4.77	7.60	19.95	59.41	84.22	117.01	#N/A
	1:16:26	0.32	5.91	3.94	6.29	16.66	50.16	71.52	99.98	#N/A
	1:21:54	0.26	4.84	3.21	5.15	13.76	41.68	59.52	83.30	#N/A
	1:27:22	0.19	3.75	2.47	3.99	10.82	33.32	47.83	67.31	#N/A
	1:32:49	0.13	2.80	1.84	2.99	8.28	25.93	37.37	52.76	#N/A
	1:38:17	0.10	2.02	1.33	2.16	6.12	19.55	28.32	40.21	#N/A
	1:43:44	0.08	1.56	1.03	1.67	4.63	14.53	20.92	29.74	#N/A
	1:49:12	0.07	1.28	0.85	1.37	3.75	11.58	16.58	23.38	#N/A
	1:54:40	0.06	1.09	0.72	1.16	3.17	9.71	13.88	19.50	#N/A
	2:00:07	0.05	0.96	0.63	1.02	2.76	8.42	12.00	16.81	#N/A
	2:05:35	0.05	0.86	0.57	0.92	2.48	7.51	10.69	14.93	#N/A
	2:11:02	0.04	0.79	0.53	0.84	2.27	6.86	9.75	13.59	#N/A
	2:16:30	0.03	0.58	0.39	0.62	1.68	5.21	7.50	10.63	#N/A
	2:21:58	0.02	0.43	0.28	0.45	1.22	3.76	5.41	7.66	#N/A
	2:27:25	0.02	0.31	0.21	0.33	0.90	2.79	4.01	5.68	#N/A
	2:32:53	0.01	0.23	0.15	0.25	0.67	2.07	2.98	4.21	#N/A
	2:38:20	0.01	0.17	0.11	0.18	0.49	1.53	2.20	3.12	#N/A
	2:43:48	0.01	0.12	0.08	0.13	0.35	1.10	1.59	2.27	#N/A
	2:49:16	0.00	0.08	0.05	0.09	0.25	0.80	1.15	1.64	#N/A
	2:54:43	0.00	0.06	0.04	0.06	0.17	0.56	0.82	1.18	#N/A
	3:00:11	0.00	0.03	0.02	0.04	0.11	0.37	0.55	0.79	#N/A
	3:05:38	0.00	0.02	0.01	0.02	0.06	0.22	0.33	0.48	#N/A
	3:11:06	0.00	0.01	0.00	0.01	0.03	0.11	0.16	0.24	#N/A
	3:16:34	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.09	#N/A
	3:22:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	#N/A
	3:27:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:32:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:38:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:43:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:49:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:54:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:00:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:05:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:11:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:16:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:22:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:27:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:33:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:38:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:43:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:49:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:54:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:00:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:05:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:11:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:16:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:22:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:27:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:33:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:38:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:43:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:49:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:54:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:00:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:05:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:11:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:16:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:22:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:27:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:33:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Pond 3

Basin ID: Basin D1.2+D3.4.6 with Manual WQ Area



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**		
Watershed Area =	101.00	acres	**Note: L / W Ratio > 8**
Watershed Length =	6,480	ft	**L / W Ratio = 9.5**
Watershed Slope =	0.029	ft/ft	
Watershed Imperviousness =	6.60%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	97.5%	percent	
Percentage Hydrologic Soil Groups C/D =	2.5%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.392	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.604	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.401	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.659	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.857	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	5.716	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	8.114	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	11.244	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.372	acre-feet	
Approximate 5-yr Detention Volume =	0.617	acre-feet	
Approximate 10-yr Detention Volume =	1.536	acre-feet	
Approximate 25-yr Detention Volume =	2.263	acre-feet	
Approximate 50-yr Detention Volume =	2.332	acre-feet	
Approximate 100-yr Detention Volume =	3.087	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (User Defined) =	0.048	acre-feet	**WQCV not provided!**
Zone 2 Volume (EURV - Zone 1) =	0.556	acre-feet	
Zone 3 Volume (100-year - Zones 1 & 2) =	2.482	acre-feet	
Total Detention Basin Volume =	3.087	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

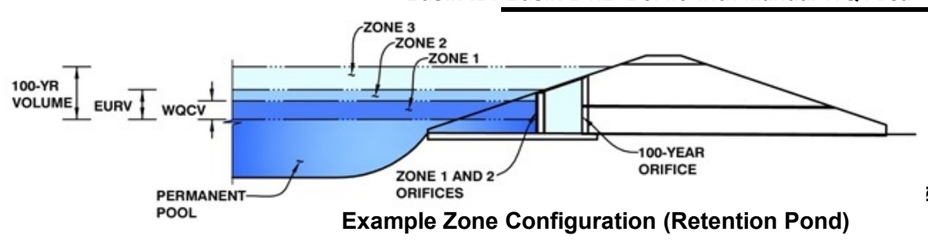
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	989	0.023		
	--	1.00	--	--	--	13,752	0.316	7,233	0.166
	--	2.00	--	--	--	39,772	0.913	33,736	0.774
	--	3.00	--	--	--	44,956	1.032	76,496	1.756
	--	4.00	--	--	--	50,317	1.155	124,133	2.850
	--	5.00	--	--	--	55,782	1.281	177,182	4.068
	--	6.00	--	--	--	61,372	1.409	235,759	5.412
Spillway Invert	--	7.00	--	--	--	67,078	1.540	299,984	6.887
	--	8.00	--	--	--	73,314	1.683	370,180	8.498
Freeboard	--	9.00	--	--	--	78,198	1.795	445,936	10.237

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome Filing 1 - Pond 3 (Water Quality Area)

Basin ID: Basin D1.2+D3.4.6 with Manual WQ Area



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (User)	0.51	0.048	Orifice Plate
Zone 2 (EURV)	1.79	0.556	Rectangular Orifice
Zone 3 (100-year)	4.21	2.482	Weir&Pipe (Circular)
		3.087	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	0.25	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	2.40	inches
Orifice Plate: Orifice Area per Row =	0.35	sq. inches (diameter = 5/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.431E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.20						
Orifice Area (sq. inches)	0.35	0.35						

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	0.25	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	1.50	N/A	inches
Vertical Orifice Width =	8.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.08	N/A	ft^2
Vertical Orifice Centroid =	0.06	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.00	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.08	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	10.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.10	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	30.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	4.91	N/A	ft^2
Outlet Orifice Centroid =	1.25	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	47.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

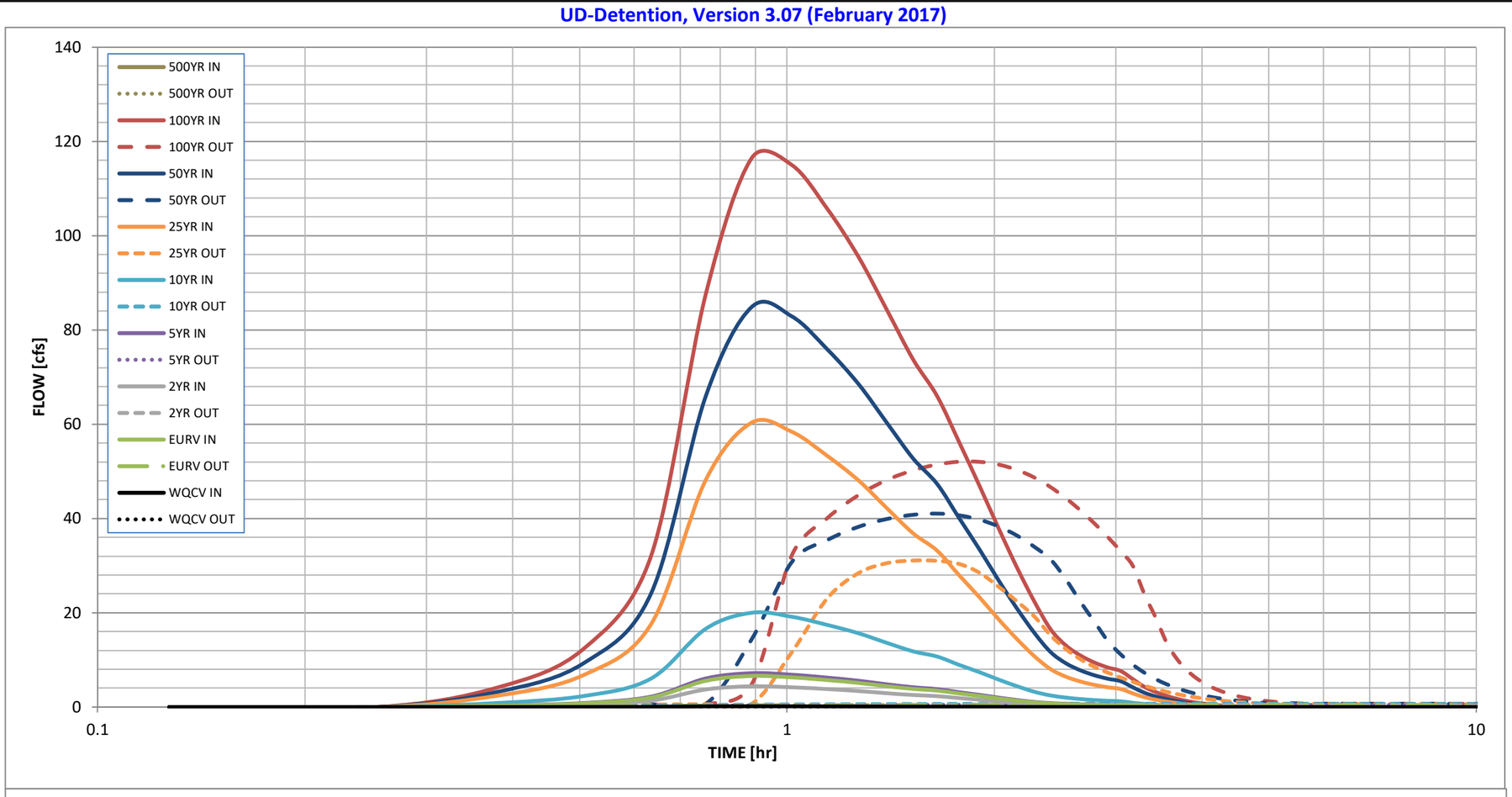
Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	8.96	feet
Basin Area at Top of Freeboard =	1.79	acres

