Final Drainage Report

Prepared for:

CV DEVELOMPMENT Sedona, Inc
5018 Shoal Creek Blvd
Austin, Texas 78756

Prepared by:

Sefton Engineering Consultants
Your Ideas to Completion
Surveying • Engineering • Land Planning
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Multi-disciplined Team Specializing in Residential and Commerical Projects of all Scope and Size.

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ENGINEERING CERTIFICATION

This report and drainage plan for the Phase Ill drainage design of Canyon Vista Subdivision was prepared by me (or under my direct supervision) in accordance with the provisions of the "Drainage Planning Submittal Requirements" of Coconino County and other regulations of the Coconino County Flood Control District. I understand that Coconino County does not, and will not, assume liability for the drainage facilities designed by others.

SIGNATURE: ————————————————————————

Luke Sefton, Registered Professional Engineer

State of **ARIZONA** **No: 37322**

DEVELOPER CERTIFICATION

William Heyer hereby certifies that the drainage facilities for Canyon Vista Subdivision shall be constructed according to the design presented in this report.

I understand that the City of Sedona do not, and will not, assume liability for the drainage facilities designed and/or certified by my engineer, and that the City of Sedona review drainage plans pursuant to the Arizona Revised Statues, Chapter 21, Article 1, 48-3601 to 48-3628; but cannot, on behalf of Canyon Vista Subdivision, guarantee that final drainage design review will absolve William Heyer and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Final Plat does not imply approval of my engineer's drainage design.

SIGNATURE: ————————————————————————

William Heyer

I. GENERAL LOCATION AND DESCRIPTION

A. LOCATION

Canyon Vista Subdivision is located within the City of Sedona, Coconino County, Arizona. More specifically described as Assessor's Parcel Number 401-20-027G: NW ¼ of the NE ¼ Section 18, Township 17 North, Range 6 East, and Gila & Salt River Base & Meridian. The property is located to the north of Brewer Road along Denise Lane. The property can be accessed from Brewer Road.

1. Project Owner/Developer: CV DEVELOMPMENT Sedona, Inc
   5018 Shoal Creek Blvd
   Austin, Texas 78756

2. Streets and Roadway: Private roadways (Proposed on-site)

3. Major Drainage Ways and Facilities:

   No major drainage way lies within the property. Two major drainage ways lie within a half mile of the property. Oak Creek Floodplain is located half mile south of the property and Soldier Wash Floodplain is located half mile east of the property. Two unnamed washes are identified as Profile 3100 and Profile 3150 in the *City of Sedona Flood Plain Management Study prepared by the United States Department of Agriculture Soil Conservation Service* (Exhibit B). The wash identified as Profile 3100 lies just north of the property boundary and flows in a west to east direction to Soldier Wash. The wash identified as Profile 3150 flows in a west to east direction through the south end of the property to Oak Creek Wash. The washes identified above are tributaries to Oak Creek.

   A flood status report shows this property being out of any floodplain area (Map 04025C1460 F, September 03, 2010) (See Exhibit A).

   Les Springs Subdivision lies to the northwest of the property with Coconino National Forest to the west and north of the property. Surrounding zoning is National Forest (NF) to the west, Planned Residential Development (PRD) to the northwest, Single Family Residential (RS-18b) to the north and Single Family Residential (RS-10b) to the east and south.

B. DESCRIPTION OF PROPERTY

The proposed development of Canyon Vista Subdivision encompasses 5.71 acres of land. The site has an existing primitive road named Denise Lane that runs through the property from Brewer Road. The project area consists of approximately 50 percent vegetative cover consisting of mesquite, brush and grass. The general area consists of a SCS D type soil which consists of nearly level to very steep, well-drained soils that are only 8 to 20 inches deep over basal, permeability is slow. There are no irrigation ditches or canals on this site. The site is situated at the base

of a large ridge which extends along the north and west property boundary with two drainage channels running in a west to east direction through the project area. The drainage channel on the south end of the property can be identified as Profile 3150 in the *City of Sedona Flood Plain Management Study*. The area has a high 10 to 15 percent slope, with some 100% slopes in some areas, which declines in a northwest to southeast direction. The site is currently zoned as Single Family Residential (RS-10b).

II. DRAINAGE BASINS AND SUB-BASINS

A. MAJOR BASIN DESCRIPTION

The City of Sedona Flood Plain Management Study dated May 1994 was referenced and used in this report.

The proposed Canyon Vista Subdivision development will be situated among two major drainage basins as shown in the City of Sedona Floodplain Management Study, 1994. The major drainage basins are identified as Profile 3100 and Profile 3150 (See Exhibit B). The 0.47 acres located on the northwest corner of the proposed development area, Sub-Basin 3A (See Exhibit D) will be considered as a portion of drainage basin Profile 3100. The remaining 5.24 acres of the proposed development will be considered as a portion of drainage basin Profile 3150. Drainage basins Profile 3100 and Profile 3150 typically drain in a west to east direction consisting of sheet flow and shallow channel flow.

There are no irrigation facilities within the project area. The soil type is SCS type D and soil texture classification is moderately fine texture to sandy texture. No detention basins are currently located on-site.

B. SUB-BASIN DESCRIPTION

The two major drainage basins were sub-divided into on-site and off-site basins to further determine the impact of development on the surrounding areas (See Exhibit D).

1. On-site Basin:

   Four sub-basins were delineated within the boundaries of the proposed development. The sub-basins are identified as sub-basins 3A, 4A, 5A and 6A. Sub-Basin 3A is a portion of the drainage area of Profile 3100. Drainage in Sub-Basin 3A will typically consist of sheet flow in a southwest to north direction. Sub-Basins 4A, 5A and 6A are portions of the drainage area for Profile 3150. Drainage in Sub-Basin 4A will consist of sheet flow to localized shallow channel flow which flows in a west to east direction from the western property boundary to the eastern property boundary. Drainage in Sub-Basin 5A will consist of sheet flow to localized shallow channel flow which flows in a west to east direction from the western property boundary to the southern property boundary. Drainage in Sub-Basin 6A will also consist of sheet flow

to localized shallow channel flow which flows in a north to south direction within the proposed development area.

2. Off-site Basin:

Two sub-basins were delineated beyond the proposed development area in order to determine the off-site drainage basins which contribute to the on-site basins. Sub-Basin 1A is a portion of the drainage area of Profile 3150. Drainage in Sub-Basin 1A is predominately channel flow in a west to east direction entering the proposed development area on the western property boundary and continuing to flow through the site. The defined drainage network of Sub-Basin 1A encompasses portion of the undeveloped area of the Coconino National Forest. Sub-Basin 2A is also a portion of the drainage area of Profile 3150. Drainage in Sub-Basin 2A consists of sheet flow in a west to east direction entering the proposed development area on the western property boundary and continuing to flow through the site.

Table 1 addresses the physical properties of the Sub-Basins delineated for this drainage study (See Pre-Development Map, Exhibit D).

Table 1 – Pre-Development Basin Characteristics

Basin Designation	Area	Channel Length	Elevation Delta	Slope
	(mi^2)	(mi)	(ft)	(ft/mi)
1A	0.0322	0.42	600	1429
2A	0.0017	0.05	60	1200
3A	0.0007	0.03	25	833
4A	0.0039	0.07	65	929
5A	0.0021	0.04	17	425
6A	0.0026	0.09	75	832

III. DRAINAGE DESIGN CRITERIA

A. DEVELOPMENT CRITERIA AND CONSTRAINTS

The development of Canyon Vista Subdivision is within the study area of the "Floodplain Management Study of City of Sedona, Main Report" dated May 1994 and the "City of Sedona Stormwater Master Plan, Volume-1 Main Report" dated March 2005. Development within the proposed project area therefore is constrained in that the natural drainage patterns and networks should not be significantly altered or post-development discharge conditions should not increase

beyond pre-development discharge conditions.

B. HYDROLOGIC CRITERIA AND RESULTS

1. Design Rainfall

Information was gathered from the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service website for the 2 year and 100 year return periods for the 6 hour and 24 hour storm durations. These values were then used to develop the Intensity-Duration-Frequency curves and the Intensity-Duration-Depth table according to the procedures outlined in Chapter 1 *Rainfall* of the Highway Drainage Design Manual. Results and excerpts can be found in Exhibit C of this report. The following data from the NOAA National Weather Service website was used to determine the design rainfall.

Table 2 Data from the National Weather Service

Determine Rainfall Depths from the isopluvial maps (Exhibit C)					
2yr, 6hr	**$P_{2,6'}$**	1.28	**100yr, 6hr**	**$P_{100,6'}$**	2.91
2yr, 24hr	**$P_{2,24'}$**	2.10	**100yr,24hr**	**$P_{100,24'}$**	4.53

Using the values from the National Weather Service the following table was developed which was then used to create an Intensity-Duration-Frequency curve. The values in the table were then imported and used in the HydraFlow Hydrographs 2020 modeling program to conduct a hydrologic analysis of the area.

Table 3 Intensity-Duration-Frequency Chart

Rainfall Intensity, in Inches/Hour							
Duration	Frequency, in Years						
	2yr	5yr	10yr	25yr	50yr	100yr	
5-min	2.95	3.90	4.54	5.45	6.16	6.86	
10-min	2.22	2.96	3.46	4.17	4.71	5.26	
15-min	1.80	2.46	2.91	3.53	4.02	4.50	
20-min	1.49	2.05	2.43	2.96	3.37	3.77	
30-min	1.19	1.65	1.96	2.39	2.72	3.05	
40-min	1.04	1.44	1.72	2.10	2.39	2.69	
1-hour	0.72	1.02	1.21	1.49	1.70	1.91	
2-hour	0.46	0.62	0.73	0.89	1.01	1.12	
3-hour	0.35	0.46	0.54	0.65	0.74	0.83	
6-hour	0.21	0.28	0.32	0.39	0.44	0.49	
12-hour	0.14	0.18	0.21	0.25	0.28	0.31	
24-hour	0.09	0.11	0.13	0.15	0.17	0.19	

2. Runoff Method (Exhibit C)

   a. The Runoff Method is a continuation of the Rational Method with watershed areas less than the 160-acre limit and was conducted as outlined in Chapter 2 Rational Method of the Highway Drainage Design Manual.

   b. The Rational Method is based on the equation Q=CIA (Exhibit C, equation 2-1) where Q is the peak flow in cubic feet per second, C is the runoff coefficient, i is the average rainfall intensity in inches per hour and A is the contributing drainage area in acres.

   c. The intensity in the Rational Method equation is the average rainfall

intensity for rainfall of a selected return period for a rainfall duration that is equal to the time of concentration. Minimum rainfall duration of 10 minutes was used if the calculated Time of Concentration was less than 10 minutes.

d. The Time of Concentration was determined by using the equation of $T_c=11.4*L^{0.5}*K_b^{0.52}*S^{-0.31}*i^{-0.38}$ (Exhibit C, equation 2-2) where L is the length of the longest flow path in miles, K_b is the resistance coefficient, S is the slope of the longest flow path in feet per mile and i is the average rainfall intensity in inches per hour. The Resistance Coefficient (K_b) for the undeveloped site was foothills (0.10), and for the developed site, was paved and buildings with undeveloped land (0.03) (Exhibit C, Table 2-1). The following table contains the results for the determination of Time of Concentration for the 100-year return period. Additional results and calculations can be found in Exhibit C within this report.

Table 4 Pre-Development Time of Concentrations

Basin Designation	Time of Concentration
	(hrs)
1A	0.17
2A	0.17
3A	0.17
4A	0.17
5A	0.17
6A	0.17

Table 5 Post-Development Time of Concentrations

Basin Designation	Time of Concentration
	(hrs)
1A	0.17
2A	0.17
3A	0.17
4A	0.17
5A	0.17
6A	0.17

e. For the pre-development condition sub-basins 1A through 5A are undeveloped with 50% vegetative cover and SCS Type-D soil therefore a Rational "C" Coefficient of 0.45 was determined using Figure 2-5 in Exhibit C. Sub-basin 6A was partially developed with 20% impervious surfaces therefore a Rational "C" Coefficient of 0.62 was determined using Figure 2-3 in Exhibit C. For the post-development condition sub-basins 3A through 6A are developed with 50% impervious surfaces therefore a Rational "C" Coefficient of 0.70 was determined using Figure 2-3 in Exhibit C.

f. HydraFlow Hydrographs 2004 modeling program based on the Rational Method was used to determine peak flows for on-site and off-site basins for the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year return periods in the pre-development and post-development conditions. The results and computations can be found in Exhibit F.

3. Detention calculation method (Exhibit F)

HydraFlow Hydrographs 2004 was used for the calculation of the detention ponds. The detention pond found on the northeast portion of the property was designed to accept a drainage area of 3.62 acres [Drainage Sub-Basin 2A (off-site) and 4A (on-site)] which has a runoff discharge volume of 7,120 cubic feet according to the results for Hydrograph 28 of the Post-Development with Detention model in Exhibit F. The northeast detention basin has a total depth of 4 feet with a maximum storage area of 5,152 cubic feet which includes a 1 foot freeboard. The following table was taken from the Pond Report in the Post-Development with Detention model in Exhibit F.

Table 6 Stage/Storage Table for North Detention Basin

Stage	Elevation	Contour Area	Incr. Storage	Total Storage
(feet)	(feet)	(sqft)	(cuft)	(cuft)
0	4249	515	0	0
1	4250	869	692	692
2	4251	1261	1065	1758
3	4252	1690	1476	3233
4	4253	2147	1919	5152

The detention pond found on the southwest portion of the property as designed to accept a drainage area of 20.6 acres (Drainage Sub-Basin 1A (off-site)] which has a runoff discharge volume of 19,822 cubic feet according

to the results for Hydrograph 26 of the Post-Development with Detention model in Exhibit F. The southwest detention basin has a total depth of 4 feet with a maximum storage area of 11,230 cubic feet which includes a 1 foot freeboard. The following table was taken from the Pond Report in the Post-Development with Detention model in Exhibit F.

