Conceptual Drainage Design Report

I-25 The New Pueblo Freeway Environmental Impact Statement

Prepared For:

Colorado Department of Transportation-Region 2

CDOT Project No.: IM-0251-156

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Project Description

The Federal Highway Administration (FHWA), in cooperation with the Colorado Department of Transportation (CDOT), is preparing an Environmental Impact Statement (EIS) for the New Pueblo Freeway project, a proposal to improve a 7-mile segment of Interstate 25 (I-25) through Pueblo, Colorado as shown in Figure 1. Improvements are necessary to address a deteriorating roadway and bridges with inadequate geometrics, safety issues, and existing and future traffic demand.

Alternatives under consideration include taking no action (No Action Alternative), reconstruction of the interstate on essentially the existing alignment (Existing I-25 Alignment Alternative), and reconstruction of the interstate on existing and new alignments (Modified I-25 Alignment Alternative). The alternatives are further described as follows:

- No Action Alternative – This alternative provides only for minor improvements, repairs, and other maintenance actions. The existing four-lane highway will otherwise remain unchanged.
- Existing I-25 Alignment Alternative – This alternative consists of reconstructing I-25 to six lanes on essentially the same location, reconfiguring and eliminating access points to the interstate to improve safety, and providing other improvements to the local street system to enhance system connectivity and traffic movement near the interstate. The Existing I-25 Alignment Alternative is shown in Figure 2.
- Modified I-25 Alignment Alternative – This alternative consists of rebuilding I-25 to six lanes and providing the other improvements included in the Existing Alignment Alternative, except the alignment would be shifted to accommodate different interchange configurations. The Modified I-25 Alignment Alternative is shown in Figure 3.

Project Objective

This report summarizes the Conceptual Drainage Design performed for the New Pueblo Freeway EIS specifically identifying drainage infrastructure and water quality best management practices (BMPs) that can be used to mitigate stormwater and water quality impacts and assess right-of-way (ROW) impacts. The two reconstruction alternatives have been considered and evaluated in this report.

This is a concept level study that assesses the feasibility of general design concepts without determining specific system details. Included in the plan are the components that could impact ROW requirements including detention basins, conveyance network, outfall locations, and facilities that serve as BMPs for water quality.

Hydrology

Drainage Basin Description

The New Pueblo Freeway is located within the Arkansas River Basin, which begins in the central mountains near Leadville and flows south and east to Kansas. The streams of concern to the project are the Arkansas River and its tributary, Fountain Creek. Runoff that must be treated for quantity and quality before being released to these streams is generated from approximately 464 acres within the project footprint. An additional 180 acres of offsite area drains through the project site.

I-25 through the City of Pueblo is the culmination of numerous separate projects constructed over many years. The age of the project coupled with the multiple design and construction phases has made it difficult to find complete documentation of the existing drainage system. Therefore, review of Pueblo's drainage system archives, examination of aerial photographs, review of site topography, and site visits were used to ascertain the existing drainage infrastructure and flow paths. What was determined by this investigation is that the area to the north of the Arkansas River and west of I-25 typically drains to the City's storm sewer system; the land to the north of the Arkansas River and east of I-25 drains to Fountain Creek through a series of culverts, pipes, and open channels; and the drainage from the area to the south of the Arkansas River is collected in roadside swales and pipes along I-25 that direct the flow north to the river. Although a quantitative hydrologic analysis of the existing development condition was not performed, every effort was made to maintain the existing flow paths in the proposed design. When the project progresses further in the design phase, a more extensive investigation should be conducted to expand the knowledge of the existing conditions.

Both the onsite (areas within the CDOT ROW) and offsite (areas outside the ROW which contributes stormwater to the ROW) areas were delineated into drainage basins. The onsite basin boundaries were based on the proposed roadway vertical and horizontal alignments as well as the surrounding topography. The determination of offsite areas was accomplished by examining both the existing topography and The City of Pueblo Master Storm Drainage Plan (Master Plan). Pueblo is in the early phases of revising the Master Plan. It is unclear how the revisions to the Master Plan will alter the drainage patterns for the offsite areas. If the updated Master Plan is completed prior to the project design phase, changes to the offsite drainage patterns will be taken into account. For this hydrologic evaluation, it is assumed that the existing drainage patterns of offsite areas will be unchanged for the purposes of quantifying the offsite areas.