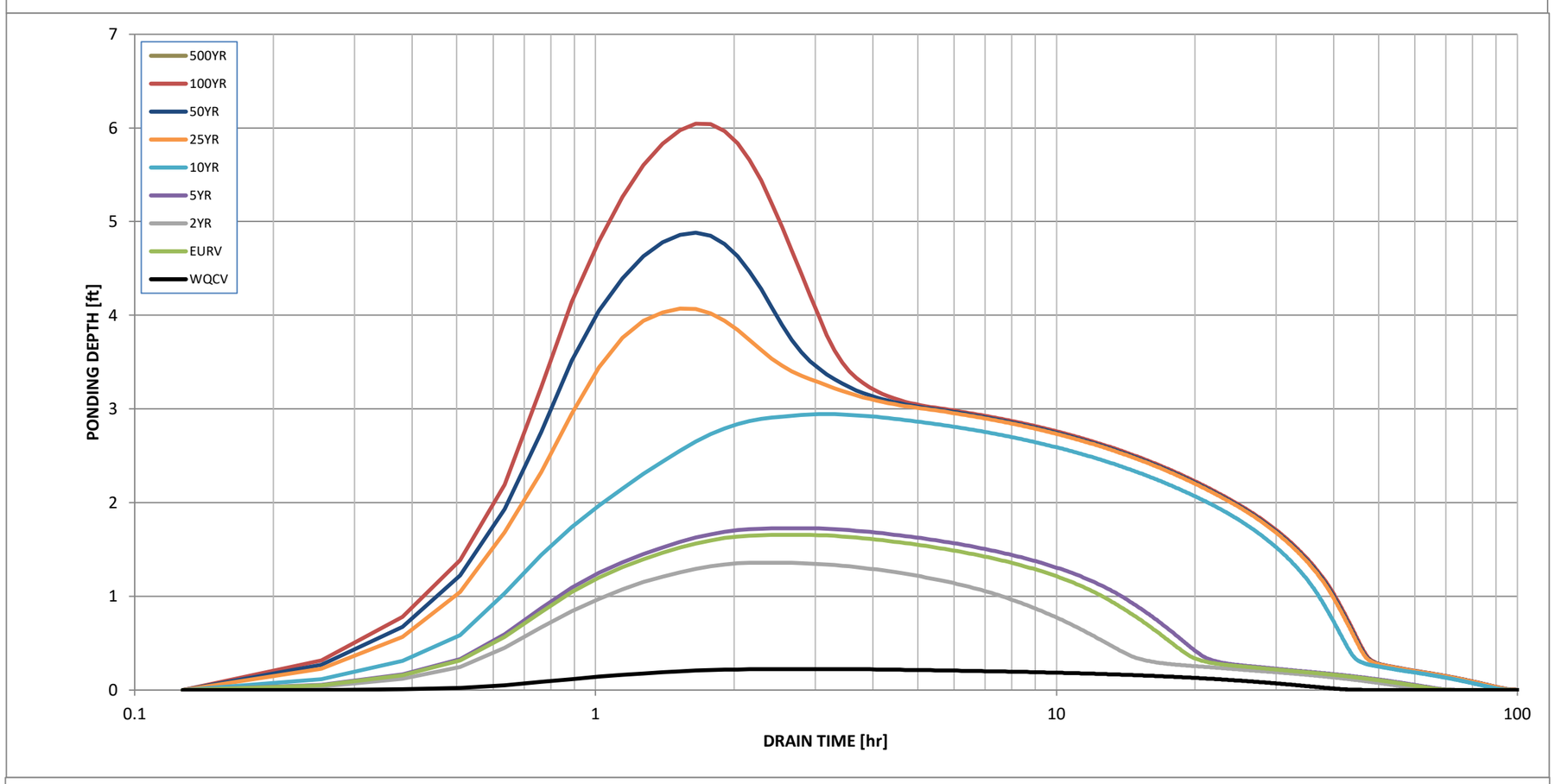
Routed Hydrograph Results

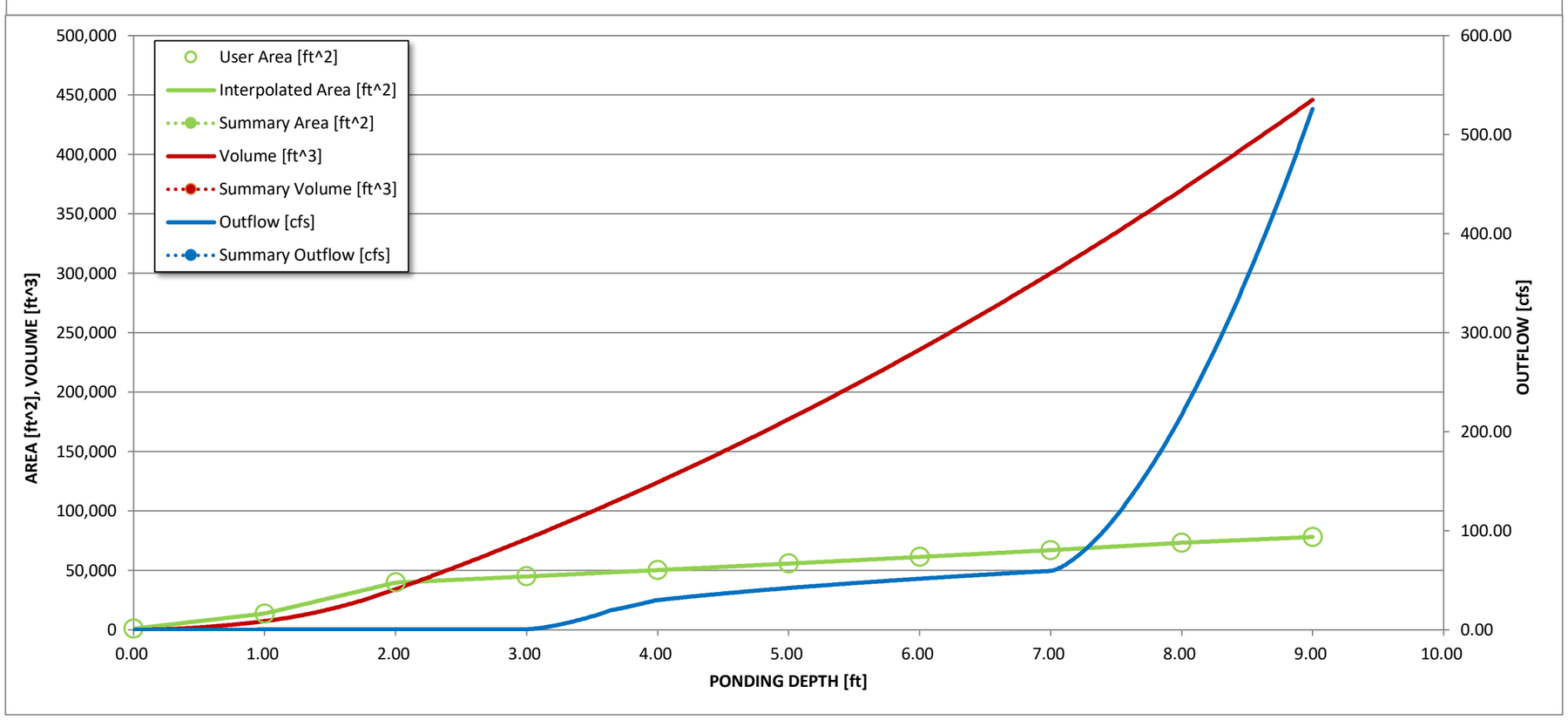
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.392	0.604	0.401	0.659	1.857	5.716	8.114	11.244	0.000
OPTIONAL Override Runoff Volume (acre-ft) =	0.014								
Inflow Hydrograph Volume (acre-ft) =	0.014	0.604	0.401	0.659	1.858	5.715	8.114	11.247	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.14	0.47	0.66	0.89	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.8	1.6	13.7	47.8	66.2	90.3	0.0
Peak Inflow Q (cfs) =	0.2	6.6	4.4	7.2	20.0	60.3	84.9	116.5	#N/A
Peak Outflow Q (cfs) =	0.0	0.5	0.4	0.5	0.7	31.1	41.0	52.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.1	0.7	0.6	0.6	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	3.0	3.9	5.0	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	40	22	25	23	42	40	38	35	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**43**	44	45	44	47	44	43	42	#N/A
Maximum Ponding Depth (ft) =	0.22	1.66	1.36	1.73	2.95	4.07	4.88	6.04	#N/A
Area at Maximum Ponding Depth (acres) =	0.09	0.70	0.53	0.75	1.02	1.16	1.27	1.41	#N/A
Maximum Volume Stored (acre-ft) =	0.012	0.501	0.322	0.551	1.694	2.919	3.915	5.469	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
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]
7.62 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:07:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:15:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:22:52	0.01	0.29	0.20	0.32	0.86	2.42	3.24	4.18	#N/A
0.657	0:30:29	0.02	0.79	0.53	0.86	2.35	6.84	9.37	12.46	#N/A
	0:38:06	0.05	2.02	1.35	2.20	6.04	17.57	24.07	32.03	#N/A
	0:45:43	0.14	5.55	3.72	6.05	16.58	48.12	65.86	87.47	#N/A
	0:53:20	0.16	6.58	4.39	7.18	20.00	60.34	84.88	116.48	#N/A
	1:00:58	0.15	6.28	4.18	6.85	19.15	58.39	82.88	114.99	#N/A
	1:08:35	0.14	5.72	3.81	6.24	17.43	53.32	75.94	105.77	#N/A
	1:16:12	0.12	5.11	3.39	5.57	15.64	48.06	68.50	95.47	#N/A
	1:23:49	0.10	4.41	2.92	4.81	13.59	42.14	60.22	84.15	#N/A
	1:31:26	0.09	3.84	2.55	4.19	11.80	36.84	52.71	73.71	#N/A
	1:39:04	0.08	3.48	2.31	3.80	10.70	33.17	47.32	65.96	#N/A
	1:46:41	0.06	2.87	1.89	3.14	8.92	27.91	40.02	56.11	#N/A
	1:54:18	0.05	2.34	1.54	2.56	7.35	23.17	33.27	46.70	#N/A
	2:01:55	0.03	1.80	1.18	1.97	5.76	18.45	26.64	37.59	#N/A
	2:09:32	0.02	1.34	0.87	1.47	4.38	14.31	20.75	29.39	#N/A
	2:17:10	0.02	0.97	0.63	1.06	3.22	10.75	15.68	22.30	#N/A
	2:24:47	0.02	0.75	0.49	0.82	2.45	8.02	11.63	16.45	#N/A
	2:32:24	0.01	0.62	0.41	0.68	1.99	6.42	9.25	13.02	#N/A
	2:40:01	0.01	0.53	0.35	0.58	1.68	5.39	7.76	10.89	#N/A
	2:47:38	0.01	0.46	0.30	0.51	1.47	4.68	6.72	9.41	#N/A
	2:55:16	0.01	0.42	0.27	0.46	1.32	4.18	5.99	8.38	#N/A
	3:02:53	0.01	0.38	0.25	0.42	1.21	3.82	5.47	7.64	#N/A
	3:10:30	0.01	0.28	0.19	0.31	0.89	2.88	4.17	5.90	#N/A
	3:18:07	0.00	0.21	0.14	0.23	0.65	2.08	3.00	4.25	#N/A
	3:25:44	0.00	0.15	0.10	0.17	0.48	1.54	2.23	3.16	#N/A
	3:33:22	0.00	0.11	0.07	0.12	0.36	1.14	1.66	2.34	#N/A
	3:40:59	0.00	0.08	0.05	0.09	0.26	0.84	1.22	1.73	#N/A
	3:48:36	0.00	0.06	0.04	0.06	0.18	0.61	0.88	1.26	#N/A
	3:56:13	0.00	0.04	0.03	0.04	0.13	0.44	0.64	0.91	#N/A
	4:03:50	0.00	0.03	0.02	0.03	0.09	0.31	0.45	0.65	#N/A
	4:11:28	0.00	0.02	0.01	0.02	0.06	0.20	0.30	0.43	#N/A
	4:19:05	0.00	0.01	0.00	0.01	0.03	0.12	0.18	0.26	#N/A
	4:26:42	0.00	0.00	0.00	0.00	0.01	0.06	0.09	0.13	#N/A
	4:34:19	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	#N/A
	4:41:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:49:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:57:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:04:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:12:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:20:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:27:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:35:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:42:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:50:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:58:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:05:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:13:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:21:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:28:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:36:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:43:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:51:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:59:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:06:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:14:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:21:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:29:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:37:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:44:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:52:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:00:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:07:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:15:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:22:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:30:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:38:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:45:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:53:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:01:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:08:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

8.4 FORBAY CALCULATIONS

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**October 2, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond B**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a	I_a = 11.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.110
C) Contributing Watershed Area	Area = 11.000 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 2.52 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ◉ Water Quality Capture Volume (WQCV) ○ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 0.017 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 1% of the WQCV)	V_{FMIN} = 0.000 ac-ft
B) Actual Forebay Volume	V_F = 0.008 ac-ft
C) Forebay Depth (D_F = 12 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 20.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.40 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir — **Flow too small for berm w/ pipe**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 3.8 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**October 2, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond B**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 45 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 0.63 inches
E) Total Outlet Area	A_{ot} = 0.90 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 15.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 33 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*S.S. Well Screen with 60% Open Area*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 54 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 0.51 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 34.12 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**October 2, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond B**

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:
Company:
Date: October 5, 2020
Project: Winsome Filing 1
Location: Pond C

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 3.7 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.037

C) Contributing Watershed Area — Area = 136.500 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 1.19 in

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

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

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

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

H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= 0.048 ac-ft

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

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

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.001 ac-ft

B) Actual Forebay Volume — V_F = 0.017 ac-ft

C) Forebay Depth
(D_F = 18 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 166.90 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 3.34 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 14.4 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company:
Date: October 5, 2020
Project: Winsome Filing 1
Location: Pond C

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 583 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 0.35 inches
E) Total Outlet Area	A_{ot} = 1.05 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 6 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 194.3 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 39 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*S.S. Well Screen with 60% Open Area*
Other (Y/N): n	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 65 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 1.01 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 40.12 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company:
Date: October 5, 2020
Project: Winsome Filing 1
Location: Pond C

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ◉ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**August 4, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond D**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a	I_a = 7.6 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.076
C) Contributing Watershed Area	Area = 127.000 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 2.52 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ◉ Water Quality Capture Volume (WQCV) ○ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 0.051 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 5.3 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.002 ac-ft
B) Actual Forebay Volume	V_F = 0.047 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 203.90 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 4.08 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir — **Flow too small for berm w/ pipe**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 17.1 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**August 4, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond D**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 45 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 0.63 inches
E) Total Outlet Area	A_{ot} = 1.80 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 7 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 15.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 65 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*S.S. Well Screen with 60% Open Area*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 109 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 1 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 40 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**August 4, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond D**

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**October 5, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond 3**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 6.6 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.066

C) Contributing Watershed Area — Area = 101.000 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 2.52 in

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

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

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

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

H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= 0.051 ac-ft

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

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

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

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 5.3 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume
(V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.002 ac-ft

B) Actual Forebay Volume — V_F = 0.006 ac-ft

C) Forebay Depth
(D_F = 18 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 52.00 cfs

ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$) — Q_F = 1.04 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

Flow too small for berm w/ pipe

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

G) Rectangular Notch Width — Calculated W_N = 6.1 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**October 5, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond 3**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 4.0 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 45 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 0.94 inches
E) Total Outlet Area	A_{ot} = 2.10 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 7 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 15.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 74 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*S.S. Well Screen with 60% Open Area*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 123 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 1 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 58 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Jason Priddy**
Company:	**Vertex Engineering**
Date:	**October 5, 2020**
Project:	**Winsome Filing 1**
Location:	**Water Quality Pond 3**

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping:	
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

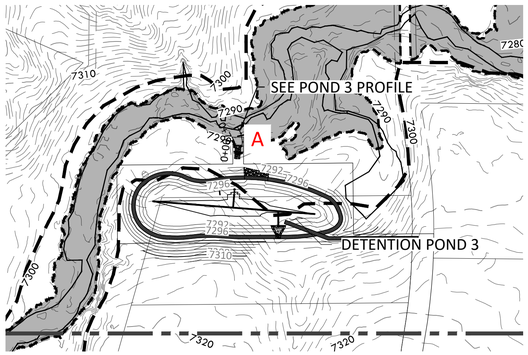
Notes:

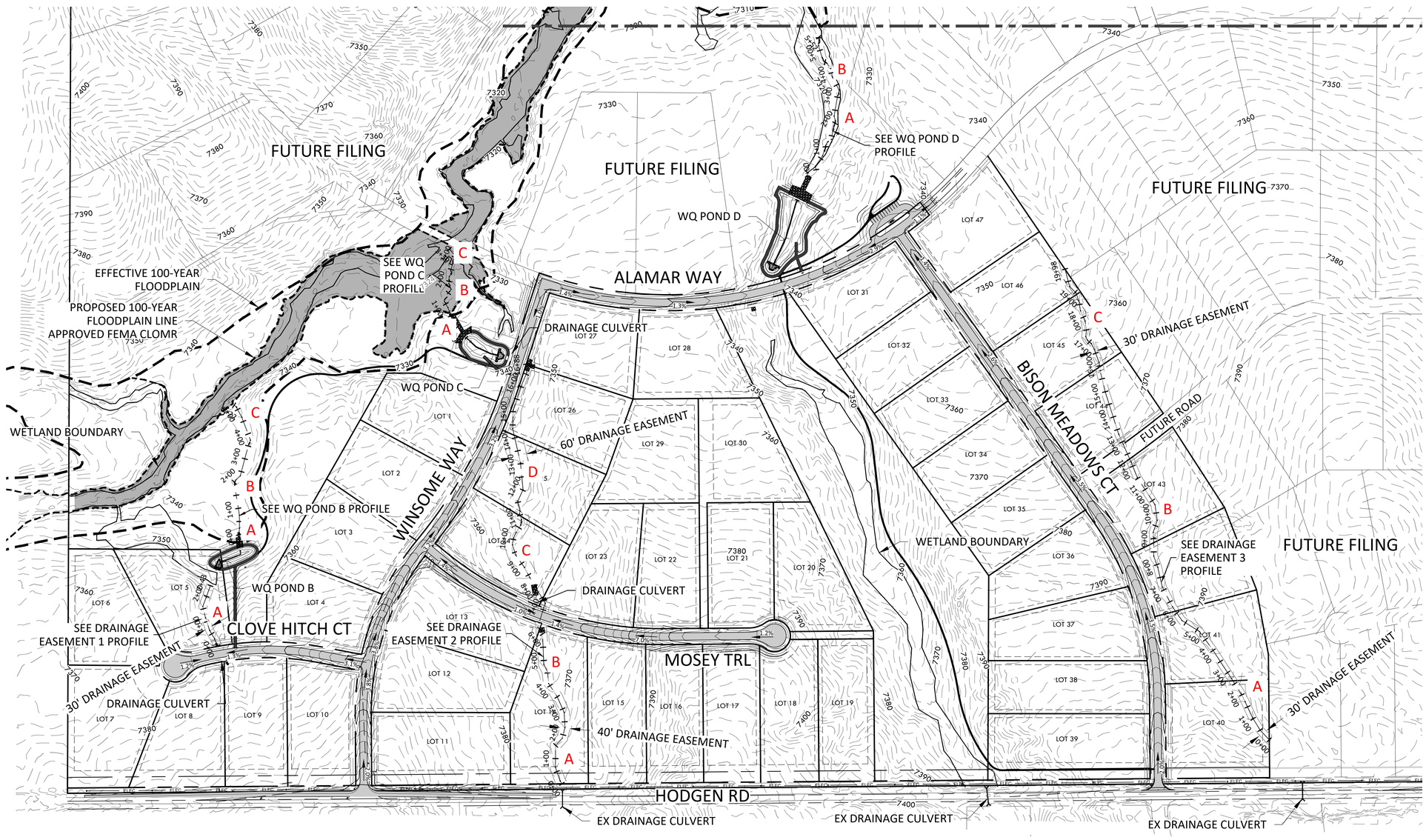
9.1 EXISTING MINOR DRAINAGE CHANNEL PROFILES

CONSTRUCTION DOCUMENTS

WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST,
OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO





0' 300' 600' 900'

SCALE: 1" = 300'

SF-20-003

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9/29/20
43911
PROFESSIONAL ENGINEER

DRAINAGE CUT SECTIONS

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	08.01.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

DATE: 01.22.20
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388.01

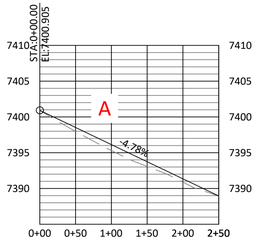
1

Z:\Shared\Projects\49000-49999\49300-49399\49388.mccune ranch\06-Engineering\Vertex Drawings\Exhibits\49388-FILING 1-Drainage Easement Cut Sections.dwg Tuesday, September 29, 2020 9:27:06 AM

CONSTRUCTION DOCUMENTS

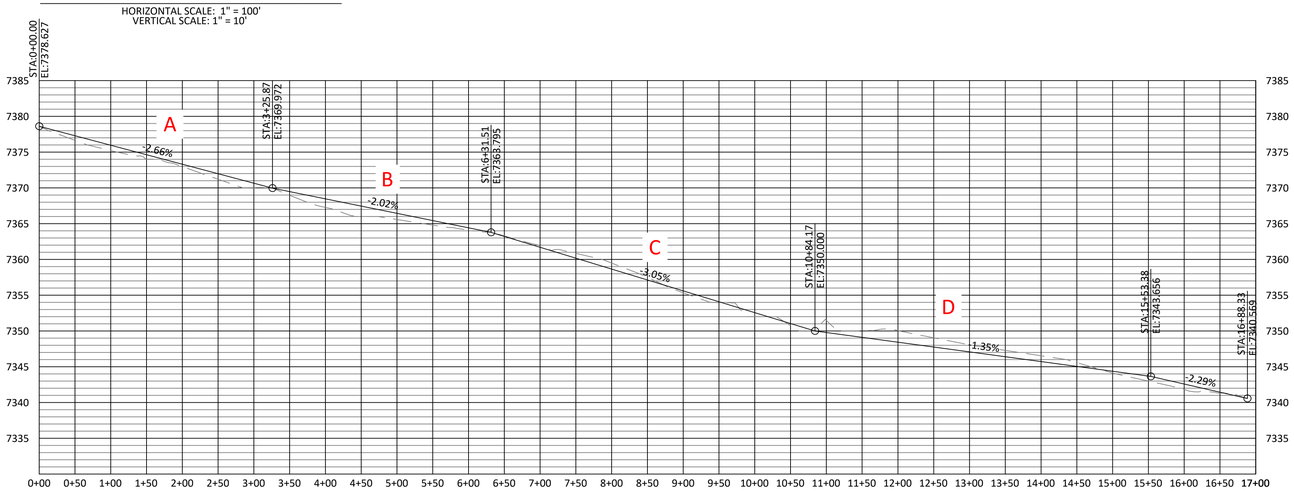
WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST,
OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO



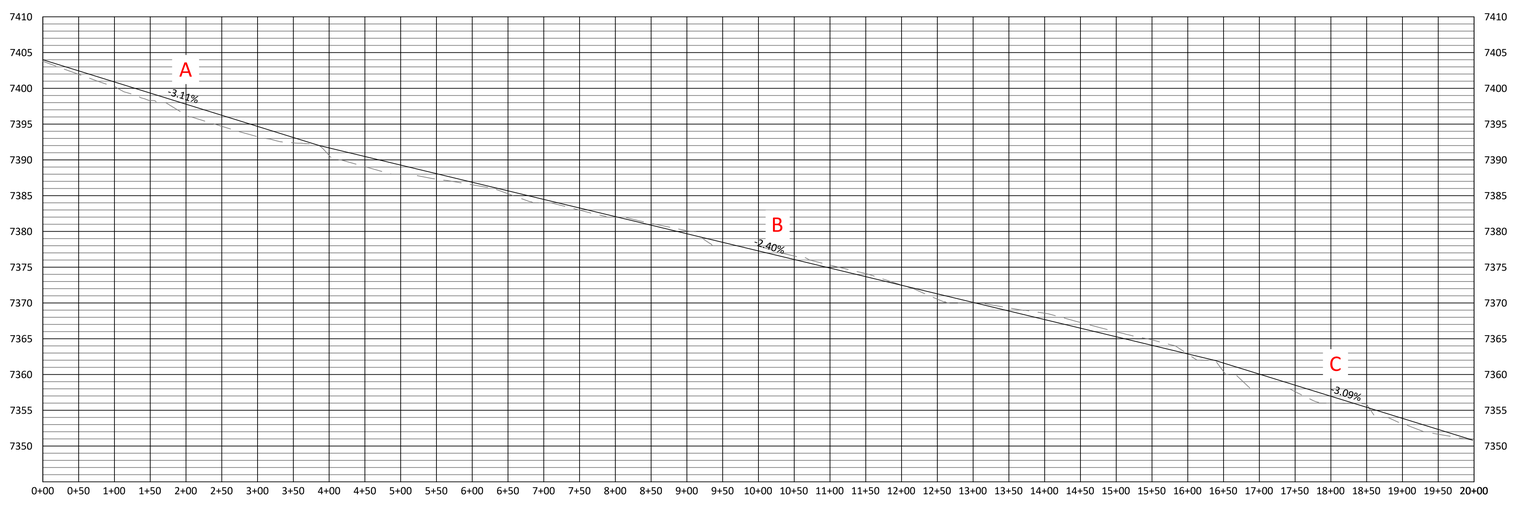
DRAINAGE EASEMENT 1 PROFILE

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'



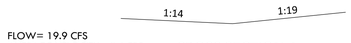
DRAINAGE EASEMENT 2 PROFILE

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'



DRAINAGE EASEMENT 3 PROFILE

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'



FLOW= 19.9 CFS
AVERAGE VELOCITY= 3.6 FPS
TOP WIDTH= 19.2 FEET

CROSS SECTION A

FLOW=127.7 CFS
AVERAGE VELOCITY= 5.6 FPS
TOP WIDTH= 25.8 FEET

SECTION A

FLOW=127.7 CFS
AVERAGE VELOCITY= 4.4 FPS
TOP WIDTH= 37.6 FEET

SECTION B

FLOW=149.8 CFS
AVERAGE VELOCITY= 5.1 FPS
TOP WIDTH= 42.2 FEET

SECTION C

FLOW=149.8 CFS
AVERAGE VELOCITY= 3.6 FPS
TOP WIDTH= 53.9 FEET

SECTION D

FLOW=34.1 CFC
AVERAGE VELOCITY= 3.7 FPS
TOP WIDTH= 21.1 FEET

SECTION A

FLOW=101.0 CFC
AVERAGE VELOCITY= 4.9 FPS
TOP WIDTH= 25.2 FEET

SECTION B

FLOW=141.9 CFC
AVERAGE VELOCITY= 6.4 FPS
TOP WIDTH= 22.7 FEET

SECTION C

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43911
PROFESSIONAL ENGINEER

DRAINAGE CUT SECTIONS

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	08.01.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

DATE: 01.22.20	2
DRAWN BY: JCP	
CHECKED BY: LPV	
JOB #: 49388.01	

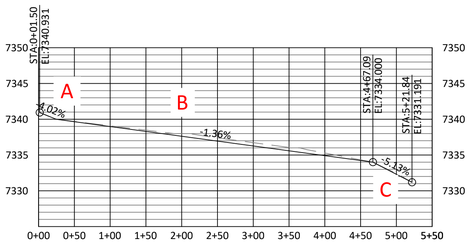
SF-20-003

CONSTRUCTION DOCUMENTS

WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST,
OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO

Know what's below. Call before you dig.



WQ POND B DRAINAGE PROFILE

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

FLOW=17.1 CFS
AVERAGE VELOCITY= 2.9 FPS
TOP WIDTH= 23.7 FEET

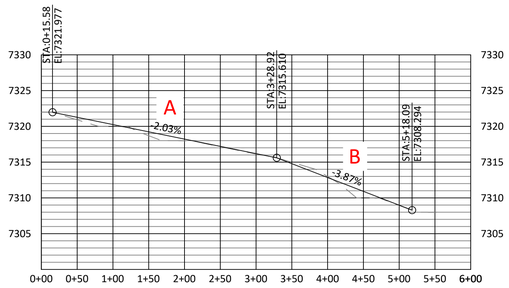
CROSS SECTION A

FLOW= 17.1 CFS
AVERAGE VELOCITY= 2.0 FPS
TOP WIDTH= 28.6 FEET

CROSS SECTION B

FLOW= 17.1CFS
AVERAGE VELOCITY= 3.5 FPS
TOP WIDTH= 18.6 FEET

CROSS SECTION C



WQ POND D DRAINAGE WAY PROFILE

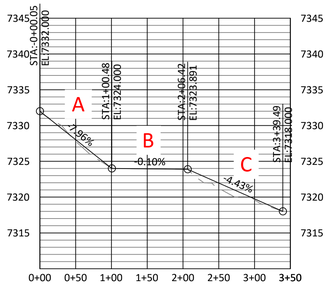
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

FLOW=174.7 CFS
AVERAGE VELOCITY= 4.7 FPS
TOP WIDTH= 45.3 FEET

CROSS SECTION A

FLOW=174.7 CFS
AVERAGE VELOCITY= 6.3 FPS
TOP WIDTH= 34.5 FEET

CROSS SECTION B



WQ POND C DRAINAGE WAY PROFILE

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

FLOW= 165.5 CFS
AVERAGE VELOCITY= 7.0 FPS
TOP WIDTH= 43.2 FEET

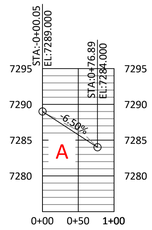
CROSS SECTION A

FLOW= 165.5 CFS
AVERAGE VELOCITY= 1.5 FPS
TOP WIDTH= 75.8 FEET

CROSS SECTION B

FLOW= 165.5 CFS
AVERAGE VELOCITY= 6.0 FPS
TOP WIDTH= 41.0 FEET

CROSS SECTION C



POND 3 DRAINAGE WAY PROFILE

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

FLOW= 22.8 CFS
AVERAGE VELOCITY= 4.3 FPS
TOP WIDTH= 17.7 FEET

CROSS SECTION A

FLOW= 22.8 CFS
AVERAGE VELOCITY= 4.5 FPS
TOP WIDTH= 15.4 FEET

CROSS SECTION B

VERTEX®
2420 W. 26th Avenue, Suite 100-D I Denver, CO 80211
Main: 303.623.9116 I VERTEXENG.COM

COLORADO LICENSED
LAURA PATRICK VARDAS
9/29/20
43911
PROFESSIONAL ENGINEER

DRAINAGE CUT SECTIONS

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	08.01.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

DATE: 01.22.20
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388.01

3

SF-20-003

Hydraulic Analysis Report

Project Data

Project Title: Drainage

Designer:

Project Date: Tuesday, June 30, 2020

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Drainage ESMT 1 - A

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 14.0000 ft/ft

Side Slope 2 (Z2): 19.0000 ft/ft

Longitudinal Slope: 0.0478 ft/ft

Manning's n: 0.0400

Flow: 19.9000 cfs

Result Parameters

Depth: 0.5819 ft

Area of Flow: 5.5870 ft^2

Wetted Perimeter: 19.2387 ft

Hydraulic Radius: 0.2904 ft

Average Velocity: 3.5618 ft/s

Top Width: 19.2027 ft

Froude Number: 1.1637

Critical Depth: 0.6212 ft

Critical Velocity: 3.1259 ft/s

Critical Slope: 0.0337 ft/ft

Critical Top Width: 20.98 ft

Calculated Max Shear Stress: 1.7356 lb/ft^2

Calculated Avg Shear Stress: 0.8662 lb/ft^2

Channel Analysis: Drainage ESMT 2 - A

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 6.5000 ft/ft

Side Slope 2 (Z2): 7.5000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0266 ft/ft

Manning's n: 0.0400

Flow: 127.7000 cfs

Result Parameters

Depth: 1.4881 ft

Area of Flow: 22.9410 ft^2

Wetted Perimeter: 26.0457 ft

Hydraulic Radius: 0.8808 ft

Average Velocity: 5.5664 ft/s

Top Width: 25.8331 ft

Froude Number: 1.0410

Critical Depth: 1.5167 ft

Critical Velocity: 5.3913 ft/s

Critical Slope: 0.0244 ft/ft

Critical Top Width: 26.23 ft

Calculated Max Shear Stress: 2.4700 lb/ft^2

Calculated Avg Shear Stress: 1.4620 lb/ft^2

Channel Analysis: Drainage ESMT 2 - B

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 12.0000 ft/ft

Side Slope 2 (Z2): 12.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0202 ft/ft

Manning's n: 0.0400

Flow: 127.7000 cfs

Result Parameters

Depth: 1.3570 ft

Area of Flow: 28.8831 ft^2

Wetted Perimeter: 37.6814 ft

Hydraulic Radius: 0.7665 ft

Average Velocity: 4.4213 ft/s

Top Width: 37.5685 ft

Froude Number: 0.8886

Critical Depth: 1.2862 ft

Critical Velocity: 4.8585 ft/s

Critical Slope: 0.0260 ft/ft

Critical Top Width: 35.87 ft

Calculated Max Shear Stress: 1.7105 lb/ft^2

Calculated Avg Shear Stress: 0.9662 lb/ft^2

Channel Analysis: Drainage ESMT 2 - C

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 12.5000 ft/ft

Side Slope 2 (Z2): 17.4000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0305 ft/ft