Table 7 Stage/Storage Table for South Detention Basin

Stage	Elevation	Contour Area	Incr. Storage	Total Storage
(feet)	(feet)	(sqft)	(cuft)	(cuft)
0	4261	1893	0	0
1	4262	2325	2109	2109
2	4263	2788	2557	4665
3	4264	3276	3032	7697
4	4265	3790	3533	11230

4. Storm Recurrence Intervals

   Results are presented for the 2, 5, 10, 25, 50 and 100-year events

5. Other Hydrologic Criteria / Methods

   No additional hydrologic criteria / methods are requested or anticipated.

6. Hydrologic Results

Using HydraFlow Hydrographs 2020 hydrologic modeling program the first model created was to establish the pre-development drainage of all off-site and on-site sub-basins affecting the project area. The following table summarizes the results of the pre-development model in Exhibit F.

Table 8 Pre-Development Discharges

PRE-DEVELOPMENT DISHARGES (cfs)						
Design Pt.	2-yr Peak	5-yr Peak	10-yr Peak	25-yr Peak	50-yr Peak	100-yr Peak
1A	21.85	29.52	34.57	41.89	47.47	53.10
2A	1.17	1.58	1.85	2.24	2.53	2.84
3A	0.50	0.67	0.79	0.96	1.08	1.21
4A	2.67	3.61	4.23	5.13	5.81	6.50
5A	1.42	1.92	2.25	2.73	3.09	3.45
6A	2.41	3.26	3.81	4.62	5.24	5.86
1	21.85	29.52	34.57	41.89	47.47	53.10
2	1.17	1.58	1.85	2.24	2.53	2.84
3	23.27	31.44	36.82	44.62	50.55	56.55
4	3.84	5.19	6.07	7.36	8.34	9.33
5	6.25	8.44	9.89	11.99	13.58	15.19

The second model created was to establish the post-development drainage which takes into account the development of the project area but no drainage mitigation is established. The following table summarizes the results of the post-development model in Exhibit F.

Table 9 Post-Development Discharges-no mitigation

POST-DEVELOPMENT DISHARGES (cfs)						
Design Pt.	2-yr Peak	5-yr Peak	10-yr Peak	25-yr Peak	50-yr Peak	100-yr Peak
1A	21.85	29.52	34.57	41.89	47.47	53.10
2A	1.17	1.58	1.85	2.24	2.53	2.84
3A	0.78	1.05	1.23	1.49	1.68	1.88
4A	4.16	5.62	6.58	7.97	9.03	10.10
5A	2.21	2.99	3.50	4.24	4.80	5.37
6A	2.72	3.68	4.31	5.22	5.91	6.62
1	21.85	29.52	34.57	41.89	47.47	53.10
2	1.17	1.58	1.85	2.24	2.53	2.84
3	24.06	32.50	38.07	46.13	52.27	58.47
4	5.32	7.19	8.42	10.21	11.57	12.94
5	8.05	10.87	12.73	15.43	17.48	19.56

The third model created was to establish the post-development drainage with the establishment of a drainage network that will mitigate the runoff discharges. The following table summarizes the results of the post-development with detention model in Exhibit F.

Table 10 Post-Development with Detention Implementation

POST-DEVELOPMENT w/ DETENTION DISHARGES (cfs)						
Design Pt.	2-yr Peak	5-yr Peak	10-yr Peak	25-yr Peak	50-yr Peak	100-yr Peak
1A	21.85	29.52	34.57	41.89	47.47	53.10
2A	1.17	1.58	1.85	2.24	2.53	2.84
3A	0.78	1.05	1.23	1.49	1.68	1.88
4A	4.16	5.62	6.58	7.97	9.03	10.10
5A	2.21	2.99	3.50	4.24	4.80	5.37
6A	2.72	3.68	4.31	5.22	5.91	6.62
1	21.85	29.52	34.57	41.89	47.47	53.10
2	1.17	1.58	1.85	2.24	2.53	2.84
3	20.59	27.91	32.27	37.48	41.58	45.62
4	3.53	4.39	4.84	5.41	5.82	6.18
5	5.84	7.45	8.48	9.92	10.90	11.88

The increase in runoff from the Pre-Development to the Post-Development is due to the development of the project area. The decrease in runoff between Post-Development and Post-Development with Detention is due to the implementation of a detention basin that mitigates the off-site and on-site drainage areas.

The increase in runoff from Sub-Basin 3A was not significant enough to require mitigation. The increase of 0.67 cubic feet per second is effective over a 0.47 acre area and is considered overland sheet flow therefore the increase is not concentrated to one specific point. The increase in runoff will have no significant impact to the surrounding areas or drainage ways.

C. HYDRAULIC CRITERIA

The procedure and design criteria outlined in Yavapai County Drainage Manual Chapter 6 and Chapter 8 was followed when performing hydraulic analysis. HydraFlow Express was also used in sizing and designing culverts and channels used in this project. No additional hydrologic criteria/methods are requested or anticipated.

IV. DRAINAGE FACILITY DESIGN

A. GENERAL CONCEPT

1. The development of Canyon Vista Subdivision increased the overall runoff as shown when comparing the Post-development discharges (Table 9) to the Pre-development discharges (Table 8). To reduce the Post-development discharges two detention basins will be implemented into the development of the site to reduce the overall runoff discharges below the Pre-development levels.

2. To reduce the impact of development on overall runoff peak discharges the Pre-development drainage patterns will typically be followed with little modifications. Areas of development that obstruct the pre-development drainage patterns will be modified with a drainage structure that returns the runoff discharge to a pre-development condition.

3. The following tables and figures were included in this report for further clarification and summarization of data.

   a. Table 1: Summarizes the physical characteristics of each sub-basin delineated for this project.

   b. Table 2: Shows the point rainfall depth-duration-frequency values for the watershed that encompasses the project site.

   c. Table 3: Shows the intensity-duration-frequency values for the watershed that encompasses the project site.

   d. Table 4: Shows the calculated Time of Concentrations for the Pre-development sub-basins.

   e. Table 5: Shows the calculated Time of Concentrations for the Post-development sub-basins.

   f. Table 6: Shows the incremental stage/storage values for the north detention basin.

   g. Table 7: Shows the incremental stage/storage values for the south detention basin.

   h. Table 8: Shows the calculated Pre-development peak discharge for the required storm recurrence intervals for each sub-basin and concentration point.

   i. Table 9: Shows the calculated Post-development peak discharges for the required storm recurrence intervals for each sub-basin and

concentration point.

j. Table 10: Shows the calculated Post-development with Detention Implementation peak discharges for the required storm recurrence intervals for each sub-basin and concentration point.

4. The method for managing storm water quality during the construction phase will be addressed on the Storm Water Pollution Prevention Plan (SWPPP) to be included in the subdivision's construction plans. The plan will call for straw bale silt barriers to be placed on-site in accordance with the SWPPP. The contractor will be instructed to clean up all silt barriers and basins at the time of final cleanup to ensure that all intended grading as shown on the plan is met.

B. SPECIFIC DETAILS

1. Design Point 1, Q_{100}= 53.10 cfs: The 100-year peak discharge from off-site sub-basin 1A entering on-site sub-basin 5A on the western property boundary. The peak discharge will be routed through a detention basin to reduce the peak discharge.

   Design Point 2, Q_{100}= 2.84 cfs: The 100-year peak discharge from off-site sub-basin 2A entering on-site sub-basin 4A on the western property boundary. The peak discharge will be routed through an 18-inch diameter corrugated metal pipe located beneath Denise Lane and continue through Sub-Basin 4A.

   Design Point 3, Q_{100}= 45.62 cfs: The 100-year peak discharge leaving on-site sub-basin 5A on the south property boundary into a pre-existing channel.

   Design Point 4, Q_{100}= 6.18 cfs: The 100-year peak discharge leaving on-site sub-basin 4A on the east property boundary into a pre-existing channel.

   Design Point 5, Q_{100}= 11.88 cfs: The 100-year peak discharge entering an existing 36-inch diameter corrugated metal pipe beneath Brewer Road southeast of the project site.

2. To reduce the post-development peak discharges from Sub-Basin 4A to a level below or equal to the pre-development peak discharges a detention basin with a storage volume of 5,152 cubic feet will be constructed on the north portion of the project area. The total depth of the basin will be 4 feet which includes a 1 foot freeboard. The detention basin will have a maximum 2:1 side slopes which will be lined with D_{50}= 6" aggregate rock. The outlet structure will be a 14.3% slope, 12-inch diameter corrugated metal pipe. In addition an emergency spillway will be installed which will be 10-feet long and 1' deep at a base elevation of 4252.0 feet.

3. To reduce the post-development peak discharges from Sub-Basin 5A to a

level below or equal to the pre-development peak discharges a detention basin with a storage volume of 11,230 cubic feet will be constructed on the south portion of the project area. The total depth of the basin will be 4 feet which includes a 1 foot freeboard. The detention basin will have a maximum 2:1 side slopes which will be lined with D_{50}= 6" aggregate rock. The outlet structure will be two 24-inch diameter corrugated metal pipes at 6.3% slope. In addition, an emergency spillway will be installed which will be 10-feet long by 1-foot deep at a base elevation of 4264.0 feet.

4. The detention basin in Lot 1 & 2 will have a maximum water surface elevation of 4263.87 feet therefore a minimum finished floor elevation of 4264.87 feet will be required for the building in Lot 1 & 2. The detention basin in Lot 6 will have a maximum water surface elevation of 4252.17 feet therefore a minimum finished floor elevation of 4253.17 feet will be required for the building in Lot 6.

V. CONCLUSIONS

It is the engineer's opinion that the site be constructed as proposed. The plan will satisfy the conditions for design while maintaining cost effective, low maintenance drainage facilities. The facilities will mitigate any anticipated increases related to the development. The project complies with Coconino County and the City of Sedona criteria.

VI. REFERENCES

i. Yavapai County Flood Control District Drainage Criteria Manual, Revised August 2015.

ii. Arizona Department of Transportation, Highway Drainage Design Manual Hydrology, March 2014.

iii. United States Department of Agriculture, Soil Conservation Services, Floodplain Management Study, City of Sedona, Main Report. Phoenix, Arizona, May1994.

iv. Dibble & Associates Consulting Engineers, City of Sedona Storm Water Master Plan, Volume I, Main Report. March 2005.

v. National Oceanic and Atmospheric Administration's (NOAA) National Weather Service. Office of Hydrologic Development. Silver Spring, Maryland. Last Modified: December 13, 2005.

vi. HydraFlow Hydrographs 2020 program..

vii. HydraFlow Express 2020 program. .

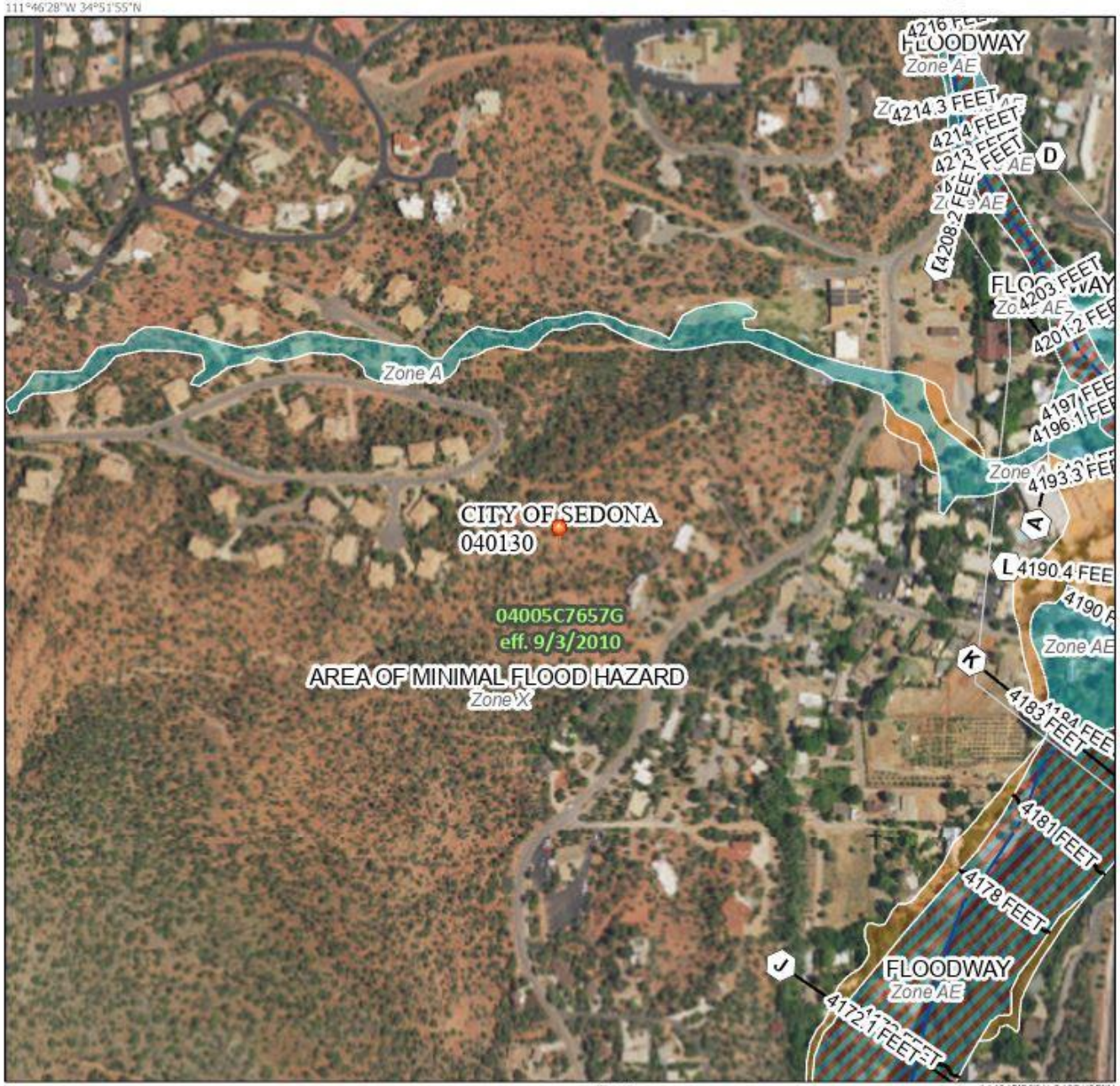
EXHIBIT A

FIRM MAP

National Flood Hazard Layer FIRMette

FEMA

111°46'28"W 34°51'55"N



111°45'50"W 34°51'25"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

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

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

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

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

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

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/5/2021 at 6:06 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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EXHIBIT B

CITY OF SEDONA STUDY

CITY OF SEDONA
STORM WATER MASTER PLAN

VOLUME I – MAIN REPORT

PREPARED FOR:

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EXHIBIT C

ADOT DRAINAGE DESIGN MANUAL EXCERPTS AND CALCULATIONS

CHAPTER 2
RATIONAL METHOD

2.1 INTRODUCTION

The Rational Method relates rainfall intensity, a runoff coefficient and a drainage area size to the direct runoff from the drainage basin.

Three basic assumptions of the Rational Method are:

a. The frequency of the storm runoff is the same as the frequency of the rainfall producing the runoff (i.e., a 25-year runoff event results from a 25-year rainfall event).

b. The peak runoff occurs when all parts of the drainage basin are contributing to the runoff.

c. Rainfall is uniform over the watershed.

2.1.1 General Discussion

The Rational Method, as presented herein, can be used to estimate peak discharges, the runoff hydrograph shape, and runoff volume for small, uniform drainage areas that are not larger than 160 acres in size. The method is usually used to size drainage structures for the peak discharge of a selected return period. An extension of the basic method is provided to estimate the shape of the runoff hydrograph if it is necessary to design retention/detention facilities and/or to design drainage facilities that will require routing of the runoff hydrograph through the structure.

The Rational Method is based on the equation: $Q = CiA$ (2-1)

where Q = the peak discharge, in cfs, of selected return period,
C = the runoff coefficient,
i = the average rainfall intensity, in inches/hr, of calculated rainfall duration for the selected rainfall return period, and
A = the contributing drainage area, in acres.

2.2 PROCEDURE

2.2.1 General Considerations

1. Depending on the intended application, the runoff coefficient (C) should be selected based on the character of the existing land surface or the projected character of the land surface under future development conditions. In some situations, it may be necessary to estimate C for both existing and future conditions.

2. Land-use must be carefully considered because the evaluation of land-use will affect both the estimation of C and also the estimation of the watershed time of concentration (T_C).

3. The peak discharge (Q) is generally quite sensitive to the calculation of T_C and care must be exercised in obtaining the most appropriate estimate of T_C.

4. Both C and the rainfall intensity (i) will vary if peak discharges for different flood return periods are desired.

5. Since the T_C equation is a function of rainfall intensity (i), T_C will also vary for different flood return periods.

2.2.2 Applications and Limitations

1. The total drainage area must be less than or equal to 160 acres.

2. T_C shall not exceed 60 minutes.

3. The land-use of the contributing area must be fairly consistent over the entire area; that is, the area should not consist of a large percentage of two or more land-uses, such as 50 percent commercial and 50 percent undeveloped. This will lead to inconsistent estimates of T_C (and therefore i) and errors in selecting the most appropriate C coefficient.

4. The contributing drainage area cannot have drainage structures or other facilities in the area that would require flood routing to correctly estimate the discharge at the point of interest.

5. Drainage areas that do not meet the above conditions will require the use of an appropriate rainfall-runoff model (the HEC-1 Program) to estimate flood discharges.

2.2.3 Estimation of Area (A)

An adequate topographic map of the drainage area and surrounding land is needed to define the drainage boundary and to estimate the area (A), in acres. The map should be supplemented with aerial photographs, if available, especially if the area is developed. If the area is presently undeveloped but is to undergo development, then the land development plan and maps should be obtained because these may indicate a change in the drainage boundary due to road construction or land grade changes. If development plans are not available, then land-use should be based on current zoning of the area.

The delineation of the drainage boundary needs to be carefully determined. The contributing drainage area for a lower intensity storm does not always coincide with the drainage area for more intense storms. This is particularly true for urban areas where roads can form a drainage boundary for small storms but more intense storm runoff can cross roadway crowns, curbs, etc. resulting in a larger contributing area. Floods on alluvial fans (active and inactive) and in distributary flow systems can result in increased contributing drainage areas during larger and more intense storms. It is generally prudent to consider the largest reasonable drainage area in such situations.

2.2.4 Estimation of Rainfall Intensity (i)

The intensity (i) in Equation 2-1 is the average rainfall intensity in inches/hour for the period of maximum rainfall of a specified return period (frequency) having a duration equal to the time of concentration (T_C) for the drainage area. The frequency is usually specified according to a design criteria or standard for the intended application. The

rainfall intensity (i) is obtained from an intensity-duration-frequency (I-D-F) graph. Two methods can be used for obtaining I-D-F information: 1) two generalized I-D-F graphs are provided that can be used for any site in Arizona, and 2) a site-specific I-D-F graph can be developed, if desired. The two generalized I-D-F graphs are shown in **Figure 2-1** for Zone 6, and **Figure 2-2** for Zone 8, respectively. The delineation of the two rainfall zones for Arizona is shown in **Figure 1-1** of Chapter 1 - Rainfall. Procedures for developing a site-specific I-D-F graph are described in Chapter 1.

The intensity (i) in Equation 2-1 is the average rainfall intensity for rainfall of a selected return period from an I-D-F graph for a rainfall duration that is equal to the time of concentration (T_C) as calculated according to the procedure described below. A minimum rainfall duration of 10 minutes is to be used if the calculated T_C is less than 10 minutes. The Rational Method should not be used if the calculated T_C is greater than 60 minutes.

2.2.5 Estimation of Time of Concentration (T_C)

Time of concentration (T_C) is to be calculated by Equation 2-2:

$$T_C = 11.4\ L^{0.5}\ K_b^{0.52}\ S^{-0.31}\ i^{-0.38} \qquad (2\text{-}2)$$

Note: Reference Papadakis and Kazan, 1987.

where T_C = the time of concentration, in hours,
L = the length of the longest flow path, in miles,
K_b = the watershed resistance coefficient,
S = the slope of the longest flow path, in ft/mile, and
i = the average rainfall intensity, in inches/hr, for a duration of rainfall equal to T_C (the same (i) as Equation 2-1) unless T_C is less than 10 minutes, in which case the (i) of Equation 2-1 is for a 10-minute duration).

The longest flow path will be estimated from the best available map and the length (L) measured from the map.

FIGURE 2-1
GENERALIZED I-D-F GRAPH FOR ZONE 6 OF ARIZONA

Example: For a selected 10-year return period, P_1 = 2.0 inches. T_C is calculated as 20 minutes. Therefore, (i) = 4.25 in/hr.

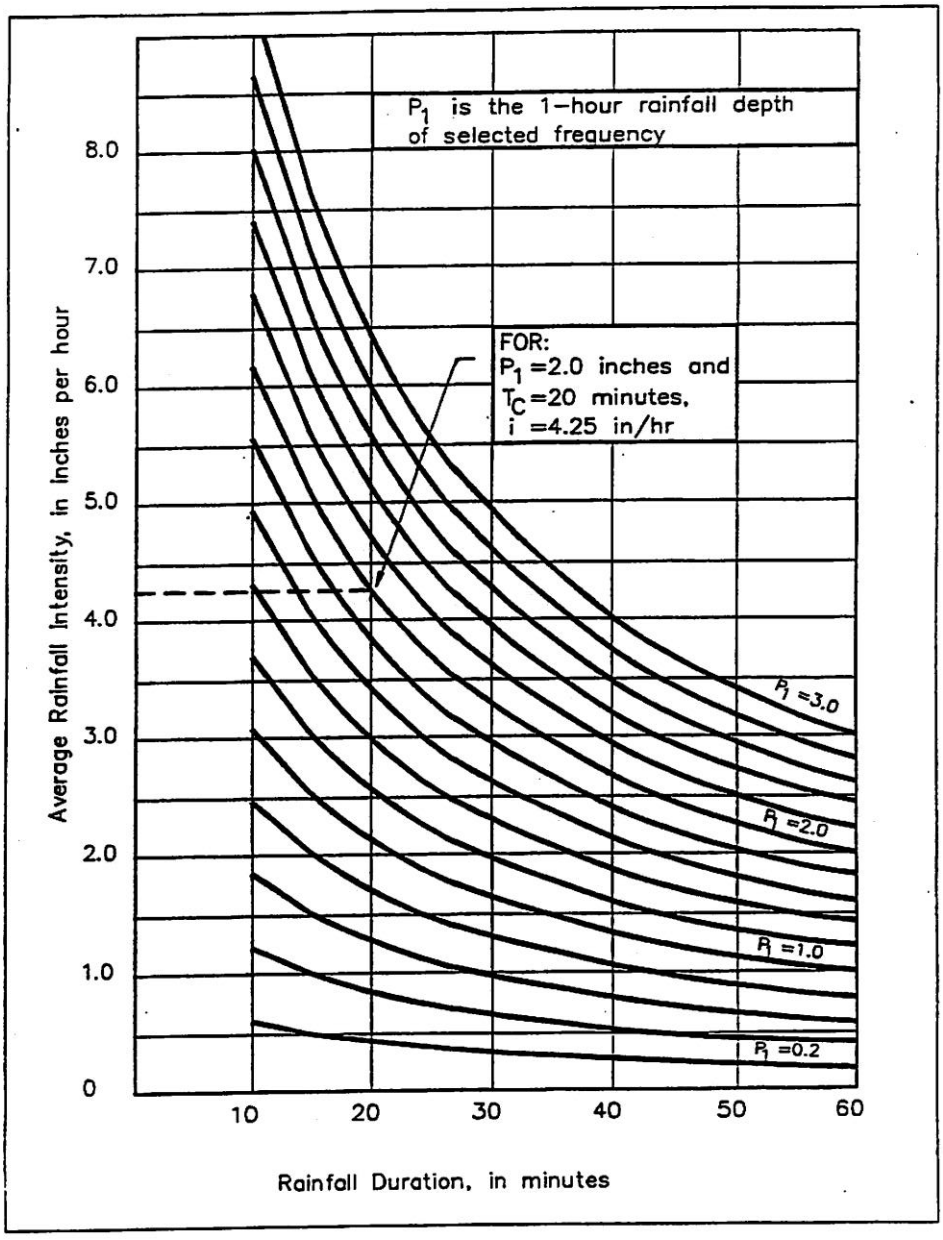
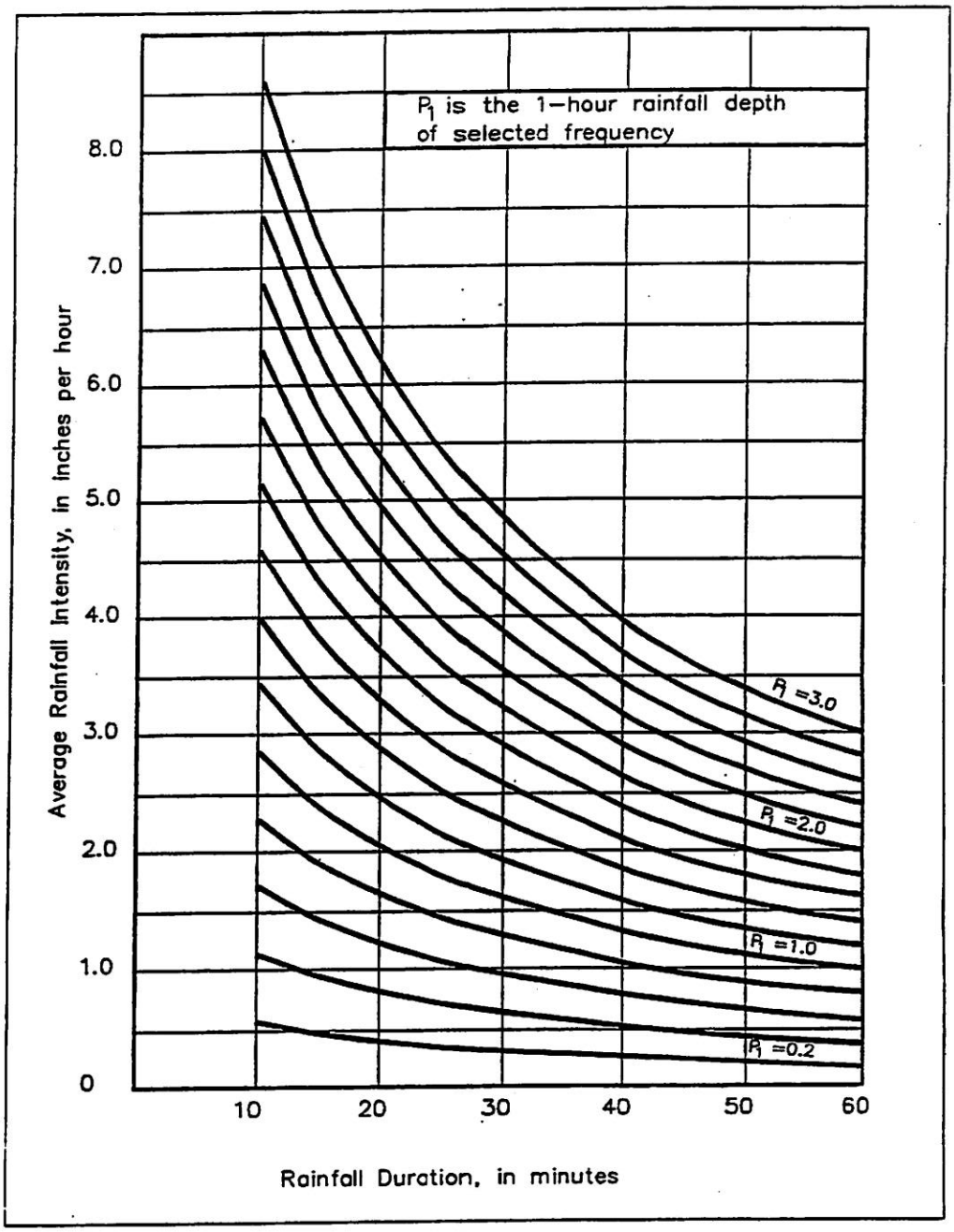


FIGURE 2-2
GENERALIZED I-D-F GRAPH FOR ZONE 8 OF ARIZONA



The slope (S), in ft/mile, will be calculated by one of two methods:

1. If the longest flow path has a uniform gradient with no appreciable grade breaks, then the slope is calculated by Equation 2-3;

$$S = \frac{H}{L} \qquad (2\text{-}3)$$

where H = the change in elevation, in feet, along L, and
L = as defined in Equation 2-2.