Manning's n: 0.0400

Flow: 149.8000 cfs

Result Parameters

Depth: 1.2456 ft

Area of Flow: 29.4241 ft^2

Wetted Perimeter: 42.3296 ft

Hydraulic Radius: 0.6951 ft

Average Velocity: 5.0911 ft/s

Top Width: 42.2441 ft

Froude Number: 1.0750

Critical Depth: 1.2865 ft

Critical Velocity: 4.8049 ft/s

Critical Slope: 0.0261 ft/ft

Critical Top Width: 43.47 ft

Calculated Max Shear Stress: 2.3707 lb/ft^2

Calculated Avg Shear Stress: 1.3230 lb/ft^2

Channel Analysis: Drainage ESMT 2 - D

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 20.7000 ft/ft

Side Slope 2 (Z2): 14.1000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0135 ft/ft

Manning's n: 0.0400

Flow: 149.8000 cfs

Result Parameters

Depth: 1.4061 ft

Area of Flow: 41.4325 ft^2

Wetted Perimeter: 54.0162 ft

Hydraulic Radius: 0.7670 ft

Average Velocity: 3.6155 ft/s

Top Width: 53.9324 ft

Froude Number: 0.7269

Critical Depth: 1.2224 ft

Critical Velocity: 4.6647 ft/s

Critical Slope: 0.0267 ft/ft

Critical Top Width: 47.54 ft

Calculated Max Shear Stress: 1.1845 lb/ft^2

Calculated Avg Shear Stress: 0.6462 lb/ft^2

Channel Analysis: Drainage ESMT 3 - A

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 14.0000 ft/ft

Side Slope 2 (Z2): 9.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0311 ft/ft

Manning's n: 0.0400

Flow: 34.1000 cfs

Result Parameters

Depth: 0.6990 ft

Area of Flow: 9.1140 ft^2

Wetted Perimeter: 21.1408 ft

Hydraulic Radius: 0.4311 ft

Average Velocity: 3.7415 ft/s

Top Width: 21.0771 ft

Froude Number: 1.0027

Critical Depth: 0.6999 ft

Critical Velocity: 3.7339 ft/s

Critical Slope: 0.0310 ft/ft

Critical Top Width: 21.10 ft

Calculated Max Shear Stress: 1.3565 lb/ft^2

Calculated Avg Shear Stress: 0.8366 lb/ft^2

Channel Analysis: Drainage ESMT 3 - B

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 6.0000 ft/ft

Side Slope 2 (Z2): 9.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0240 ft/ft

Manning's n: 0.0400

Flow: 101.0000 cfs

Result Parameters

Depth: 1.3470 ft

Area of Flow: 20.3430 ft^2

Wetted Perimeter: 25.3910 ft

Hydraulic Radius: 0.8012 ft

Average Velocity: 4.9649 ft/s

Top Width: 25.2049 ft

Froude Number: 0.9739

Critical Depth: 1.3302 ft

Critical Velocity: 5.0697 ft/s

Critical Slope: 0.0254 ft/ft

Critical Top Width: 24.95 ft

Calculated Max Shear Stress: 2.0173 lb/ft^2

Calculated Avg Shear Stress: 1.1999 lb/ft^2

Channel Analysis: Drainage ESMT 3 - C

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 7.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0309 ft/ft

Manning's n: 0.0400

Flow: 141.9000 cfs

Result Parameters

Depth: 1.6059 ft

Area of Flow: 22.2128 ft^2

Wetted Perimeter: 22.9764 ft

Hydraulic Radius: 0.9668 ft

Average Velocity: 6.3882 ft/s

Top Width: 22.6645 ft

Froude Number: 1.1372

Critical Depth: 1.7078 ft

Critical Velocity: 5.7727 ft/s

Critical Slope: 0.0235 ft/ft

Critical Top Width: 23.79 ft

Calculated Max Shear Stress: 3.0964 lb/ft^2

Calculated Avg Shear Stress: 1.8641 lb/ft^2

Channel Analysis: WQPond B - A

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 29.0000 ft/ft

Side Slope 2 (Z2): 19.0000 ft/ft

Longitudinal Slope: 0.0402 ft/ft

Manning's n: 0.0400

Flow: 17.1000 cfs

Result Parameters

Depth: 0.4933 ft

Area of Flow: 5.8406 ft^2

Wetted Perimeter: 23.7005 ft

Hydraulic Radius: 0.2464 ft

Average Velocity: 2.9278 ft/s

Top Width: 23.6791 ft

Froude Number: 1.0389

Critical Depth: 0.5054 ft

Critical Velocity: 2.7898 ft/s

Critical Slope: 0.0353 ft/ft

Critical Top Width: 25.36 ft

Calculated Max Shear Stress: 1.2375 lb/ft^2

Calculated Avg Shear Stress: 0.6182 lb/ft^2

Channel Analysis: WQPond B - B

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 27.0000 ft/ft

Side Slope 2 (Z2): 20.0000 ft/ft

Longitudinal Slope: 0.0136 ft/ft

Manning's n: 0.0400

Flow: 17.1000 cfs

Result Parameters

Depth: 0.6093 ft

Area of Flow: 8.7234 ft^2

Wetted Perimeter: 28.6621 ft

Hydraulic Radius: 0.3044 ft

Average Velocity: 1.9603 ft/s

Top Width: 28.6356 ft

Froude Number: 0.6259

Critical Depth: 0.5074 ft

Critical Velocity: 2.8263 ft/s

Critical Slope: 0.0361 ft/ft

Critical Top Width: 24.39 ft

Calculated Max Shear Stress: 0.5170 lb/ft^2

Calculated Avg Shear Stress: 0.2583 lb/ft^2

Channel Analysis: WQPond B - C

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 22.0000 ft/ft

Side Slope 2 (Z2): 13.0000 ft/ft

Longitudinal Slope: 0.0513 ft/ft

Manning's n: 0.0400

Flow: 17.1000 cfs

Result Parameters

Depth: 0.5306 ft

Area of Flow: 4.9276 ft^2

Wetted Perimeter: 18.6048 ft

Hydraulic Radius: 0.2649 ft

Average Velocity: 3.4702 ft/s

Top Width: 18.5724 ft

Froude Number: 1.1873

Critical Depth: 0.5762 ft

Critical Velocity: 2.9433 ft/s

Critical Slope: 0.0331 ft/ft

Critical Top Width: 21.59 ft

Calculated Max Shear Stress: 1.6986 lb/ft^2

Calculated Avg Shear Stress: 0.8478 lb/ft^2

Channel Analysis: WQPond C - A

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 18.0000 ft/ft

Side Slope 2 (Z2): 21.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0796 ft/ft

Manning's n: 0.0400

Flow: 165.5000 cfs

Result Parameters

Depth: 0.9799 ft

Area of Flow: 23.6246 ft^2

Wetted Perimeter: 43.2677 ft

Hydraulic Radius: 0.5460 ft

Average Velocity: 7.0054 ft/s

Top Width: 43.2172 ft

Froude Number: 1.6697

Critical Depth: 1.2283 ft

Critical Velocity: 4.6542 ft/s

Critical Slope: 0.0267 ft/ft

Critical Top Width: 52.90 ft

Calculated Max Shear Stress: 4.8673 lb/ft^2

Calculated Avg Shear Stress: 2.7121 lb/ft^2

Channel Analysis: WQPond C - B

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 13.0000 ft/ft

Side Slope 2 (Z2): 13.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0010 ft/ft

Manning's n: 0.0400

Flow: 165.5000 cfs

Result Parameters

Depth: 2.7240 ft

Area of Flow: 110.0788 ft^2

Wetted Perimeter: 76.0320 ft

Hydraulic Radius: 1.4478 ft

Average Velocity: 1.5035 ft/s

Top Width: 75.8228 ft

Froude Number: 0.2199

Critical Depth: 1.4085 ft

Critical Velocity: 5.0408 ft/s

Critical Slope: 0.0253 ft/ft

Critical Top Width: 41.62 ft

Calculated Max Shear Stress: 0.1700 lb/ft^2

Calculated Avg Shear Stress: 0.0903 lb/ft^2

Channel Analysis: WQPond C - C

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 10.0000 ft/ft

Side Slope 2 (Z2): 20.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0443 ft/ft

Manning's n: 0.0400

Flow: 165.5000 cfs

Result Parameters

Depth: 1.1997 ft

Area of Flow: 27.5878 ft^2

Wetted Perimeter: 41.0809 ft

Hydraulic Radius: 0.6715 ft

Average Velocity: 5.9990 ft/s

Top Width: 40.9910 ft

Froude Number: 1.2887

Critical Depth: 1.3430 ft

Critical Velocity: 4.9008 ft/s

Critical Slope: 0.0258 ft/ft

Critical Top Width: 45.29 ft

Calculated Max Shear Stress: 3.3164 lb/ft^2

Calculated Avg Shear Stress: 1.8564 lb/ft^2

Channel Analysis: WQPond D - A

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 16.0000 ft/ft

Side Slope 2 (Z2): 11.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0203 ft/ft

Manning's n: 0.0400

Flow: 174.7000 cfs

Result Parameters

Depth: 1.4917 ft

Area of Flow: 37.4970 ft^2

Wetted Perimeter: 45.3894 ft

Hydraulic Radius: 0.8261 ft

Average Velocity: 4.6590 ft/s

Top Width: 45.2751 ft

Froude Number: 0.9022

Critical Depth: 1.4254 ft

Critical Velocity: 5.0554 ft/s

Critical Slope: 0.0252 ft/ft

Critical Top Width: 43.49 ft

Calculated Max Shear Stress: 1.8895 lb/ft^2

Calculated Avg Shear Stress: 1.0465 lb/ft^2

Channel Analysis: WQPond D - B

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 13.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0387 ft/ft

Manning's n: 0.0400

Flow: 174.7000 cfs

Result Parameters

Depth: 1.4038 ft

Area of Flow: 27.7119 ft^2

Wetted Perimeter: 34.6218 ft

Hydraulic Radius: 0.8004 ft

Average Velocity: 6.3041 ft/s

Top Width: 34.4804 ft

Froude Number: 1.2392

Critical Depth: 1.5479 ft

Critical Velocity: 5.3106 ft/s

Critical Slope: 0.0245 ft/ft

Critical Top Width: 37.51 ft

Calculated Max Shear Stress: 3.3901 lb/ft^2

Calculated Avg Shear Stress: 1.9329 lb/ft^2

Channel Analysis: Pond 3 - A

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 16.0000 ft/ft

Side Slope 2 (Z2): 11.0000 ft/ft

Channel Width: 5.0000 ft

Longitudinal Slope: 0.0650 ft/ft

Manning's n: 0.0400

Flow: 22.8000 cfs

Result Parameters

Depth: 0.4710 ft

Area of Flow: 5.3495 ft^2

Wetted Perimeter: 17.7525 ft

Hydraulic Radius: 0.3013 ft

Average Velocity: 4.2621 ft/s

Top Width: 17.7164 ft

Froude Number: 1.3669

Critical Depth: 0.5505 ft

Critical Velocity: 3.3312 ft/s

Critical Slope: 0.0334 ft/ft

Critical Top Width: 19.86 ft

Calculated Max Shear Stress: 1.9103 lb/ft^2

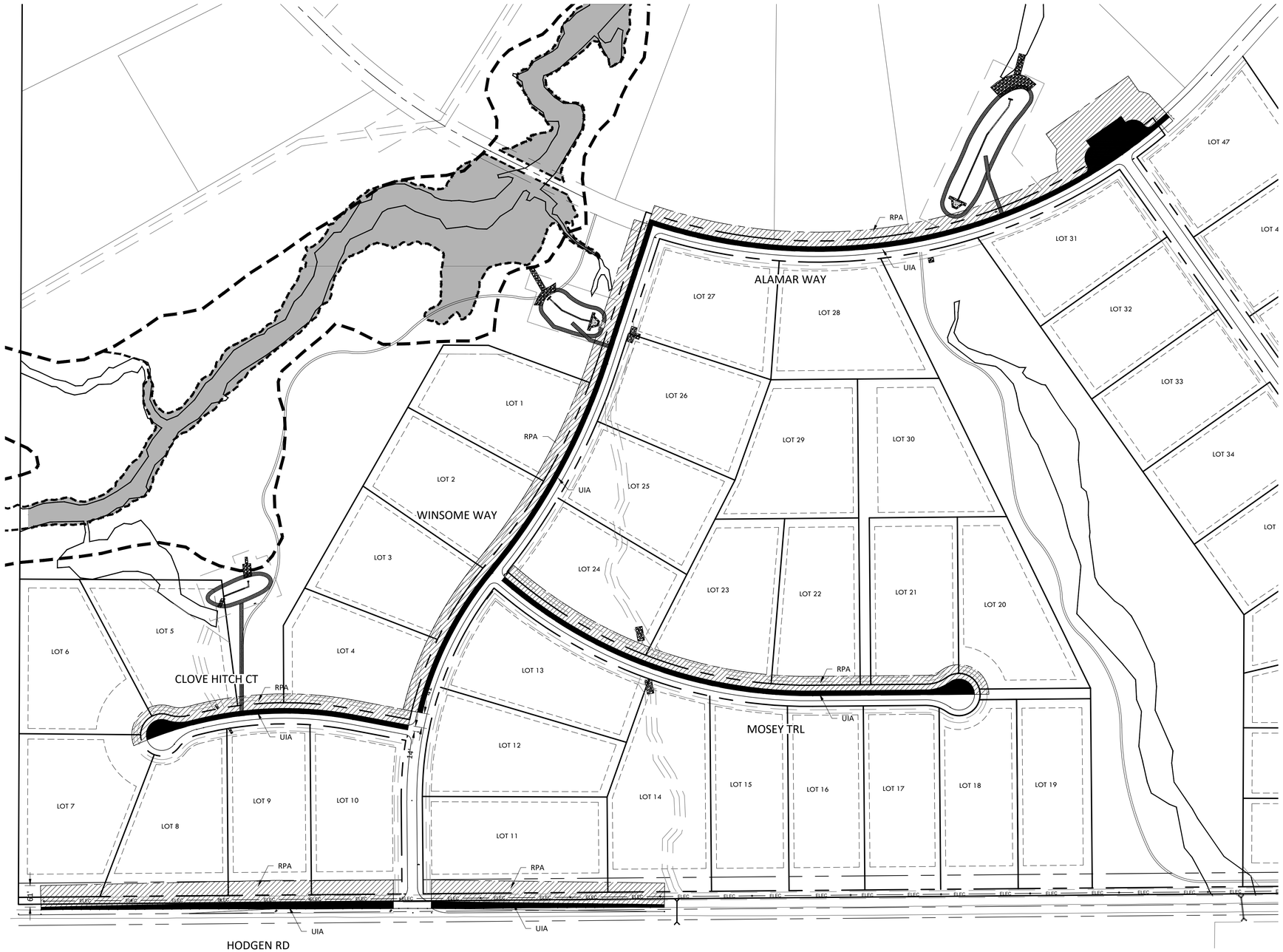
Calculated Avg Shear Stress: 1.2222 lb/ft^2

10.0 RUNOFF REDUCTION

CONSTRUCTION DOCUMENTS

WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST,
OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO



0' 300' 600' 900'

SCALE: 1" = 300'

SF-20-003

VERTEX®
2420 W. 26th Avenue, Suite 100-D I Denver, CO 80211
Main: 303.623.9116 I VERTEXENG.COM

RUNOFF REDUCTION EXHIBIT

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	06.18.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

DATE: 01.22.20	1
DRAWN BY: JCP	
CHECKED BY: LPV	
JOB #: 49388.01	

Know what's below. Call before you dig.