2. If the longest flow path does not have a uniform gradient or has distinct grade breaks, then the slope is calculated by Equation 2-4:

$$S = 5{,}280 \left(\frac{d}{j}\right)^2 \qquad (2\text{-}4)$$

where $d = 5{,}280 \times L$

$$j = \sum \left(\frac{d_i^3}{H_i}\right)^{1/2}$$

Note: Reference, Pima County Department of Transportation and Flood Control District, September 1979.

and d_i = an incremental change in length, in <u>feet</u>, along the longest flowpath and
H_i = an incremental change in elevation, in feet, for each length segment, d_i.

The resistance coefficient (K_b) is selected from **Table 2-1**. Use of **Table 2-1** requires a classification as to the landform and a determination of the nature of runoff; whether in a defined drainage network of rills, gullies, channels, etc., or predominantly as overland flow.

TABLE 2-1
RESISTANCE COEFFICIENT (K_b) FOR USE WITH THE RATIONAL METHOD T_c EQUATION

Description of Landform	K_b	
	Defined Drainage Network	Overland Flow Only
Mountain, with forest and dense ground cover (overland slopes - 50% or greater)	0.15	0.30
Mountain, with rough rock and boulder cover (overland slopes - 50% or greater)	0.12	0.25
Foothills (overland slopes - 10% to 50%)	0.10	0.20
Alluvial fans, Pediments and Rangeland (overland slopes - 10% or less)	0.05	0.10
Irrigated Pasture [a]	—	0.20
Tilled Agricultural Fields [a]	—	0.08
URBAN		
Residential, L is less than 1,000 ft[b]	0.04	—
Residential, L is greater than 1,000 ft[b]	0.025	—
Grass; parks, cemeteries, etc. [a]	—	0.20
Bare ground; playgrounds, etc. [a]	—	0.08
Paved; parking lots, etc. [a]	—	0.02

Notes: a - No defined drainage network.
b - L is length in the T_c equation. Streets serve as drainagae network.

The solution of Equation 2-2 is an iterative process since the determination of (i) requires the knowledge of the value of T_C. Therefore, Equation 2-2 will be solved by a trial-and-error procedure. After L, K_b, and S are estimated and after the appropriate I-D-F graph is selected or prepared, a value for T_C will be estimated (a trial value) and (i) will be read from the I-D-F graph for the corresponding value of duration = T_C. That (i) will be used in Equation 2-2 and T_C will be calculated. If the calculated value of T_C does not equal the trial value of T_C, then the process is repeated until the calculated and trial values of T_C are acceptably close (a difference of less than 10 percent should be acceptable).

2.2.6 Selection of Runoff Coefficient (C)

The runoff coefficient (C) is selected from **Figure 2-3** through **Figure 2-8** depending on the classification of the nature of the watershed. **Figure 2-3** is the C graph to be used for urbanized (developed) watersheds. Select the appropriate curve in **Figure 2-3** based on an estimate of the percent of effective impervious area in the watershed. Effective impervious area is that area that will drain directly to the outlet without flowing over pervious area. (Refer to Chapter 3 - Rainfall Losses, 3.1.1 and Table 3-3, for discussion of effective impervious areas.) **Figure 2-4** through **Figure 2-8** are to be used for undeveloped (natural) watersheds in Arizona, and the C graphs are shown as functions of Hydrologic Soil Group (HSG) and percent vegetation cover. The Hydrologic Soil Group is used to classify soil according to its infiltration rate. The Hydrologic Soil Groups, as defined by USDA, Soil Conservation Service (SCS), 1972 are:

HSG	Definition
A	Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands and gravels. These soils have a high rate of water transmission.
B	Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

HSG	Definition
C	Soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.
D	Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

The percent vegetation cover is the percent of land surface that is covered by vegetation. Vegetation cover is evaluated on plant basal area for grasses and forbs, and on canopy cover for trees and shrubs (see Appendix C).

Information on Hydrologic Soil Group and percent vegetation cover can usually be obtained from the detailed soil surveys that are prepared by the SCS. When detailed soil surveys are not available for the watershed, then the general soil maps and accompanying reports by the SCS for each county in Arizona are to be used. A site visit is encouraged to confirm watershed and soil conditions.

It may be required to select the appropriate C value for existing conditions and another C value for anticipated future conditions, if the watershed is undergoing development. Estimation of peak discharges for various conditions of development in the drainage area or for different periods will also require separate estimates of T_C for each existing or assumed land-use condition and for each flood return period.

FIGURE 2-3
RATIONAL "C" COEFFICIENT
DEVELOPED WATERSHEDS

AS A FUNCTION OF RAINFALL DEPTH AND TYPE OF DEVELOPMENT

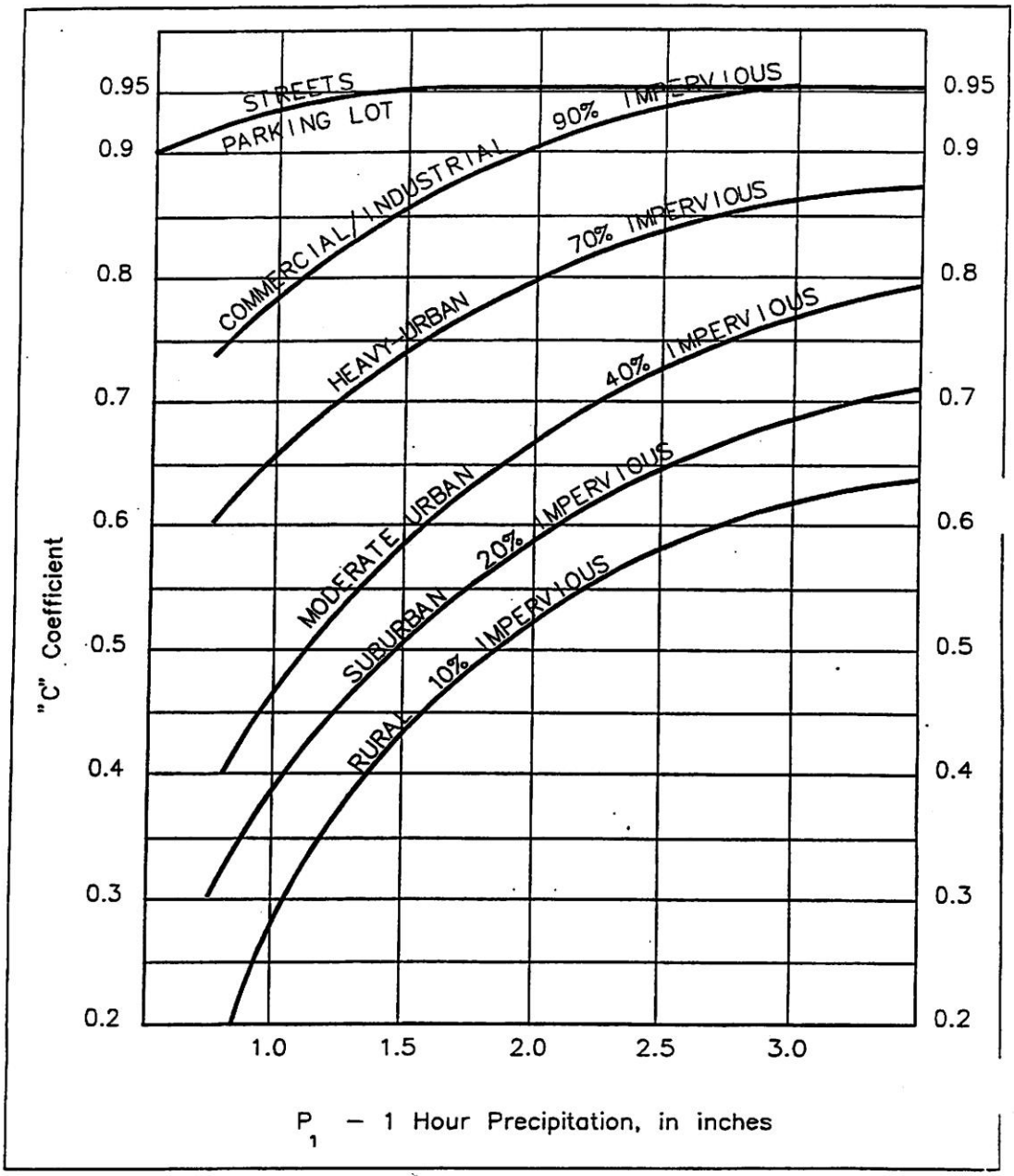
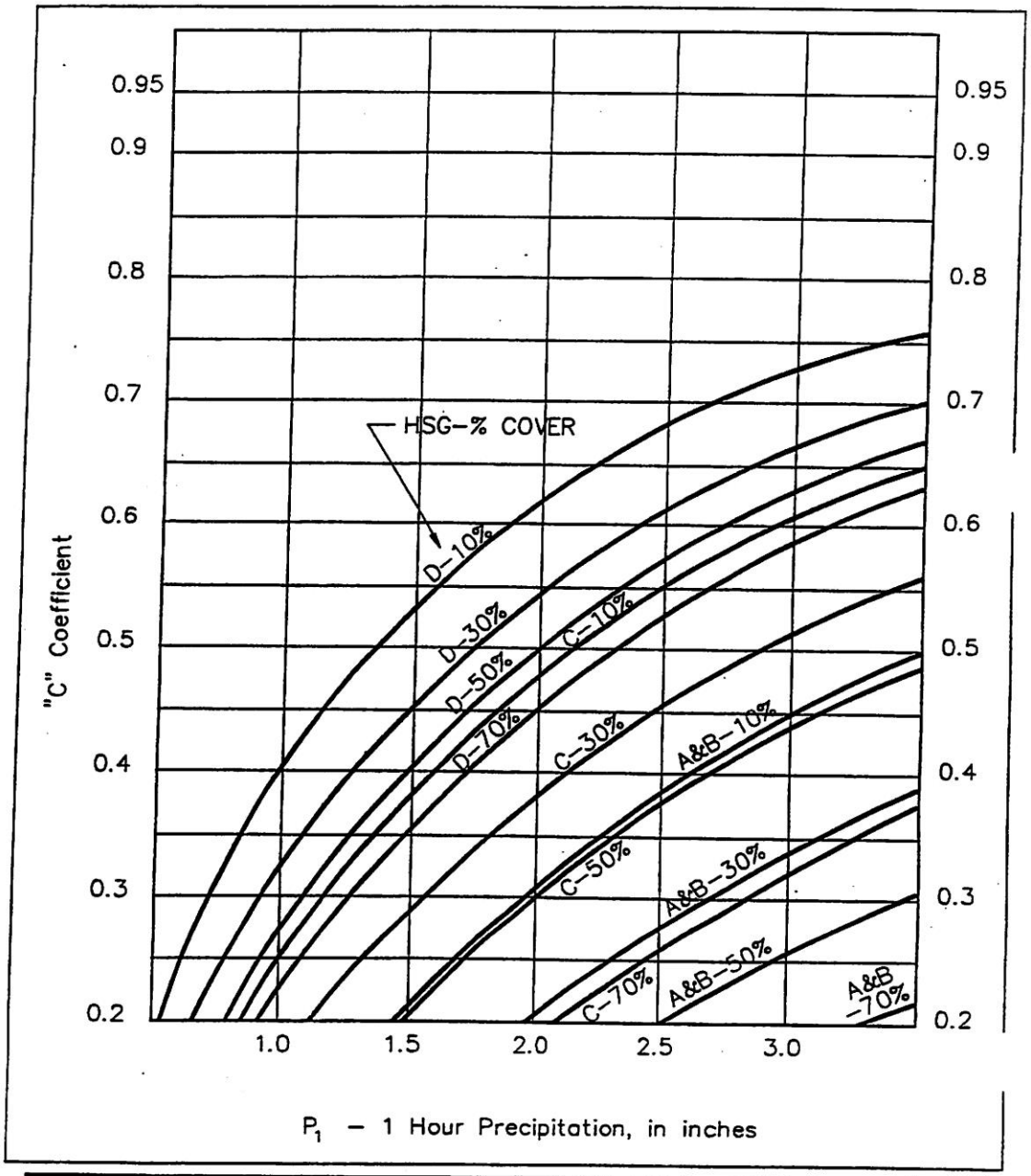


FIGURE 2-5
RATIONAL "C" COEFFICIENT
UPLAND RANGELAND
(GRASS & BRUSH)

AS A FUNCTION OF RAINFALL DEPTH, HYDROLOGIC SOIL GROUP (HSG),
AND % OF VEGETATION COVER



PROJECT NAME:	Heyer Brewer Development	DATE:	7/19/2005
LOCATION: Sedona, AZ		ZONE:	8
Designer: TCH		Checker:	LAS

Reference: ADOT HIGHWAY DRAINAGE DESIGN MANUAL HYDROLOGY (March, 1993 SI)

RAINFALL DEPTH-DURATION-FREQUENCY (D-D-F)

Determine rainfall depths from the isopluvial maps (Appendix B)

2yr, 6hr	$P_{2,6'}$	1.28	100yr, 6hr	$P_{100,6'}$	2.91
2yr, 24hr	$P_{2,24'}$	2.10	100yr,24hr	$P_{100,24'}$	4.53

2yr, 1hr	$P_{2,1'}$	0.724	100yr, 1hr	$P_{100,1'}$	1.905
2yr, 2hr	$P_{2,2'}$	0.914	100yr, 2hr	$P_{100,2'}$	2.248
2yr, 3hr	$P_{2,3'}$	1.040	100yr, 3hr	$P_{100,3'}$	2.477
2yr, 12hr	$P_{2,12'}$	1.690	100yr, 12hr	$P_{100,12'}$	3.720

Determine the short-duration rainfall ratios (TABLE 1-1)

Duration	Ratio	
(Minutes)	2-Year	100-Year
5	A = 0.34	E= 0.3
10	B= 0.51	F= 0.46
15	C= 0.62	G= 0.59
30	D= 0.82	H= 0.8

Frequency		
(T-yr)	X	Y
5 year	0.674	0.278
10year	0.496	0.449
25 year	0.293	0.669
50 year	0.146	0.835
500 year	-0.337	1.381

2yr, 5min	$P_{2,5'}$	0.2461	100yr, 5min	$P_{100,5'}$	0.5716
2yr,10min	$P_{2,10'}$	0.3692	100yr, 10min	$P_{100,10'}$	0.8765
2yr, 15min	$P_{2,15'}$	0.4488	100yr, 15min	$P_{100,15'}$	1.1242
2yr, 30min	$P_{2,30'}$	0.5936	100yr, 30min	$P_{100,30'}$	1.5243

Interpolation of short-duration rainfall ratios (Table 1-1)

Duration	Ratio	
(min)	2-Year	100-Year
20	0.69	0.66
40	0.95	0.94

2yr, 20min	$P_{2,20'}$	0.497	100yr, 20min	$P_{100,20'}$	1.258
2yr, 40min	$P_{2,40'}$	0.690	100yr, 40min	$P_{100,40'}$	1.791

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RAINFALL DEPTH-DURATION-FREQUENCY (D-D-F

FREQUENCY:	2yr						
5 min	0.2461		1 hour	0.724		6 hour	1.28
10 min	0.3692		2 hour	0.914		12 hour	1.690
15 min	0.4488		3 hour	1.040		24 hour	2.10
30 min	0.5936		20 min	0.497		40 min	0.690

FREQUENCY:	5yr						
5 min	0.3248		1 hour	1.0176		6 hour	1.6717
10 min	0.4925		2 hour	1.2407		12 hour	2.1732
15 min	0.6150		3 hour	1.3898		24 hour	2.6747
30 min	0.8239		20 min	0.685		40 min	0.963

FREQUENCY:	10yr						
5 min	0.379		1 hour	1.2146		6 hour	1.9415
10 min	0.577		2 hour	1.4624		12 hour	2.5085
15 min	0.727		3 hour	1.6282		24 hour	3.0756
30 min	0.979		20 min	0.811		40 min	1.146

FREQUENCY:	25yr						
5 min	0.4545		1 hour	1.4868		6 hour	2.3218
10 min	0.6945		2 hour	1.7715		12 hour	2.9839
15 min	0.8836		3 hour	1.9619		24 hour	3.6459
30 min	1.1937		20 min	0.987		40 min	1.400

FREQUENCY:	50yr						
5 min	0.5132		1 hour	1.6967		6 hour	2.6167
10 min	0.7857		2 hour	2.0104		12 hour	3.3529
15 min	1.0042		3 hour	2.2202		24 hour	4.0892
30 min	1.3594		20 min	1.123		40 min	1.596

FREQUENCY:	100yr						
5 min	0.5716		1 hour	1.9054		6 hour	2.9100
10 min	0.8765		2 hour	2.2479		12 hour	3.7200
15 min	1.1242		3 hour	2.4770		24 hour	4.5300
30 min	1.5243		20 min	1.258		40 min	1.791

FREQUENCY:	500yr						
5 min	0.7064		1 hour	2.3873		6 hour	3.5874
10 min	1.0860		2 hour	2.7965		12 hour	4.5678
15 min	1.4012		3 hour	3.0701		24 hour	5.5482
30 min	1.9050		20 min	1.569		40 min	2.241

PROJECT NAME:	Heyer Brewer Development	DATE:	7/19/2005
LOCATION: Sedona, AZ		ZONE:	8
Designer:	TCH	Checker:	LAS

Reference: ADOT HIGHWAY DRAINAGE DESIGN MANUAL HYDROLOGY (March, 1993 SI)

RAINFALL DEPTH-DURATION-FREQUENCY (D-D-F)

Rainfall Depth, in Inches							
	Frequency, in Years						
Duration	2	5	10	25	50	100	500
5-min	0.25	0.32	0.38	0.45	0.51	0.57	0.71
10-min	0.37	0.49	0.58	0.69	0.79	0.88	1.09
15-min	0.45	0.62	0.73	0.88	1.00	1.12	1.40
20-min	0.50	0.68	0.81	0.99	1.12	1.26	1.57
30-min	0.59	0.82	0.98	1.19	1.36	1.52	1.90
40-min	0.69	0.96	1.15	1.40	1.60	1.79	2.23
1-hour	0.72	1.02	1.21	1.49	1.70	1.91	2.39
2-hour	0.91	1.24	1.46	1.77	2.01	2.25	2.80
3-hour	1.04	1.39	1.63	1.96	2.22	2.48	3.07
6-hour	1.28	1.67	1.94	2.32	2.62	2.91	3.59
12-hour	1.69	2.17	2.51	2.98	3.35	3.72	4.57
24-hour	2.10	2.67	3.08	3.65	4.09	4.53	5.55

Rainfall Intensity, in Inches/Hour							
	Frequency, in Years						
Duration	2yr	5yr	10yr	25yr	50yr	100yr	500yr
5-min	2.95	3.90	4.54	5.45	6.16	6.86	8.58
10-min	2.22	2.96	3.46	4.17	4.71	5.26	6.52
15-min	1.80	2.46	2.91	3.53	4.02	4.50	5.60
20-min	1.49	2.05	2.43	2.96	3.37	3.77	4.71
30-min	1.19	1.65	1.96	2.39	2.72	3.05	3.81
40-min	1.04	1.44	1.72	2.10	2.39	2.69	3.36
1-hour	0.72	1.02	1.21	1.49	1.70	1.91	2.39
2-hour	0.46	0.62	0.73	0.89	1.01	1.12	1.40
3-hour	0.35	0.46	0.54	0.65	0.74	0.83	1.02
6-hour	0.21	0.28	0.32	0.39	0.44	0.49	0.60
12-hour	0.14	0.18	0.21	0.25	0.28	0.31	0.38
24-hour	0.09	0.11	0.13	0.15	0.17	0.19	0.23

PRE-DEVELOPMENT

Basin Designation	Area			Length		Elev Delta	Slope	
	sq ft	acres	sq mi	ft	mi	ft	ft/ft	ft/mi
1A	896549.00	20.58	0.032159	2217.60	0.42	600.00	0.271	1428.57
2A	47927.00	1.10	0.001719	264.00	0.05	60.00	0.227	1200.00
3A	20426.00	0.47	0.000733	158.4	0.03	25.00	0.158	833.33
4A	109756.00	2.52	0.003937	369.6	0.07	65.00	0.176	928.57
5A	58327.00	1.34	0.002092	211.2	0.04	17.00	0.080	425.00
6A	71943.00	1.65	0.002581	476	0.09	75.00	0.158	831.93

Basin Designation	Area	Channel Length	Elevation Delta	Slope
	(mi^2)	(mi)	(ft)	(ft/mi)
1A	0.0322	0.42	600	1429
2A	0.0017	0.05	60	1200
3A	0.0007	0.03	25	833
4A	0.0039	0.07	65	929
5A	0.0021	0.04	17	425
6A	0.0026	0.09	75	832

Basin Designation	Time of Concentration
	(hrs)
1A	0.17
2A	0.17
3A	0.17
4A	0.17
5A	0.17
6A	0.17

EXHIBIT D

PRE-DEVELOPMENT DRAINAGE PLANS

EXHIBIT E

POST-DEVELOPMENT DRAINAGE PLANS

EXHIBIT F

HYDRAFLOW DATA & RESULTS

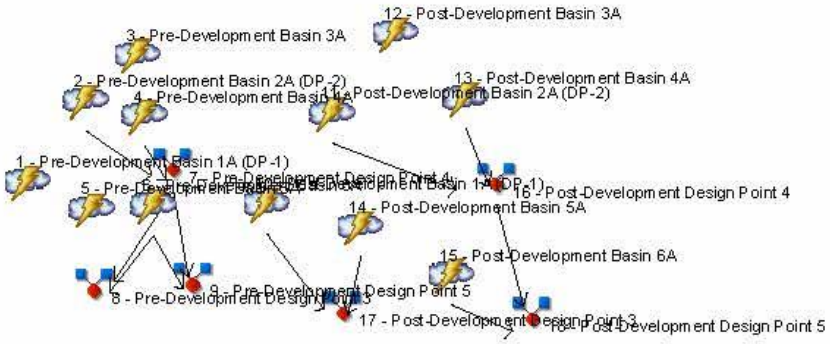
Hydraflow Table of Contents

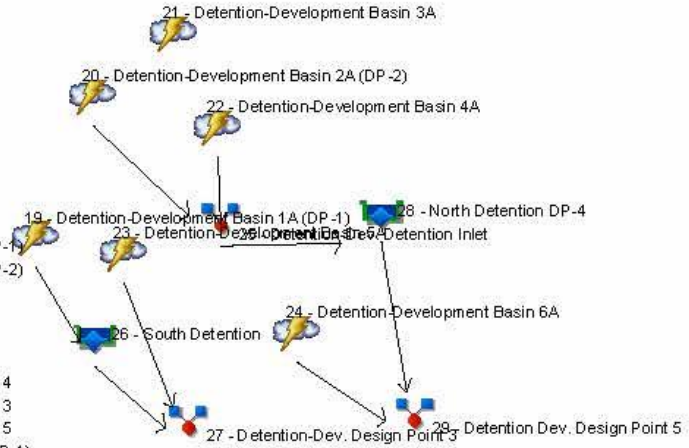
Canyon Vista Development.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 — Tuesday, 09 / 7 / 2021

Watershed Model Schematic

HydraflowHydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020





Legend

Hyd.	Origin	Description
1	Rational	Pre-Development Basin 1A (DP-1)
2	Rational	Pre-Development Basin 2A (DP-2)
3	Rational	Pre-Development Basin 3A
4	Rational	Pre-Development Basin 4A
5	Rational	Pre-Development Basin 5A
6	Rational	Pre-Development Basin 6A
7	Combine	Pre-Development Design Point 4
8	Combine	Pre-Development Design Point 3
9	Combine	Pre-Development Design Point 5
10	Rational	Post-Development Basin 1A (DP-1)
11	Rational	Post-Development Basin 2A (DP-2)
12	Rational	Post-Development Basin 3A
13	Rational	Post-Development Basin 4A
14	Rational	Post-Development Basin 5A
15	Rational	Post-Development Basin 6A
16	Combine	Post-Development Design Point 4
17	Combine	Post-Development Design Point 3
18	Combine	Post-Development Design Point 5
19	Rational	Detention-Development Basin 1A (DP-1)
20	Rational	Detention-Development Basin 2A (DP-2)
21	Rational	Detention-Development Basin 3A
22	Rational	Detention-Development Basin 4A
23	Rational	Detention-Development Basin 5A
24	Rational	Detention-Development Basin 6A
25	Combine	Detention-Dev. Detention Inlet
26	Reservoir	South Detention
27	Combine	Detention-Dev. Design Point 3
28	Reservoir	North Detention DP-4
29	Combine	Detention Dev. Design Point 5