Z:\Shared\Projects\49000-49999\49300-49399\49388 McCune Ranch\06-Engineering\Vertex Drawings\CD\Filing 1\49388-UIA-RPA Exhibit.dwg Friday, July 31, 2020 12:42:46 PM

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: JCP
Company: Vertex Engineering
Date: July 31, 2020
Project: Winsome Filing 1
Location: El Paso County

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA		UIA:RPA	UIA:RPA	UIA:RPA		UIA:RPA	UIA:RPA		UIA:RPA	UIA:RPA
Area ID	B4-1 CLOVE HITCH	B4-2 CLOVE HITCH		C3-2.1 MOSEY TRAIL	C3-2.2 MOSEY TRAIL	C3-1 MOSEY TRAIL		D5-1 ALAMAR WAY	D5-2 ALAMAR WAY		Hodgen W	Hodgen E
Downstream Design Point ID												
Downstream BMP Type	EDB	EDB		EDB	EDB	EDB		None	None		None	None
DCIA (ft^2)	--	--		--	--	--		--	--		--	--
UIA (ft^2)	2,828	7,924		3,514	3,640	13,090		11,774	7,532		33,792	22,784
RPA (ft^2)	8,282	23,206		10,291	10,660	38,335		34,481	22,058		42,240	28,480
SPA (ft^2)	--	--		--	--	--		--	--		--	--
HSG A (%)	0%	0%		0%	0%	0%		0%	0%		0%	0%
HSG B (%)	100%	100%		100%	100%	100%		100%	100%		100%	100%
HSG C/D (%)	0%	0%		0%	0%	0%		0%	0%		0%	0%
Average Slope of RPA (ft/ft)	0.250	0.250		0.250	0.250	0.250		0.250	0.250		0.100	0.100
UIA:RPA Interface Width (ft)	202.00	566.00		251.00	260.00	935.00		841.00	538.00		1056.00	712.00

CALCULATED RUNOFF RESULTS

Area ID	CLOVE H	CLOVE H		.1 MOSEY T	.2 MOSEY T	MOSEY TR		ALAMAR \	ALAMAR \		Hodgen W	Hodgen E
UIA:RPA Area (ft^2)	11,110	31,130		13,805	14,300	51,425		46,255	29,590		76,032	51,264
L / W Ratio	0.27	0.10		0.22	0.21	0.06		0.07	0.10		0.07	0.10
UIA / Area	0.2545	0.2545		0.2545	0.2545	0.2545		0.2545	0.2545		0.4444	0.4444
Runoff (in)	0.00	0.00		0.00	0.00	0.00		0.00	0.00		0.00	0.00
Runoff (ft^3)	0	0		0	0	0		0	0		0	0
Runoff Reduction (ft^3)	118	330		146	152	545		491	314		1408	949

CALCULATED WQCV RESULTS

Area ID	CLOVE H	CLOVE H		.1 MOSEY T	.2 MOSEY T	MOSEY TR		ALAMAR \	ALAMAR \		Hodgen W	Hodgen E
WQCV (ft^3)	118	330		146	152	545		491	314		1408	949
WQCV Reduction (ft^3)	118	330		146	152	545		491	314		1408	949
WQCV Reduction (%)	100%	100%		100%	100%	100%		100%	100%		100%	100%
Untreated WQCV (ft^3)	0	0		0	0	0		0	0		0	0

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID												
DCIA (ft^2)												
UIA (ft^2)												
RPA (ft^2)												
SPA (ft^2)												
Total Area (ft^2)												
Total Impervious Area (ft^2)												
WQCV (ft^3)												
WQCV Reduction (ft^3)												
WQCV Reduction (%)												
Untreated WQCV (ft^3)												

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	
Total Impervious Area (ft^2)	
WQCV (ft^3)	
WQCV Reduction (ft^3)	
WQCV Reduction (%)	
Untreated WQCV (ft^3)	

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: JCP
Company: Vertex Engineering
Date: July 31, 2020
Project: Winsome Filing 1
Location: El Paso County

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA								
Area ID	WINSOME WAY B4-3.1	WINSOME WAY B4-3.2	WINSOME WAY B4-3.3	WINSOME WAY B4-4								
Downstream Design Point ID												
Downstream BMP Type	None	None	None	None								
DCIA (ft^2)	--	--	--	--								
UIA (ft^2)	2,044	4,060	11,900	4,144								
RPA (ft^2)	5,986	11,890	34,850	12,136								
SPA (ft^2)	--	--	--	--								
HSG A (%)	0%	0%	0%	0%								
HSG B (%)	100%	100%	100%	100%								
HSG C/D (%)	0%	0%	0%	0%								
Average Slope of RPA (ft/ft)	0.250	0.250	0.250	0.250								
UIA:RPA Interface Width (ft)	146.00	290.00	850.00	296.00								

CALCULATED RUNOFF RESULTS

Area ID	SOME WAY B	SOME WAY B	SOME WAY B	SOME WAY								
UIA:RPA Area (ft^2)	8,030	15,950	46,750	16,280								
L / W Ratio	0.38	0.19	0.06	0.19								
UIA / Area	0.2545	0.2545	0.2545	0.2545								
Runoff (in)	0.00	0.00	0.00	0.00								
Runoff (ft^3)	0	0	0	0								
Runoff Reduction (ft^3)	85	169	496	173								

CALCULATED WQCV RESULTS

Area ID	SOME WAY B	SOME WAY B	SOME WAY B	SOME WAY								
WQCV (ft^3)	85	169	496	173								
WQCV Reduction (ft^3)	85	169	496	173								
WQCV Reduction (%)	100%	100%	100%	100%								
Untreated WQCV (ft^3)	0	0	0	0								

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID												
DCIA (ft^2)												
UIA (ft^2)												
RPA (ft^2)												
SPA (ft^2)												
Total Area (ft^2)												
Total Impervious Area (ft^2)												
WQCV (ft^3)												
WQCV Reduction (ft^3)												
WQCV Reduction (%)												
Untreated WQCV (ft^3)												

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

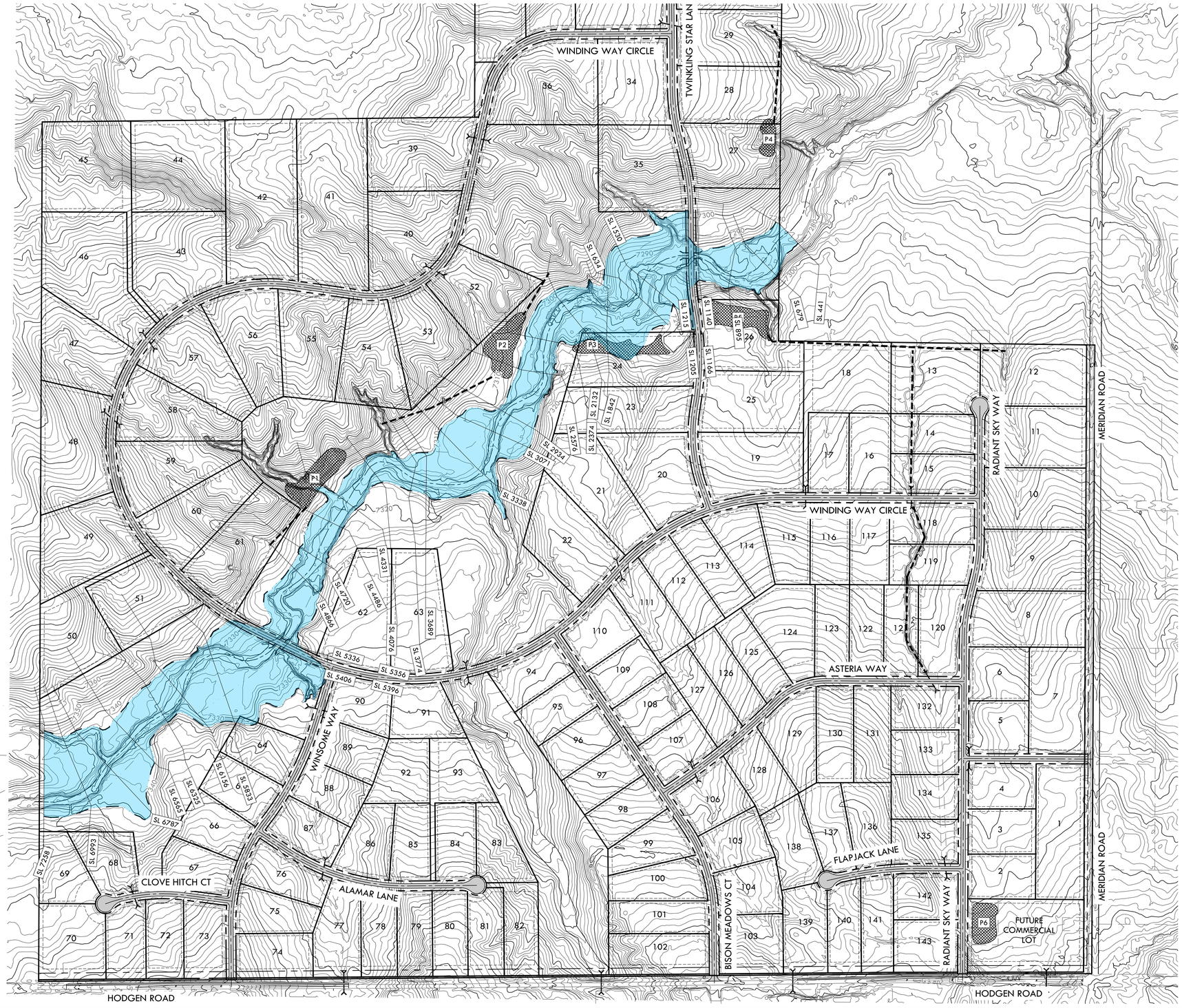
Total Area (ft^2)	
Total Impervious Area (ft^2)	
WQCV (ft^3)	
WQCV Reduction (ft^3)	
WQCV Reduction (%)	
Untreated WQCV (ft^3)	

11.1 DAM FAILURE FLOODPLAIN EXHIBIT

DAM RISK ASSESSMENT

WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



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9500 CFS DAM FAILURE FLOODPLAIN

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	
2	
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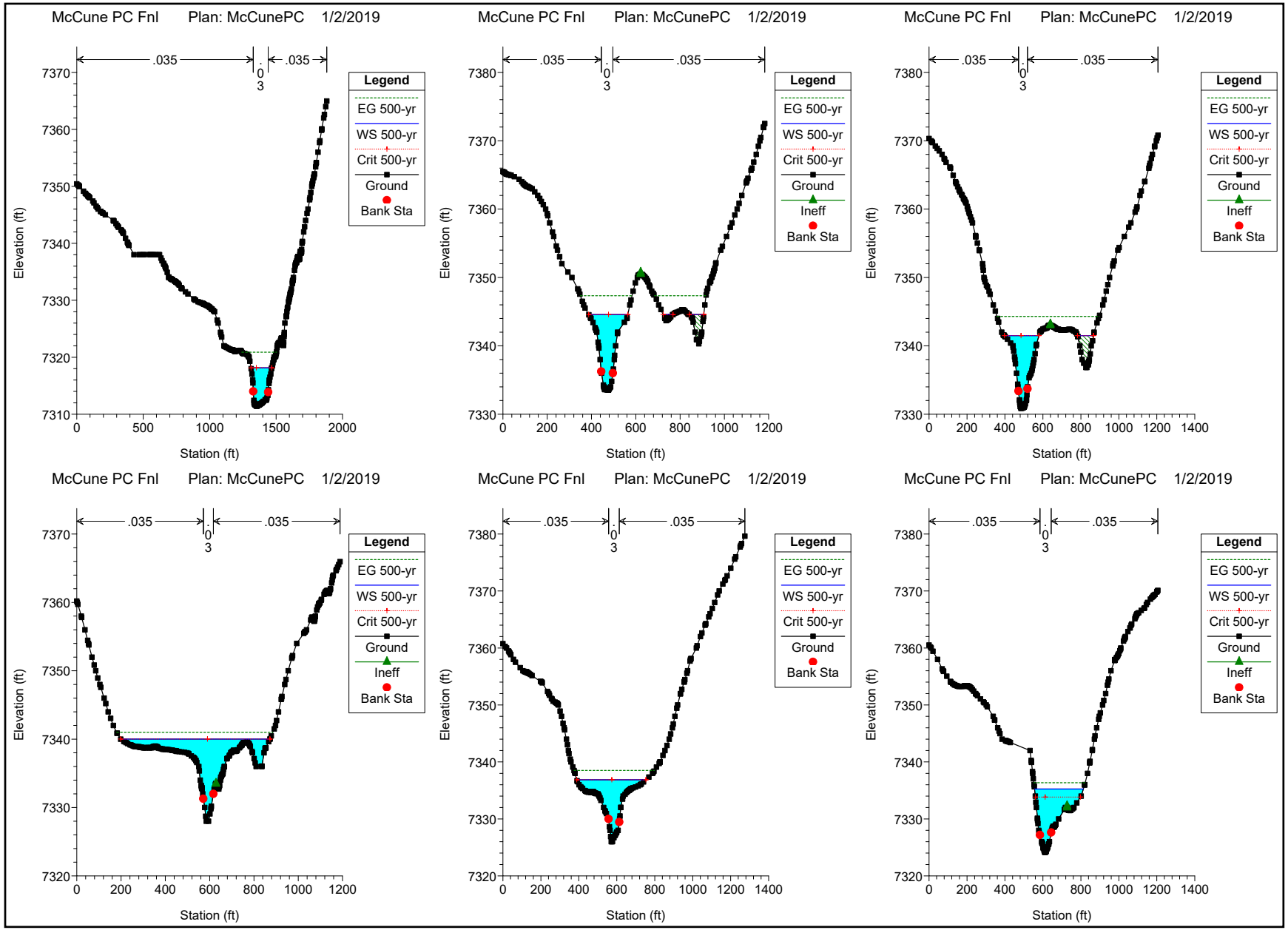
9	
10	