Project: Canyon Vista Development.gpw	Tuesday, 09 / 7 / 2021

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	------	-------	21.85	-------	29.52	34.57	41.89	47.47	53.10	Pre-Development Basin 1A (DP-1)
2	Rational	------	-------	1.167	-------	1.576	1.846	2.237	2.535	2.835	Pre-Development Basin 2A (DP-2)
3	Rational	------	-------	0.498	-------	0.673	0.789	0.956	1.083	1.212	Pre-Development Basin 3A
4	Rational	------	-------	2.672	-------	3.611	4.229	5.125	5.807	6.496	Pre-Development Basin 4A
5	Rational	------	-------	1.421	-------	1.920	2.249	2.725	3.088	3.454	Pre-Development Basin 5A
6	Rational	------	-------	2.411	-------	3.257	3.815	4.623	5.238	5.860	Pre-Development Basin 6A
7	Combine	2, 4,	-------	3.839	-------	5.187	6.075	7.362	8.341	9.331	Pre-Development Design Point 4
8	Combine	6, 7	-------	6.250	-------	8.444	9.889	11.99	13.58	15.19	Pre-Development Design Point 3
9	Combine	6, 7,	-------	6.250	-------	8.444	9.889	11.99	13.58	15.19	Pre-Development Design Point 5
10	Rational	------	-------	21.85	-------	29.52	34.57	41.89	47.47	53.10	Post-Development Basin 1A (DP-1)
11	Rational	------	-------	1.167	-------	1.576	1.846	2.237	2.535	2.835	Post-Development Basin 2A (DP-2)
12	Rational	------	-------	0.775	-------	1.048	1.227	1.487	1.685	1.885	Post-Development Basin 3A
13	Rational	------	-------	4.157	-------	5.617	6.578	7.972	9.033	10.10	Post-Development Basin 4A
14	Rational	------	-------	2.211	-------	2.987	3.498	4.239	4.803	5.373	Post-Development Basin 5A
15	Rational	------	-------	2.722	-------	3.678	4.307	5.220	5.914	6.616	Post-Development Basin 6A
16	Combine	11, 13,	-------	5.324	-------	7.193	8.424	10.21	11.57	12.94	Post-Development Design Point 4
17	Combine	10, 14,	-------	24.06	-------	32.50	38.07	46.13	52.27	58.47	Post-Development Design Point 3
18	Combine	15, 16,	-------	8.046	-------	10.87	12.73	15.43	17.48	19.56	Post-Development Design Point 5
19	Rational	------	-------	21.85	-------	29.52	34.57	41.89	47.47	53.10	Detention-Development Basin 1A (DP
20	Rational	------	-------	1.167	-------	1.576	1.846	2.237	2.535	2.835	Detention-Development Basin 2A (DP
21	Rational	------	-------	0.775	-------	1.048	1.227	1.487	1.685	1.885	Detention-Development Basin 3A
22	Rational	------	-------	4.157	-------	5.617	6.578	7.972	9.033	10.10	Detention-Development Basin 4A
23	Rational	------	-------	2.211	-------	2.987	3.498	4.239	4.803	5.373	Detention-Development Basin 5A
24	Rational	------	-------	2.722	-------	3.678	4.307	5.220	5.914	6.616	Detention-Development Basin 6A
25	Combine	20, 22,	-------	5.324	-------	7.193	8.424	10.21	11.57	12.94	Detention-Dev. Detention Inlet
26	Reservoir	19	-------	18.60	-------	25.22	29.19	34.09	37.74	41.32	South Detention
27	Combine	23, 26	-------	20.59	-------	27.91	32.27	37.48	41.58	45.62	Detention-Dev. Design Point 3
28	Reservoir	25	-------	3.533	-------	4.389	4.841	5.406	5.824	6.175	North Detention DP-4
29	Combine	24, 28	-------	5.840	-------	7.450	8.482	9.915	10.90	11.88	Detention Dev. Design Point 5

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	21.85	1	10	13,108	------	------	------	Pre-Development Basin 1A (DP-1)
2	Rational	1.167	1	10	700	------	------	------	Pre-Development Basin 2A (DP-2)
3	Rational	0.498	1	10	299	------	------	------	Pre-Development Basin 3A
4	Rational	2.672	1	10	1,603	------	------	------	Pre-Development Basin 4A
5	Rational	1.421	1	10	853	------	------	------	Pre-Development Basin 5A
6	Rational	2.411	1	10	1,447	------	------	------	Pre-Development Basin 6A
7	Combine	3.839	1	10	2,303	2, 4,	------	------	Pre-Development Design Point 4
8	Combine	6.250	1	10	3,750	6, 7	------	------	Pre-Development Design Point 3
9	Combine	6.250	1	10	3,750	6, 7,	------	------	Pre-Development Design Point 5
10	Rational	21.85	1	10	13,108	------	------	------	Post-Development Basin 1A (DP-1)
11	Rational	1.167	1	10	700	------	------	------	Post-Development Basin 2A (DP-2)
12	Rational	0.775	1	10	465	------	------	------	Post-Development Basin 3A
13	Rational	4.157	1	10	2,494	------	------	------	Post-Development Basin 4A
14	Rational	2.211	1	10	1,326	------	------	------	Post-Development Basin 5A
15	Rational	2.722	1	10	1,633	------	------	------	Post-Development Basin 6A
16	Combine	5.324	1	10	3,194	11, 13,	------	------	Post-Development Design Point 4
17	Combine	24.06	1	10	14,434	10, 14,	------	------	Post-Development Design Point 3
18	Combine	8.046	1	10	4,827	15, 16,	------	------	Post-Development Design Point 5
19	Rational	21.85	1	10	13,108	------	------	------	Detention-Development Basin 1A (DP
20	Rational	1.167	1	10	700	------	------	------	Detention-Development Basin 2A (DP
21	Rational	0.775	1	10	465	------	------	------	Detention-Development Basin 3A
22	Rational	4.157	1	10	2,494	------	------	------	Detention-Development Basin 4A
23	Rational	2.211	1	10	1,326	------	------	------	Detention-Development Basin 5A
24	Rational	2.722	1	10	1,633	------	------	------	Detention-Development Basin 6A
25	Combine	5.324	1	10	3,194	20, 22,	------	------	Detention-Dev. Detention Inlet
26	Reservoir	18.60	1	11	13,106	19	4262.38	3,090	South Detention
27	Combine	20.59	1	11	14,432	23, 26	------	------	Detention-Dev. Design Point 3
28	Reservoir	3.533	1	13	3,193	25	4250.37	1,090	North Detention DP-4
29	Combine	5.840	1	10	4,826	24, 28	------	------	Detention Dev. Design Point 5

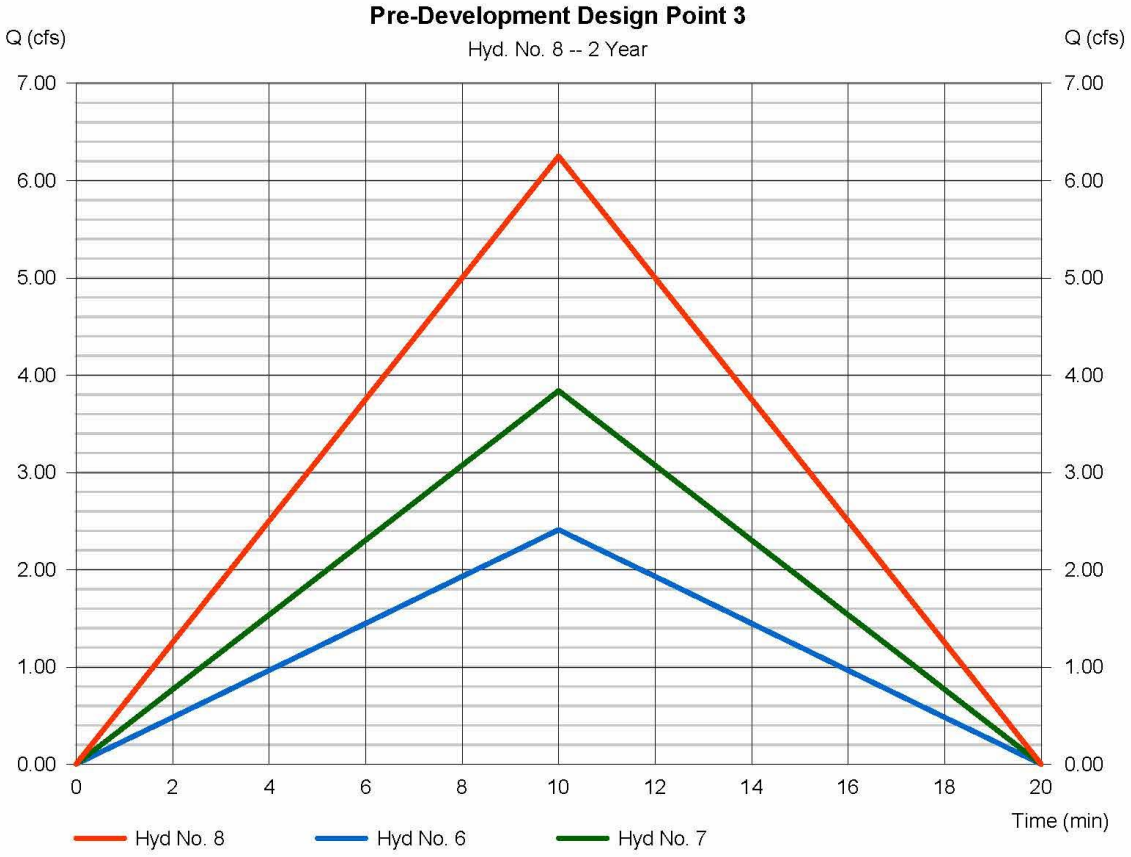
Canyon Vista Development.gpw | Return Period: 2 Year | Tuesday, 09 / 7 / 2021

Hydrograph Report

Hyd. No. 8

Pre-Development Design Point 3

Hydrograph type	= Combine	Peak discharge	= 6.250 cfs
Storm frequency	= 2 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 3,750 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.650 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	29.52	1	10	17,710	------	------	------	Pre-Development Basin 1A (DP-1)
2	Rational	1.576	1	10	946	------	------	------	Pre-Development Basin 2A (DP-2)
3	Rational	0.673	1	10	404	------	------	------	Pre-Development Basin 3A
4	Rational	3.611	1	10	2,166	------	------	------	Pre-Development Basin 4A
5	Rational	1.920	1	10	1,152	------	------	------	Pre-Development Basin 5A
6	Rational	3.257	1	10	1,954	------	------	------	Pre-Development Basin 6A
7	Combine	5.187	1	10	3,112	2, 4,	------	------	Pre-Development Design Point 4
8	Combine	8.444	1	10	5,067	6, 7	------	------	Pre-Development Design Point 3
9	Combine	8.444	1	10	5,067	6, 7,	------	------	Pre-Development Design Point 5
10	Rational	29.52	1	10	17,710	------	------	------	Post-Development Basin 1A (DP-1)
11	Rational	1.576	1	10	946	------	------	------	Post-Development Basin 2A (DP-2)
12	Rational	1.048	1	10	629	------	------	------	Post-Development Basin 3A
13	Rational	5.617	1	10	3,370	------	------	------	Post-Development Basin 4A
14	Rational	2.987	1	10	1,792	------	------	------	Post-Development Basin 5A
15	Rational	3.678	1	10	2,207	------	------	------	Post-Development Basin 6A
16	Combine	7.193	1	10	4,316	11, 13,	------	------	Post-Development Design Point 4
17	Combine	32.50	1	10	19,502	10, 14,	------	------	Post-Development Design Point 3
18	Combine	10.87	1	10	6,522	15, 16,	------	------	Post-Development Design Point 5
19	Rational	29.52	1	10	17,710	------	------	------	Detention-Development Basin 1A (DP
20	Rational	1.576	1	10	946	------	------	------	Detention-Development Basin 2A (DP
21	Rational	1.048	1	10	629	------	------	------	Detention-Development Basin 3A
22	Rational	5.617	1	10	3,370	------	------	------	Detention-Development Basin 4A
23	Rational	2.987	1	10	1,792	------	------	------	Detention-Development Basin 5A
24	Rational	3.678	1	10	2,207	------	------	------	Detention-Development Basin 6A
25	Combine	7.193	1	10	4,316	20, 22,	------	------	Detention-Dev. Detention Inlet
26	Reservoir	25.22	1	11	17,709	19	4262.70	3,890	South Detention
27	Combine	27.91	1	11	19,501	23, 26	------	------	Detention-Dev. Design Point 3
28	Reservoir	4.389	1	14	4,314	25	4250.85	1,594	North Detention DP-4
29	Combine	7.450	1	10	6,521	24, 28	------	------	Detention Dev. Design Point 5

Canyon Vista Development.gpw	Return Period: 5 Year	Tuesday, 09 / 7 / 2021

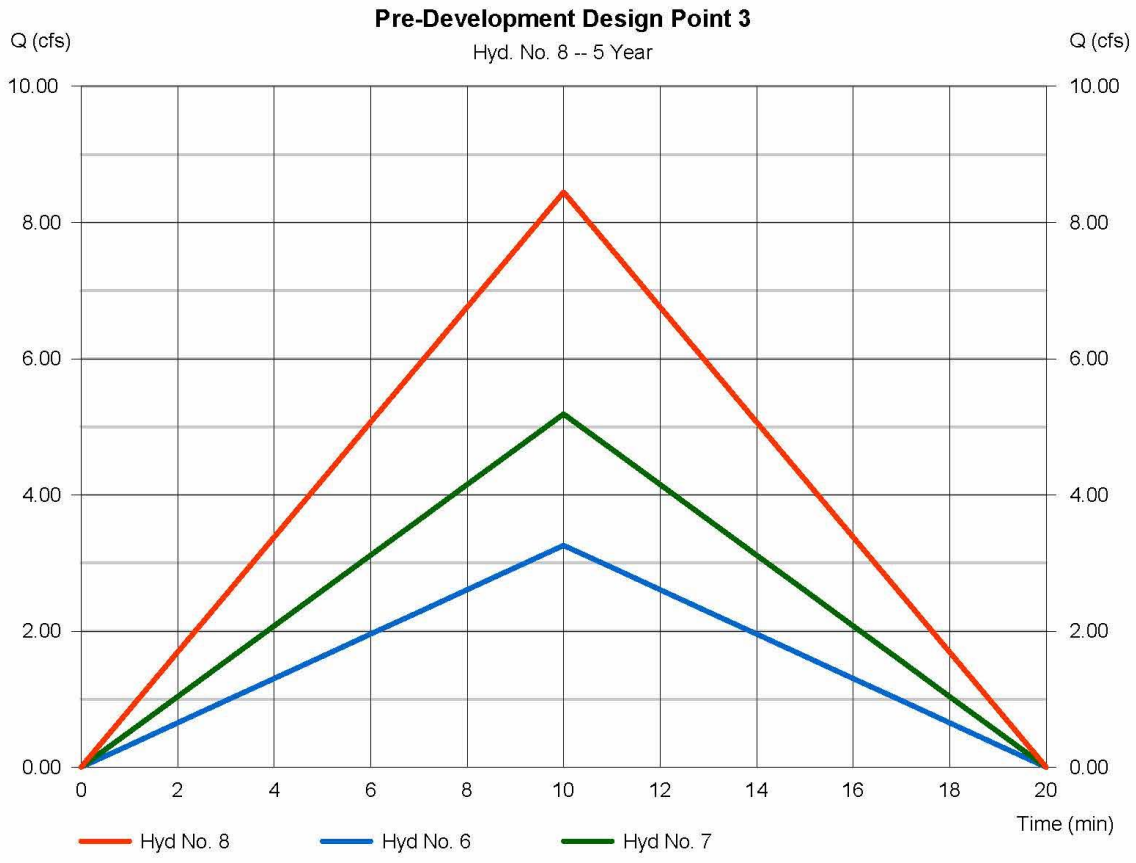
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 09 / 7 / 2021