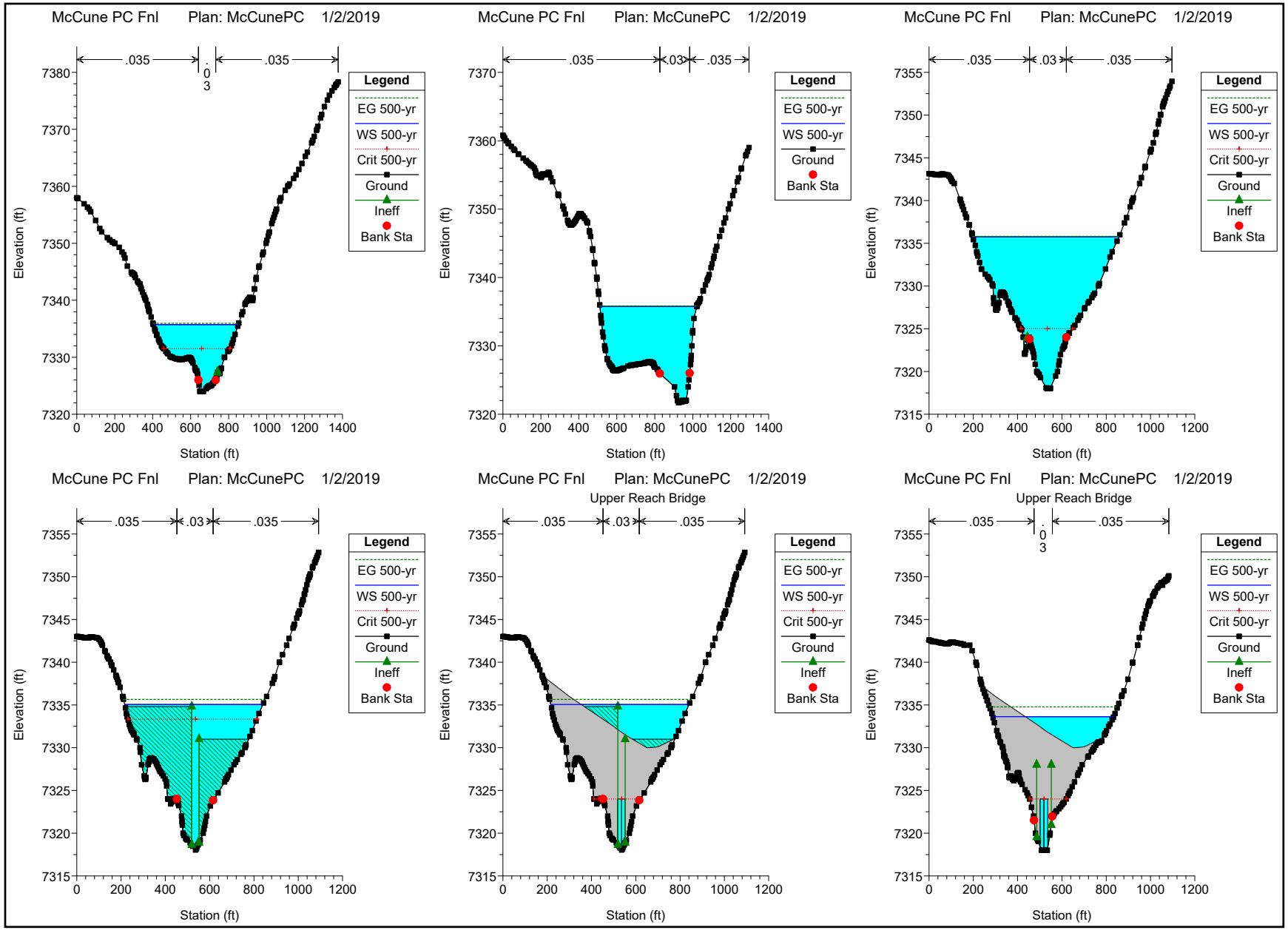
DATE: 1/4/19
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

1

0' 300' 600'

11.2 DAM FAILURE FLOODPLAIN SECTIONS


McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.035
0.3
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 1/2/2019
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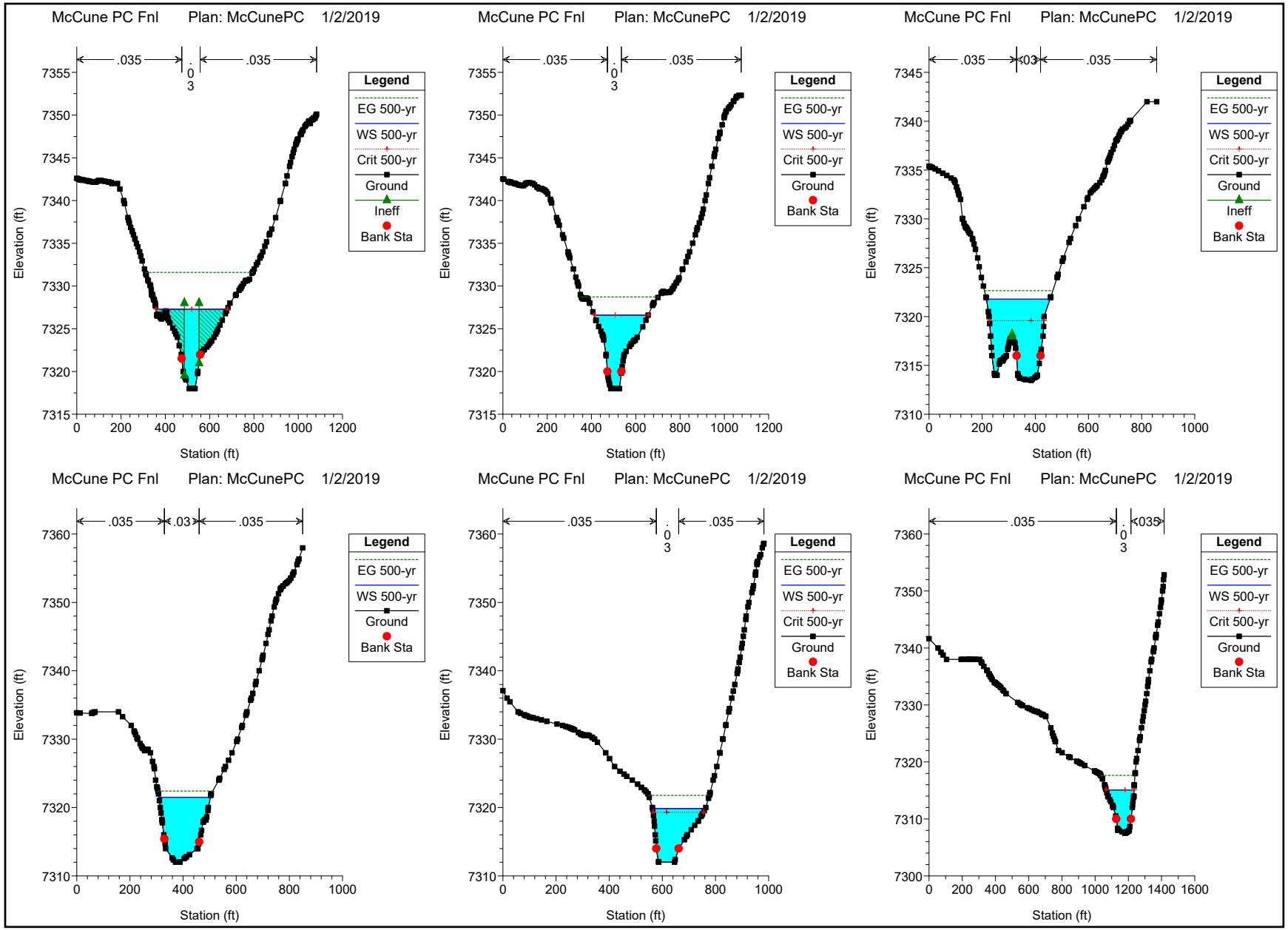
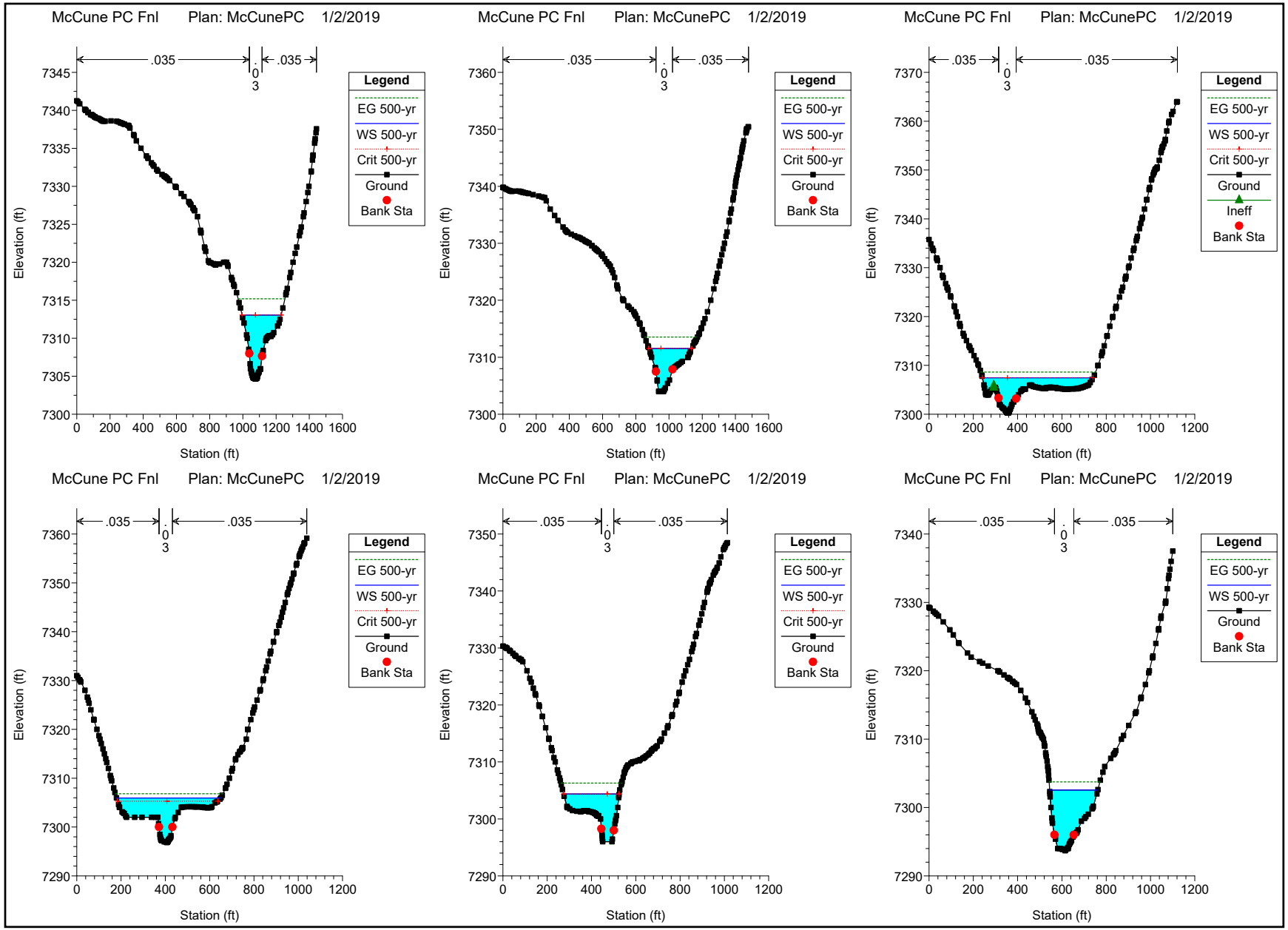
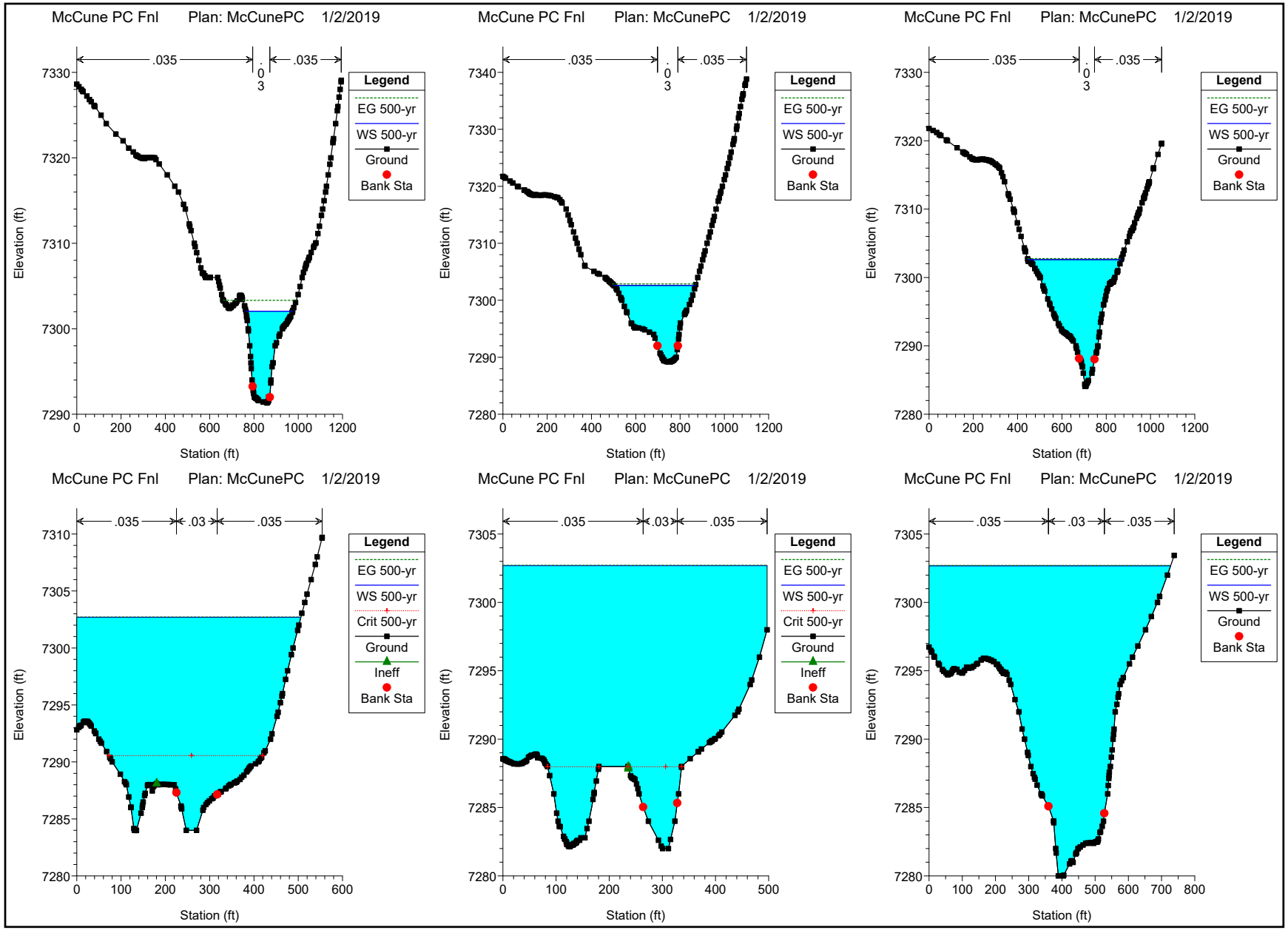
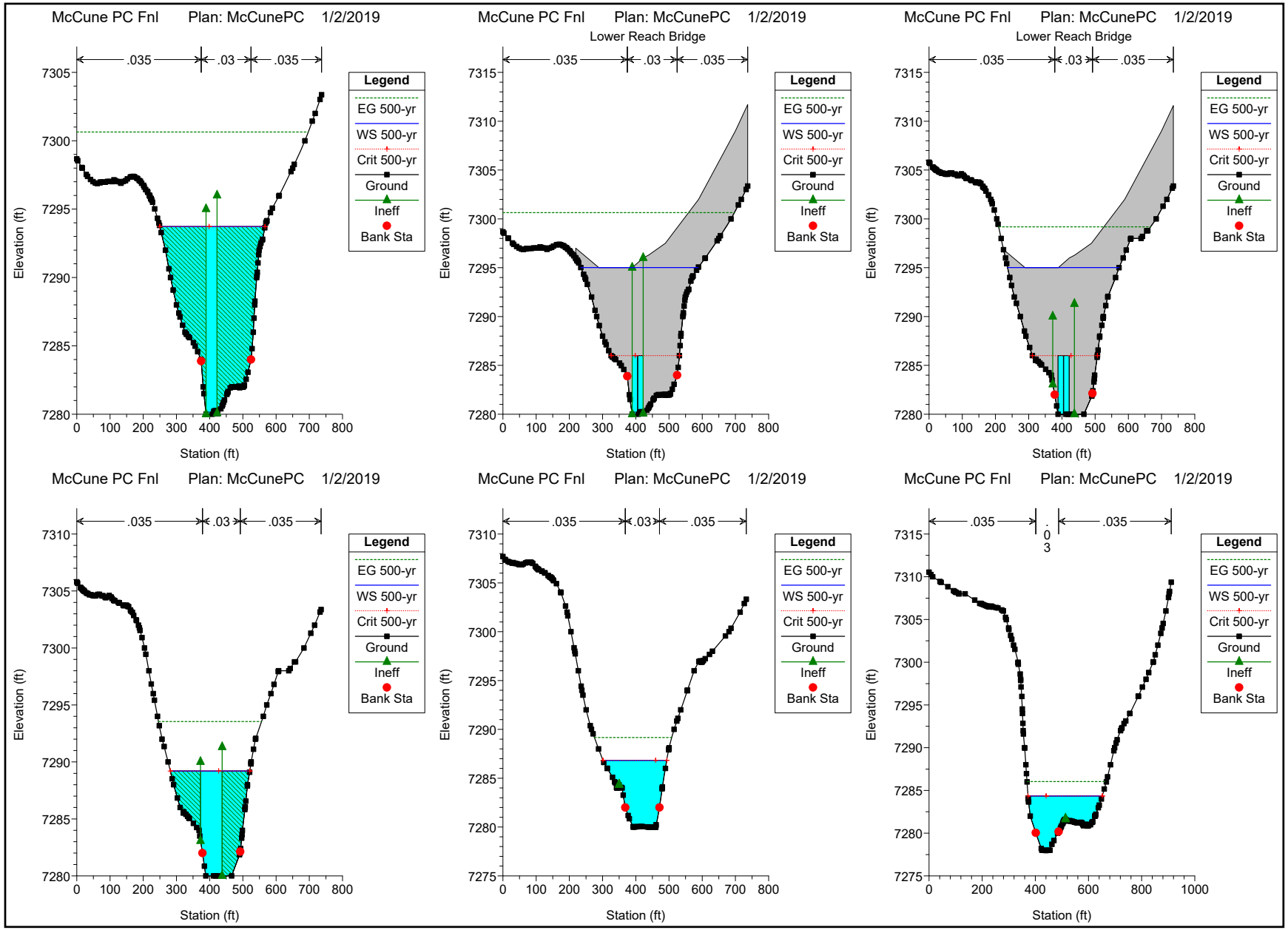
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Upper Reach Bridge


McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.03
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.03
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Bank Sta
Ineff
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.03
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 1/2/2019
Lower Reach Bridge
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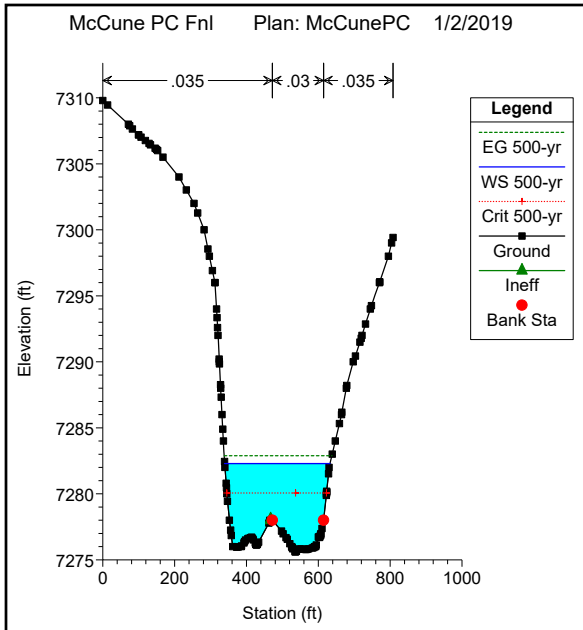
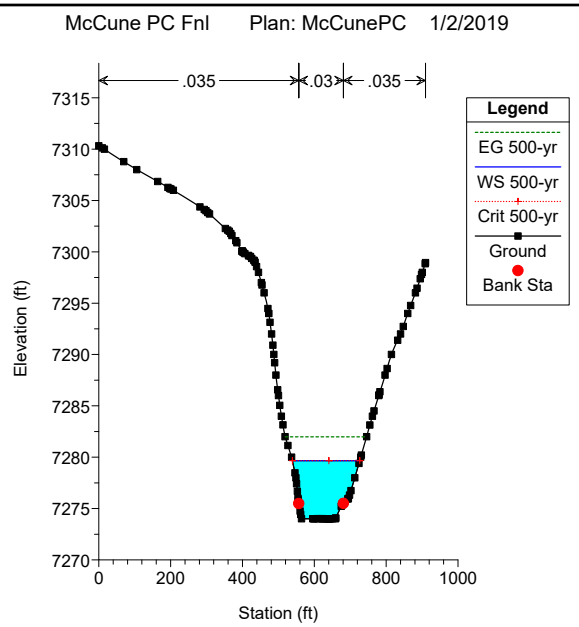
.03
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.03
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
7310
7305
7300
7295
7290
7285
7280
7275
0
200
400
600
800
1000


McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.03
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
7315
7310
7305
7300
7295
7290
7285
7280
7275
7270
0
200
400
600
800
1000

11.3 LETTER FROM COLORADO STATE DAM AUTHORITY

COLORADO
Division of Water Resources
Department of Natural Resources

Dam Safety

Mr. Jason Priddy
The Vertex Companies, Inc.
2420 W. 26th Ave., Suite 100-D
Denver, Colorado 80211
jpriddy@vertexeng.com

When replying, please refer to:
Kiowa Crk Wtrshd 1-N-10, DAMID 010318
Kiowa Crk Wtrshd 1-P-10, DAMID 010319
Kiowa Crk Wtrshd 1-P-20, DAMID 010320
Water Division 1, Water District 01

January 22, 2019

SUBJECT: Winsome Subdivision – Planning Associated with Upstream Jurisdictional Dams

Dear Mr. Priddy:

I would like to start by thanking you for reaching out to me as part of your planning efforts for the Winsome Subdivision located in northeastern El Paso County, CO. The subject dams noted above are all currently registered as Low Hazard jurisdictional dams owned by the Kiowa Conservation District and are located just upstream of the planned Winsome Subdivision. Through coordination with this office, you completed hydraulic routing of a conservative peak dam breach discharge of 9,500 cfs through the planned development. This value was developed by this office in adherence to our *2010 Guidelines for Dam Breach Analysis* for the largest reservoir, 1-P-10. All three dams are situated on different drainages and do not cause cascading failure scenarios. There was concern that a failure of any one of the dams could both impact structures within the development and cause a hazard classification increase, requiring subsequent risk mitigation efforts by the dam owner.

This office has reviewed your floodplain analysis routing the peak dam break failure through the planned development. We understand that the modelling indicates the majority of the lots were not impacted at all by the peak breach. Your modelling indicates that corner of two lots (24 and 64) were within the wetted perimeter at depths less than 2 feet. To be conservative, you have chosen to place these portions of the two lots in "no-build" areas. We have reviewed the HEC-RAS model used to develop the hydraulic analysis and have no objections with the model assumptions and the slight alteration to the planned subdivision lot usage.

In conclusion, this office believes that your foresight in planning development at Winsome will retain Low Hazard classifications for the above-referenced dams. In other words, there is no risk posed by the dams to the structures of the planned development and the owner can continue to monitor and operate these in accordance with our requirements for Low Hazard dams.

Please contact me if you have questions or comments regarding the information contained in the report or if you require assistance with any dam-safety related issues.

Sincerely,

John Hunyadi, P.E.
Dam Safety Engineer

ec: Bill McCormick, Chief Dam Safety
Gilbert LaForce, El Paso County, gilbertlaforce@elpasoco.com
Linda Pollick, NRCS, linda.pollick@co.usda.gov
Pam Brewster, Kiowa Conservation District, pam.brewster@co.nacdnet.net

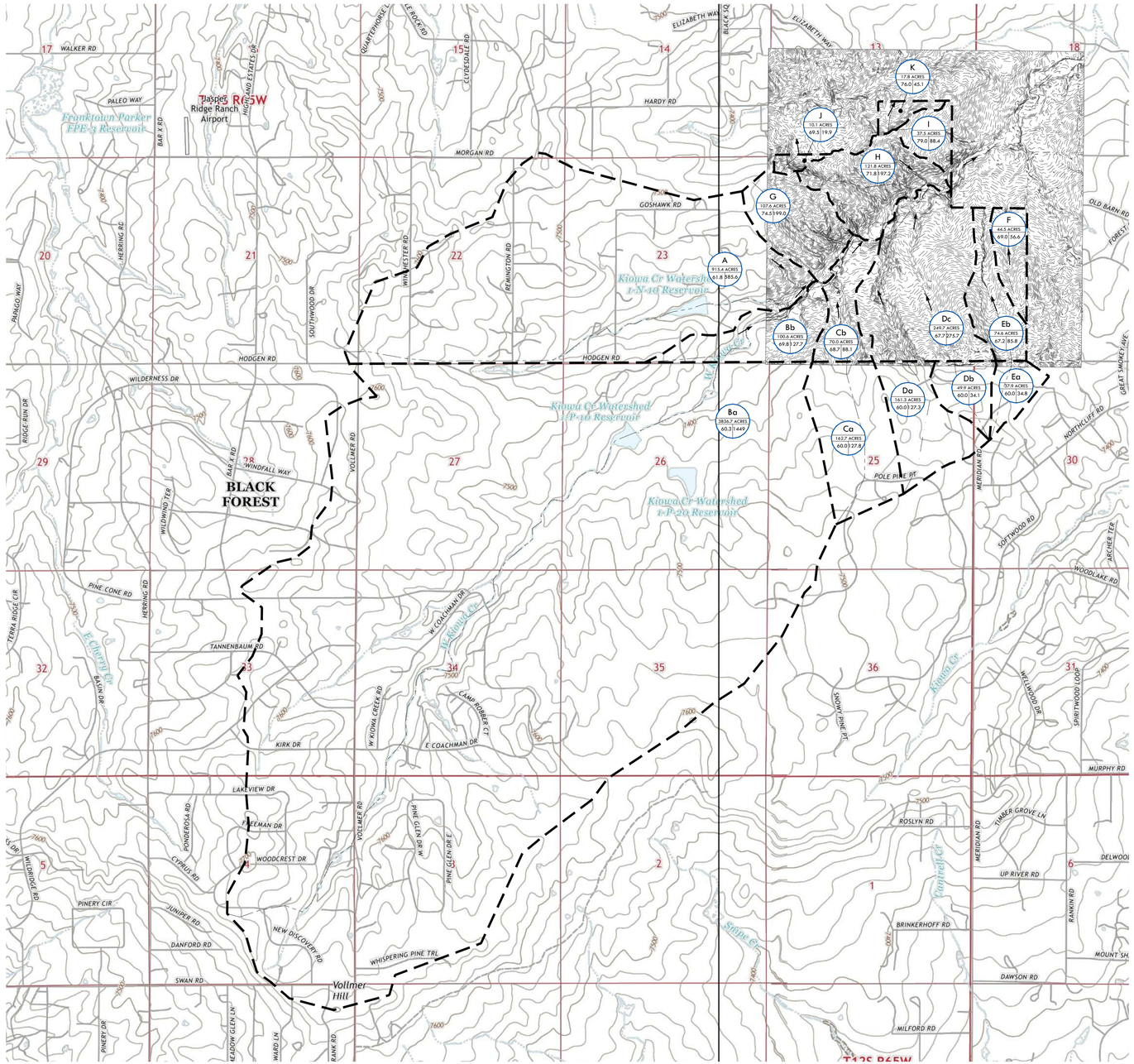
12.0 SITE PHOTOGRAPHS

13.0 DRAINAGE PLANS

CONSTRUCTION DOCUMENTS

WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO



EXISTING STORMWATER RUNOFF TABLE

BASIN	BASIN AREA (ACRES)	CURVE NUMBER	Q_{100}
A	915.4	61.8	585.6
Ba	3836.7	60.3	1448.6
Bb	100.6	69.8	127.7
Ca	162.7	60.0	127.8
Cb	70.0	68.7	88.1
Da	161.3	60.0	127.3
Db	49.9	60.0	34.1
Dc	249.7	67.7	275.7
Ea	37.9	60.0	34.8
Eb	74.6	67.2	85.8
F	44.5	69.0	56.6
G	107.6	74.5	199.0
H	121.8	71.8	197.2
I	37.5	79.0	88.4
J	10.1	69.5	19.9
K	17.8	76.0	45.1
	5998.1		