Hyd. No. 8

Pre-Development Design Point 3

Hydrograph type	= Combine	Peak discharge	= 8.444 cfs
Storm frequency	= 5 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 5,067 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.650 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	34.57	1	10	20,741	------	------	------	Pre-Development Basin 1A (DP-1)
2	Rational	1.846	1	10	1,108	------	------	------	Pre-Development Basin 2A (DP-2)
3	Rational	0.789	1	10	473	------	------	------	Pre-Development Basin 3A
4	Rational	4.229	1	10	2,537	------	------	------	Pre-Development Basin 4A
5	Rational	2.249	1	10	1,349	------	------	------	Pre-Development Basin 5A
6	Rational	3.815	1	10	2,289	------	------	------	Pre-Development Basin 6A
7	Combine	6.075	1	10	3,645	2, 4,	------	------	Pre-Development Design Point 4
8	Combine	9.889	1	10	5,934	6, 7	------	------	Pre-Development Design Point 3
9	Combine	9.889	1	10	5,934	6, 7,	------	------	Pre-Development Design Point 5
10	Rational	34.57	1	10	20,741	------	------	------	Post-Development Basin 1A (DP-1)
11	Rational	1.846	1	10	1,108	------	------	------	Post-Development Basin 2A (DP-2)
12	Rational	1.227	1	10	736	------	------	------	Post-Development Basin 3A
13	Rational	6.578	1	10	3,947	------	------	------	Post-Development Basin 4A
14	Rational	3.498	1	10	2,099	------	------	------	Post-Development Basin 5A
15	Rational	4.307	1	10	2,584	------	------	------	Post-Development Basin 6A
16	Combine	8.424	1	10	5,054	11, 13,	------	------	Post-Development Design Point 4
17	Combine	38.07	1	10	22,840	10, 14,	------	------	Post-Development Design Point 3
18	Combine	12.73	1	10	7,639	15, 16,	------	------	Post-Development Design Point 5
19	Rational	34.57	1	10	20,741	------	------	------	Detention-Development Basin 1A (DP
20	Rational	1.846	1	10	1,108	------	------	------	Detention-Development Basin 2A (DP
21	Rational	1.227	1	10	736	------	------	------	Detention-Development Basin 3A
22	Rational	6.578	1	10	3,947	------	------	------	Detention-Development Basin 4A
23	Rational	3.498	1	10	2,099	------	------	------	Detention-Development Basin 5A
24	Rational	4.307	1	10	2,584	------	------	------	Detention-Development Basin 6A
25	Combine	8.424	1	10	5,054	20, 22,	------	------	Detention-Dev. Detention Inlet
26	Reservoir	29.19	1	12	20,739	19	4262.92	4,456	South Detention
27	Combine	32.27	1	11	22,838	23, 26	------	------	Detention-Dev. Design Point 3
28	Reservoir	4.841	1	14	5,053	25	4251.14	1,963	North Detention DP-4
29	Combine	8.482	1	10	7,637	24, 28	------	------	Detention Dev. Design Point 5

Canyon Vista Development.gpw | Return Period: 10 Year | Tuesday, 09 / 7 / 2021

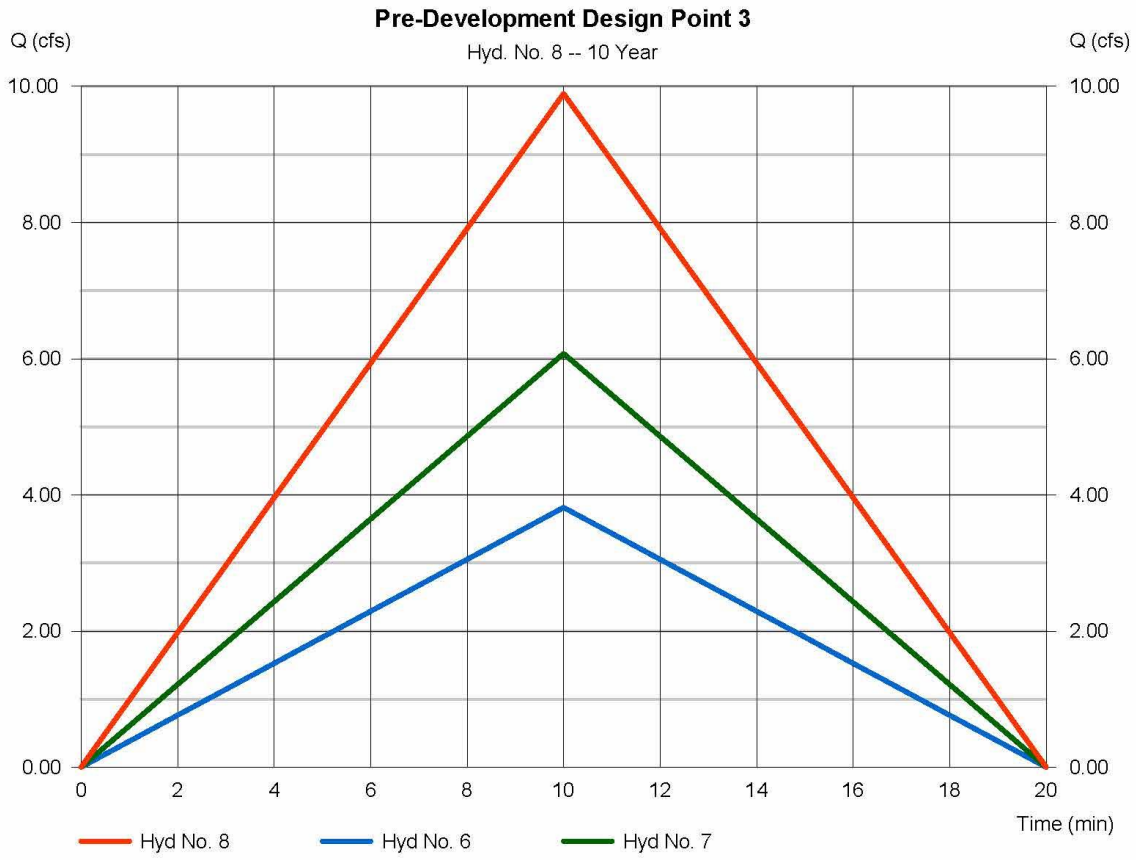
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 09 / 7 / 2021

Hyd. No. 8

Pre-Development Design Point 3

Hydrograph type	= Combine	Peak discharge	= 9.889 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 5,934 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.650 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	41.89	1	10	25,137	------	------	------	Pre-Development Basin 1A (DP-1)
2	Rational	2.237	1	10	1,342	------	------	------	Pre-Development Basin 2A (DP-2)
3	Rational	0.956	1	10	574	------	------	------	Pre-Development Basin 3A
4	Rational	5.125	1	10	3,075	------	------	------	Pre-Development Basin 4A
5	Rational	2.725	1	10	1,635	------	------	------	Pre-Development Basin 5A
6	Rational	4.623	1	10	2,774	------	------	------	Pre-Development Basin 6A
7	Combine	7.362	1	10	4,417	2, 4,	------	------	Pre-Development Design Point 4
8	Combine	11.99	1	10	7,191	6, 7	------	------	Pre-Development Design Point 3
9	Combine	11.99	1	10	7,191	6, 7,	------	------	Pre-Development Design Point 5
10	Rational	41.89	1	10	25,137	------	------	------	Post-Development Basin 1A (DP-1)
11	Rational	2.237	1	10	1,342	------	------	------	Post-Development Basin 2A (DP-2)
12	Rational	1.487	1	10	892	------	------	------	Post-Development Basin 3A
13	Rational	7.972	1	10	4,783	------	------	------	Post-Development Basin 4A
14	Rational	4.239	1	10	2,544	------	------	------	Post-Development Basin 5A
15	Rational	5.220	1	10	3,132	------	------	------	Post-Development Basin 6A
16	Combine	10.21	1	10	6,126	11, 13,	------	------	Post-Development Design Point 4
17	Combine	46.13	1	10	27,680	10, 14,	------	------	Post-Development Design Point 3
18	Combine	15.43	1	10	9,258	15, 16,	------	------	Post-Development Design Point 5
19	Rational	41.89	1	10	25,137	------	------	------	Detention-Development Basin 1A (DP
20	Rational	2.237	1	10	1,342	------	------	------	Detention-Development Basin 2A (DP
21	Rational	1.487	1	10	892	------	------	------	Detention-Development Basin 3A
22	Rational	7.972	1	10	4,783	------	------	------	Detention-Development Basin 4A
23	Rational	4.239	1	10	2,544	------	------	------	Detention-Development Basin 5A
24	Rational	5.220	1	10	3,132	------	------	------	Detention-Development Basin 6A
25	Combine	10.21	1	10	6,126	20, 22,	------	------	Detention-Dev. Detention Inlet
26	Reservoir	34.09	1	12	25,135	19	4263.27	5,484	South Detention
27	Combine	37.48	1	12	27,679	23, 26	------	------	Detention-Dev. Design Point 3
28	Reservoir	5.406	1	15	6,124	25	4251.54	2,560	North Detention DP-4
29	Combine	9.915	1	10	9,256	24, 28	------	------	Detention Dev. Design Point 5

Canyon Vista Development.gpw	Return Period: 25 Year	Tuesday, 09 / 7 / 2021

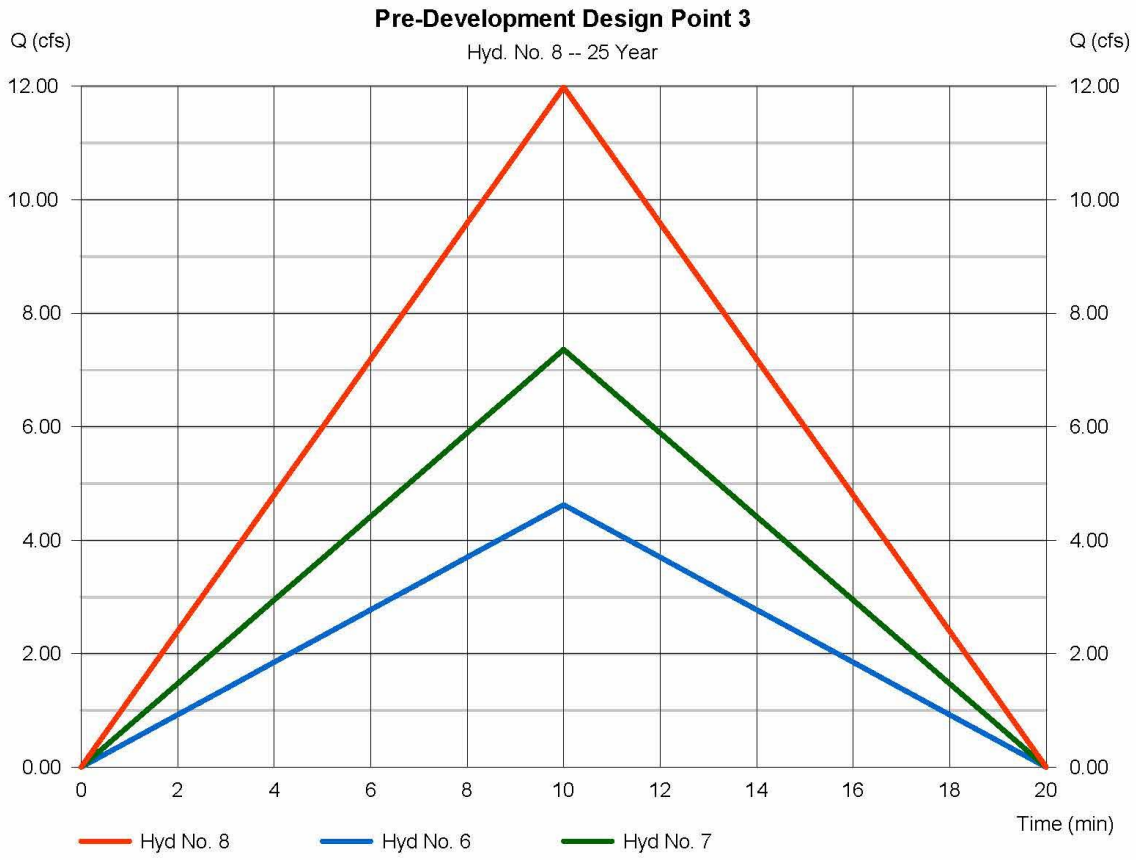
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 09 / 7 / 2021