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN FLOW PATH
- BASIN NAME (A)
- DRAINAGE BASIN SIZE (4.09 ACRES)
- 100-YEAR RUNOFF (4.73) / CURVE NUMBER (14.05)
- FLOW ARROWS

0' 1500' 3000' 4500'

SCALE: 1" = 1500'

SF-20-003

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COLORADO LICENSED LARRY PATRICK VANDIVER 10/5/20 43911 PROFESSIONAL ENGINEER

DRAINAGE PLAN - EXISTING CONDITION - FULL

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	08.01.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

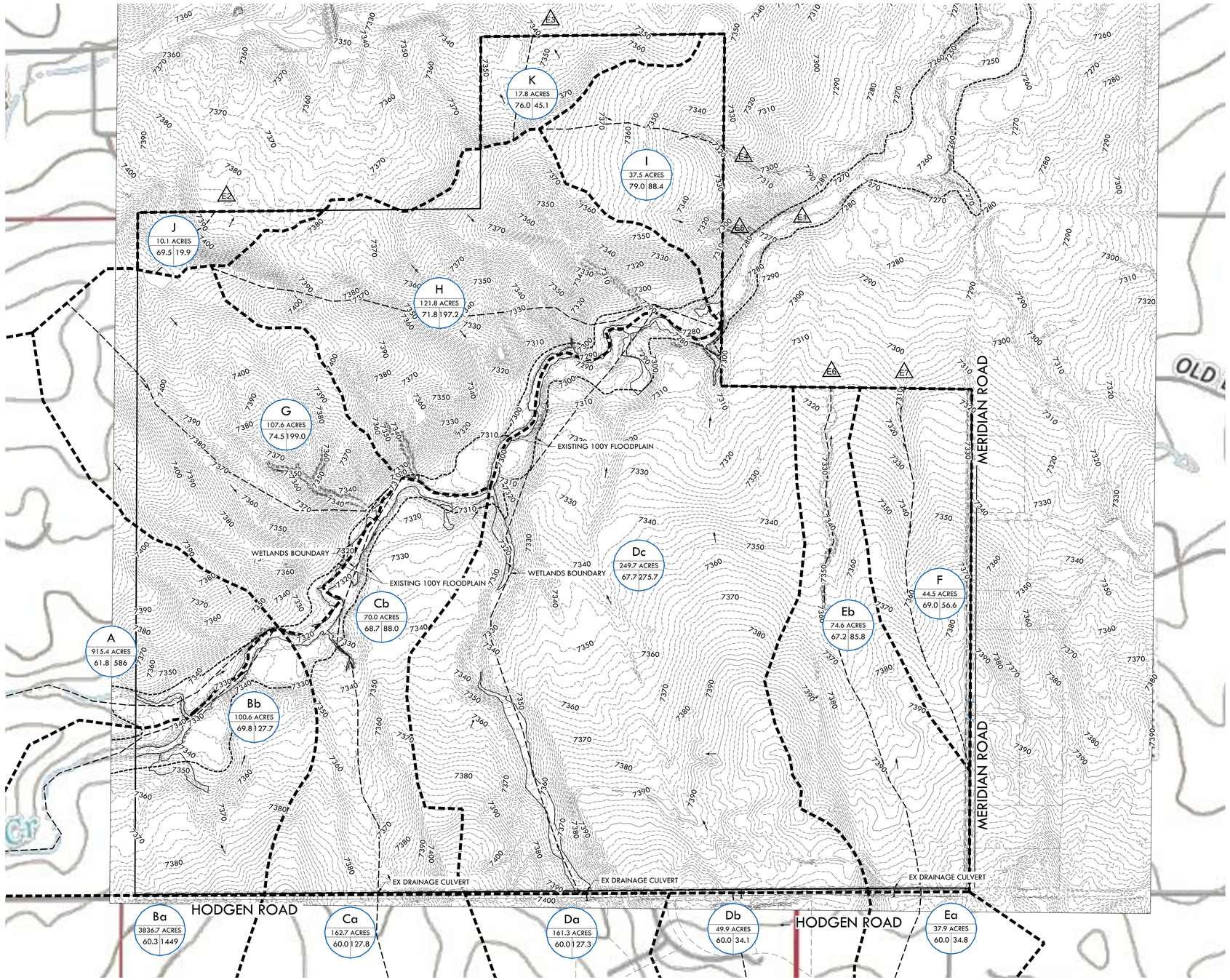
DATE: 01.22.20
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388.01

1

CONSTRUCTION DOCUMENTS

WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO



NOTES:

1. EXISTING FLOODPLAIN AS SHOWN BASED ON FIRM MAP #08041C0350G PANEL 350 REVISED 12/7/2018, GENERATED BY GRAPHICAL OVERLAY.

E1 MAIN OUTFALL E4+E5+E6+E7 Q5=408.6CFS Q100=2469.9CFS

E2 OFFSITE FLOW Q5=3.4CFS Q100=19.9CFS

E3 OFFSITE FLOW Q5=12.9CFS Q100=45.1CFS

E4 + E5 OFFSITE FLOW Q5=26.4CFS Q100=88.4CFS

E6 OFFSITE FLOW Q5=4.0CFS Q100=85.8CFS

E7 OFFSITE FLOW Q5=6.6CFS Q100=56.6CFS

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN FLOW PATH
- A — BASIN NAME
- 4.09 ACRES — DRAINAGE BASIN SIZE
- 4.73 | 14.05 — 100-YEAR RUNOFF / CURVE NUMBER
- FLOW ARROWS

0' 400' 800' 1200'

SCALE: 1" = 400'

SF-20-003

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COLORADO LICENSED
LUKE PATRICK VARDEN
10/5/20
43911
PROFESSIONAL ENGINEER

DRAINAGE PLAN - EXISTING CONDITION - SITE

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	08.01.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

DATE: 01.22.20
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388.01

2

CONSTRUCTION DOCUMENTS

WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED STORMWATER RUNOFF

BASIN	BASIN AREA (ACRES)	CURVE NUMBER	Q_{100}
A	915.4	61.8	585.6
B1	3836.7	60.3	1448.6
B2	13.1	64.0	19.9
B3	54.9	65.1	57.9
B4	41.5	68.5	53.1
C1	162.7	60.0	127.8
C2	22.4	64.0	23.7
C3	16.1	64.0	22.1
C4	23.8	65.0	22.9
D1.1	161.3	60.0	127.3
D1.2	49.9	60.0	34.1
D2	68.7	64.8	81.2
D3.4.6	106.1	66.4	111.4
D5	23.1	67.2	31.6
Ea	37.9	60.0	34.8
Eb	125.2	67.2	143.9
F	44.5	69.0	56.6
G	107.6	74.5	199.0
H	121.8	71.8	197.2
I	37.5	79.0	88.4
J	10.1	69.5	19.9
K	17.8	76.0	45.1
	5998.1		

DETENTION POND SUMMARY

POND NUMBER	PROPOSED VOLUME	100Y FLOW EXITING POND
3	6.9 AC-FT	52.0 CFS

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 — PROPOSED CONTOUR
- 5540 — EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN FLOW PATH

A — BASIN NAME
4.09 ACRES — DRAINAGE BASIN SIZE
4.73 | 14.05 — 100-YEAR RUNOFF / CURVE NUMBER
FLOW ARROWS

0' 1500' 3000' 4500'
SCALE: 1" = 1500'

SF-20-003

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COLORADO LICENSED LANCE PATRICK VANDE 10/5/20 43911 PROFESSIONAL ENGINEER

DRAINAGE PLAN - FILING 1 CONDITION - FULL

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

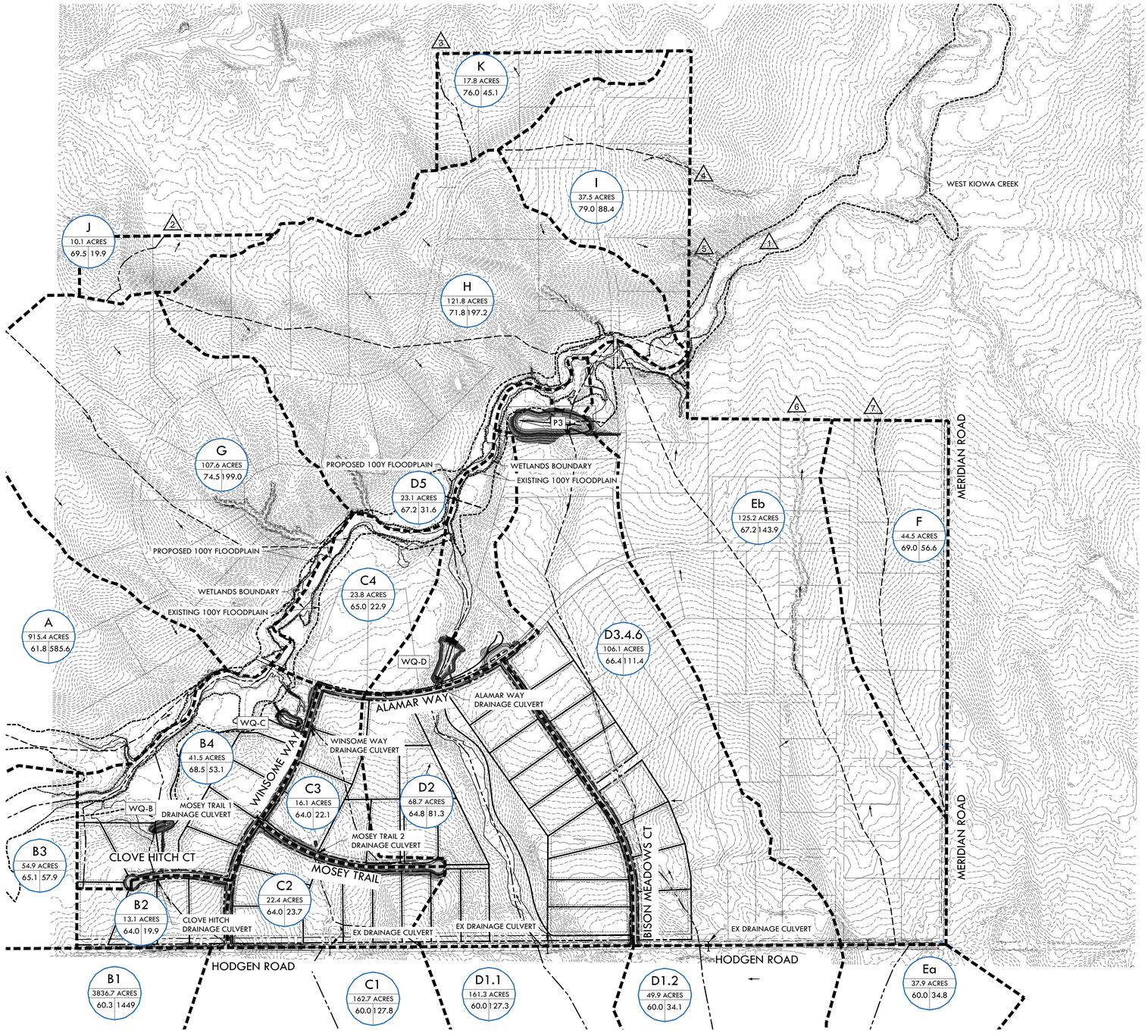
NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	08.01.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

DATE: 01.22.20
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388.01
3

CONSTRUCTION DOCUMENTS

WINSOME FILING NO 1

A TRACT OF LAND BEING A PORTION OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST, OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF EL PASO, STATE OF COLORADO



NOTES:

1. EXISTING FLOODPLAIN AS SHOWN BASED ON FIRM MAP #08041C0350G PANEL 350 REVISED 12/7/2018, GENERATED BY GRAPHICAL OVERLAY.

1 MAIN OUTFALL+DESIGN POINTS 4, 5, 6, 7 Q5=383.0CFS Q100=2294.1CFS

2 OFFSITE FLOW Q5=3.4CFS Q100=19.9CFS

3 OFFSITE FLOW Q5=12.9CFS Q100=45.1CFS

4 + 5 OFFSITE FLOW Q5=26.4CFS Q100=88.4CFS

6 OFFSITE FLOW Q5=4.0CFS Q100=85.8CFS

7 OFFSITE FLOW Q5=6.6CFS Q100=56.6CFS

POND SUMMARY TABLE

POND	DESIGNED WQCV	5-YR Q-IN / Q-OUT	100-YR Q-IN / Q-OUT
B	0.017 AC-FT	2.0 CFS / 1.9 CFS	20.0 CFS / 17.1 CFS
C	0.048 AC-FT	5.6 CFS / 6.9 CFS	166.9 CFS / 165.5 CFS
D	0.051 AC-FT	14.3 CFS / 17.0 CFS	203.9 CFS / 195.2 CFS
3	0.048 AC-FT	7.2 CFS / 0.5CFS	116.5 CFS / 52.0 CFS

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN FLOW PATH
- A / 4.09 ACRES / 4.73 | 14.05 — BASIN NAME; DRAINAGE BASIN SIZE; 100-YEAR RUNOFF; CURVE NUMBER
- FLOW ARROWS

0' 200' 400' 600'

SCALE: 1" = 200'

SF-20-003

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COLORADO LICENSED
LANCE PATRICK VANDER
10/5/20
43911
PROFESSIONAL ENGINEER

DRAINAGE PLAN - FILING 1 CONDITION - SITE

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: WINSOME, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	SUBMITTAL 1
2	04.03.2020 REVISED PER COMMENTS
3	08.01.2020 REVISED PER COMMENTS
4	
5	
6	
7	
8	
9	
10	

DATE: 01.22.20
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388.01

4