Hyd. No. 8

Pre-Development Design Point 3

Hydrograph type	= Combine	Peak discharge	= 11.99 cfs
Storm frequency	= 25 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 7,191 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.650 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	47.47	1	10	28,480	------	------	------	Pre-Development Basin 1A (DP-1)
2	Rational	2.535	1	10	1,521	------	------	------	Pre-Development Basin 2A (DP-2)
3	Rational	1.083	1	10	650	------	------	------	Pre-Development Basin 3A
4	Rational	5.807	1	10	3,484	------	------	------	Pre-Development Basin 4A
5	Rational	3.088	1	10	1,853	------	------	------	Pre-Development Basin 5A
6	Rational	5.238	1	10	3,143	------	------	------	Pre-Development Basin 6A
7	Combine	8.341	1	10	5,005	2, 4,	------	------	Pre-Development Design Point 4
8	Combine	13.58	1	10	8,148	6, 7	------	------	Pre-Development Design Point 3
9	Combine	13.58	1	10	8,148	6, 7,	------	------	Pre-Development Design Point 5
10	Rational	47.47	1	10	28,480	------	------	------	Post-Development Basin 1A (DP-1)
11	Rational	2.535	1	10	1,521	------	------	------	Post-Development Basin 2A (DP-2)
12	Rational	1.685	1	10	1,011	------	------	------	Post-Development Basin 3A
13	Rational	9.033	1	10	5,420	------	------	------	Post-Development Basin 4A
14	Rational	4.803	1	10	2,882	------	------	------	Post-Development Basin 5A
15	Rational	5.914	1	10	3,549	------	------	------	Post-Development Basin 6A
16	Combine	11.57	1	10	6,940	11, 13,	------	------	Post-Development Design Point 4
17	Combine	52.27	1	10	31,362	10, 14,	------	------	Post-Development Design Point 3
18	Combine	17.48	1	10	10,489	15, 16,	------	------	Post-Development Design Point 5
19	Rational	47.47	1	10	28,480	------	------	------	Detention-Development Basin 1A (DP
20	Rational	2.535	1	10	1,521	------	------	------	Detention-Development Basin 2A (DP
21	Rational	1.685	1	10	1,011	------	------	------	Detention-Development Basin 3A
22	Rational	9.033	1	10	5,420	------	------	------	Detention-Development Basin 4A
23	Rational	4.803	1	10	2,882	------	------	------	Detention-Development Basin 5A
24	Rational	5.914	1	10	3,549	------	------	------	Detention-Development Basin 6A
25	Combine	11.57	1	10	6,940	20, 22,	------	------	Detention-Dev. Detention Inlet
26	Reservoir	37.74	1	12	28,479	19	4263.56	6,352	South Detention
27	Combine	41.58	1	12	31,360	23, 26	------	------	Detention-Dev. Design Point 3
28	Reservoir	5.824	1	15	6,939	25	4251.87	3,044	North Detention DP-4
29	Combine	10.90	1	10	10,487	24, 28	------	------	Detention Dev. Design Point 5

Canyon Vista Development.gpw	Return Period: 50 Year	Tuesday, 09 / 7 / 2021

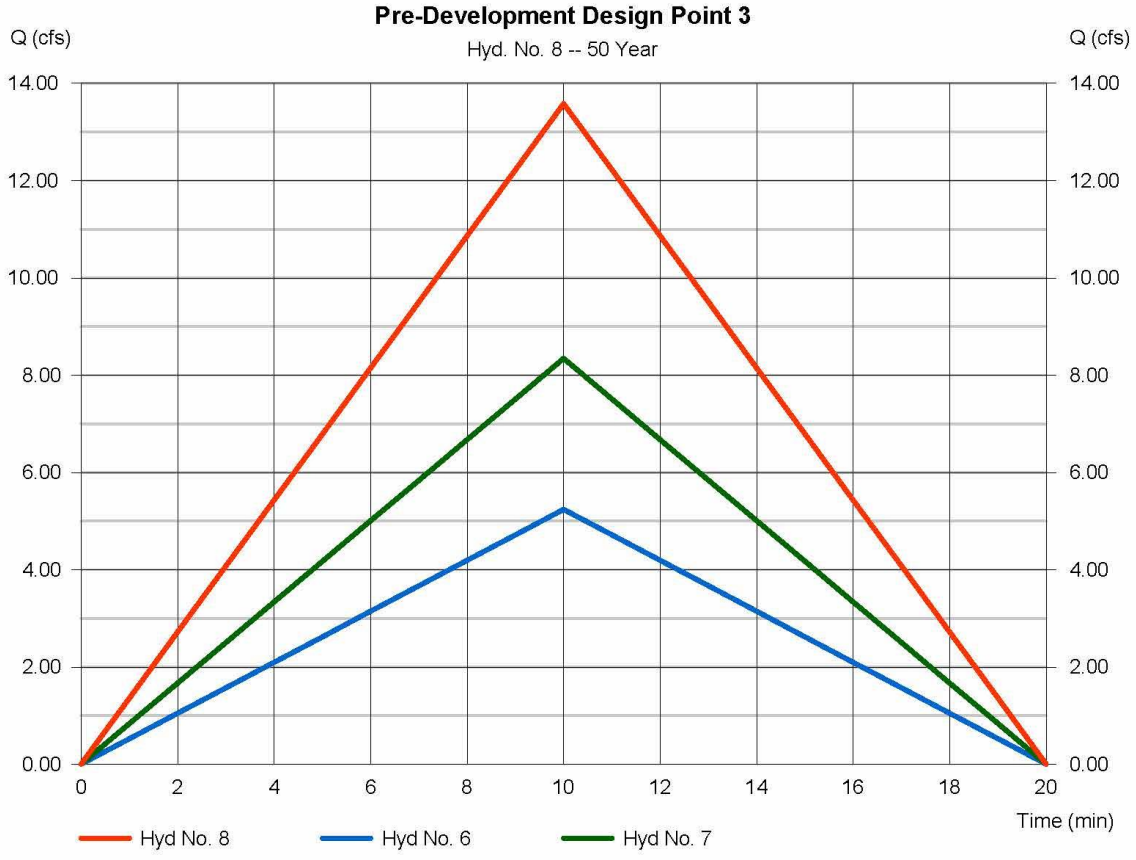
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 09 / 7 / 2021

Hyd. No. 8

Pre-Development Design Point 3

Hydrograph type	= Combine	Peak discharge	= 13.58 cfs
Storm frequency	= 50 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 8,148 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.650 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	53.10	1	10	31,860	------	------	------	Pre-Development Basin 1A (DP-1)
2	Rational	2.835	1	10	1,701	------	------	------	Pre-Development Basin 2A (DP-2)
3	Rational	1.212	1	10	727	------	------	------	Pre-Development Basin 3A
4	Rational	6.496	1	10	3,897	------	------	------	Pre-Development Basin 4A
5	Rational	3.454	1	10	2,072	------	------	------	Pre-Development Basin 5A
6	Rational	5.860	1	10	3,516	------	------	------	Pre-Development Basin 6A
7	Combine	9.331	1	10	5,599	2, 4,	------	------	Pre-Development Design Point 4
8	Combine	15.19	1	10	9,115	6, 7	------	------	Pre-Development Design Point 3
9	Combine	15.19	1	10	9,115	6, 7,	------	------	Pre-Development Design Point 5
10	Rational	53.10	1	10	31,860	------	------	------	Post-Development Basin 1A (DP-1)
11	Rational	2.835	1	10	1,701	------	------	------	Post-Development Basin 2A (DP-2)
12	Rational	1.885	1	10	1,131	------	------	------	Post-Development Basin 3A
13	Rational	10.10	1	10	6,063	------	------	------	Post-Development Basin 4A
14	Rational	5.373	1	10	3,224	------	------	------	Post-Development Basin 5A
15	Rational	6.616	1	10	3,970	------	------	------	Post-Development Basin 6A
16	Combine	12.94	1	10	7,764	11, 13,	------	------	Post-Development Design Point 4
17	Combine	58.47	1	10	35,084	10, 14,	------	------	Post-Development Design Point 3
18	Combine	19.56	1	10	11,734	15, 16,	------	------	Post-Development Design Point 5
19	Rational	53.10	1	10	31,860	------	------	------	Detention-Development Basin 1A (DP
20	Rational	2.835	1	10	1,701	------	------	------	Detention-Development Basin 2A (DP
21	Rational	1.885	1	10	1,131	------	------	------	Detention-Development Basin 3A
22	Rational	10.10	1	10	6,063	------	------	------	Detention-Development Basin 4A
23	Rational	5.373	1	10	3,224	------	------	------	Detention-Development Basin 5A
24	Rational	6.616	1	10	3,970	------	------	------	Detention-Development Basin 6A
25	Combine	12.94	1	10	7,764	20, 22,	------	------	Detention-Dev. Detention Inlet
26	Reservoir	41.32	1	12	31,859	19	4263.87	7,289	South Detention
27	Combine	45.62	1	12	35,083	23, 26	------	------	Detention-Dev. Design Point 3
28	Reservoir	6.175	1	15	7,762	25	4252.17	3,554	North Detention DP-4
29	Combine	11.88	1	10	11,732	24, 28	------	------	Detention Dev. Design Point 5

Canyon Vista Development.gpw	Return Period: 100 Year	Tuesday, 09 / 7 / 2021

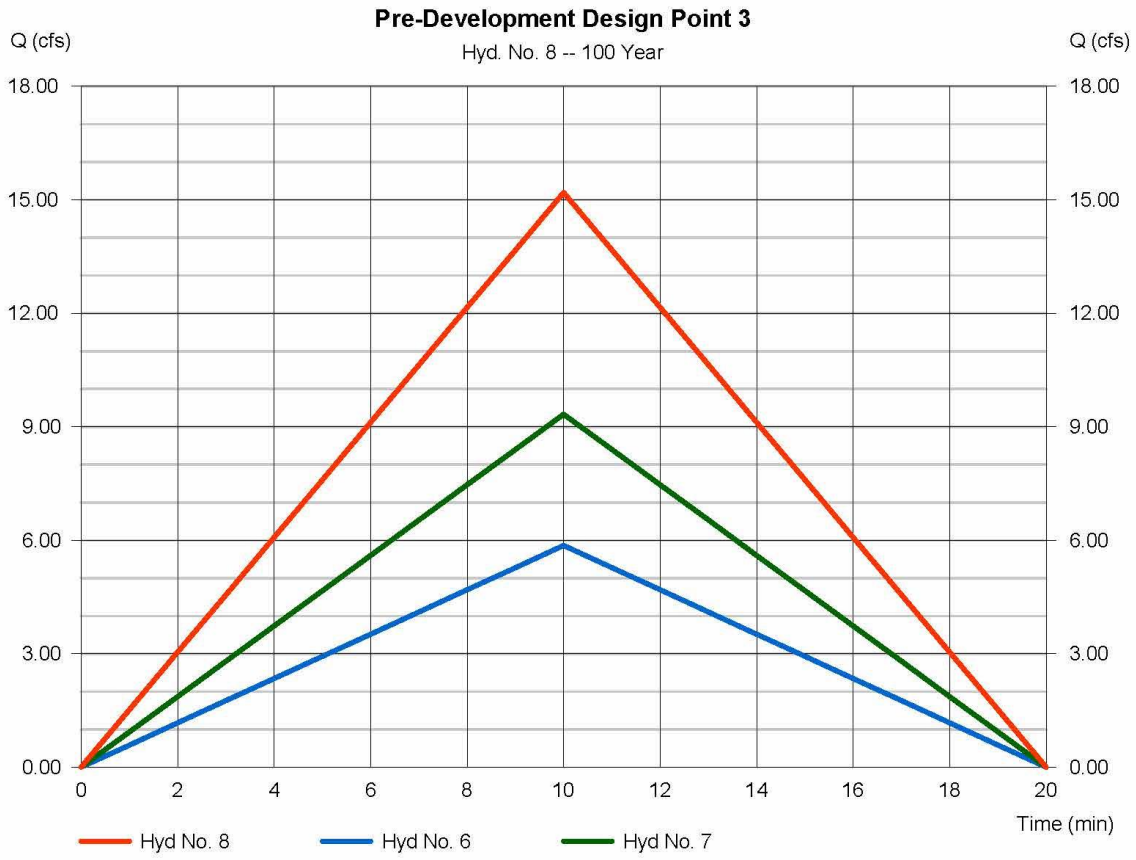
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 09 / 7 / 2021

Hyd. No. 8

Pre-Development Design Point 3

Hydrograph type	= Combine	Peak discharge	= 15.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 9,115 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.650 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	29.0017	8.4000	0.8619	--------
3	0.0000	0.0000	0.0000	--------
5	42.1984	9.8000	0.8655	--------
10	45.9193	9.6000	0.8438	--------
25	57.9492	10.2000	0.8488	--------
50	67.6756	10.6000	0.8533	--------
100	76.7260	10.8000	0.8550	--------

File name: Heyer Brewer.idf

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	3.10	2.36	1.92	1.62	1.41	1.25	1.12	1.02	0.94	0.87	0.81	0.76
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.10	3.18	2.62	2.24	1.95	1.74	1.57	1.43	1.32	1.22	1.14	1.07
10	4.78	3.73	3.08	2.63	2.31	2.06	1.86	1.70	1.57	1.46	1.36	1.28
25	5.75	4.52	3.75	3.21	2.82	2.52	2.28	2.09	1.93	1.79	1.67	1.57
50	6.49	5.12	4.25	3.65	3.21	2.87	2.60	2.38	2.19	2.04	1.91	1.79
100	7.25	5.73	4.76	4.10	3.60	3.22	2.92	2.67	2.46	2.29	2.14	2.01

Tc = time in minutes. Values may exceed 60.

Precip. file name: Heyer Brewer.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10