A total of 14 onsite basins and 10 offsite basins were identified; maps of these basins are provided in Figures 4 and 5. It is the intent of this design to route the runoff from these basins along their existing flow paths. This was accomplished by using the flow directions and receiving water bodies that are listed in Table 1.

TABLE 1
Basin Drainage

Basins	Receiving Water Body
Onsite Basin 1	Contributes to the existing Southgate Development system that outfalls to Lake Minnequa
Onsite Basins 2-6	Directed north through proposed drainage improvements to the Arkansas River
Offsite Basins Q-T	Directed north through proposed drainage improvements to the Arkansas River
Onsite Basin 7	Directed south through proposed drainage improvements to the Arkansas River
Offsite Basin U	Directed south through proposed drainage improvements to the Arkansas River
Onsite Basins 8 and 8a	Drains to the historic alignment of the Arkansas River, which flows to Runyon Lake
Offsite Basin V	Drains to the historic alignment of the Arkansas River, which flows to Runyon Lake
Onsite Basins 9-12	Directed east to Fountain Creek
Offsite Basins W-Z	Directed east to Fountain Creek

Analysis Procedure

A hydrologic analysis of the onsite and the offsite areas was performed for the ultimate build-out condition using the Rational Formula Based-Modified FAA method as outlined in the Urban Drainage and Flood Control (UDFCD) Manual, Volume II. The required inputs for this method are 1) the rainfall and time of concentration, which are dictated by the Colorado Department of Transportation Drainage Design Manual (CDOT Criteria Manual); and 2) the basin area and percent imperviousness, which depend on the site conditions.

The design rainfall event prescribed for the methodology is the 100-yr storm, which produces a one-hour rainfall depth of 2.67 inches per the Storm Drainage Design Criteria and Drainage Policies for City of Pueblo, Colorado (Pueblo Criteria Manual). The time of concentration (tc) was calculated for each basin using the constraints provided by the CDOT Criteria Manual which dictate that tc be at least 5 minutes and be less than the regional tc, which is defined by the equation tc=L/180+10. The area of each basin was determined based on Pueblo County mapping. To calculate percent imperviousness, the land uses within each basin were examined using the proposed roadway designs for the onsite basins and aerial photographs for the offsite basins. While the primary land use for the onsite basins was roadway, the offsite basins mainly consist of commercial and residential land uses. The complete calculations for the hydrologic parameters can be found in Appendix 2.

Results of Hydrologic Analysis

The flow rates and runoff volumes were calculated using design spreadsheets developed by the UDFCD and serve as the premise for the sizing of the flood control and conveyance facilities. These spreadsheets are included in Appendix 3, the results of which are summarized in Tables 2 and 3.

TABLE 2
Onsite Basin Hydrology -- Ultimate Build-out Condition

Basin	Existing Alignment Major Storm Discharge (cfs)	Modified Alignment Major Storm Discharge (cfs)
1	150	150
2	90	80
3	100	50
4	100	170
5	90	40
6a	90	210
6b	60	NA
7	60	150
8	170	60
8a	110	110
9	120	120
10	120	120
11	170	170
12	60	60

TABLE 3
Offsite Basin Hydrology

Basin	Major Storm Discharge (cfs)
Q	80
R	280
S	260
T	50
U	30
W	60
X	20
Y	40
Z	20

Hydraulic Analysis and Design

As previously stated, the objective of the conceptual drainage system design is to identify drainage infrastructure and water quality BMPs that can be used to mitigate stormwater and water quality impacts and assess ROW impacts. The design is very conceptual and intended only to provide a layout of the drainage system. System details including the types of conveyance (pipes, open channels) and appurtenances (inlets, junctions, manholes) will not be defined. In addition, flood routing was not performed as part of the analysis, rather peak discharges were accumulated along the system without the consideration for lagging. Since the proposed drainage system is conceptual, as the project progress further in the design phases, it will be subject to change.

Drainage Design Criteria

The drainage design criteria for both the City of Pueblo and CDOT were taken into consideration in the development of the drainage plan. The governing criteria used for this project are summarized in Table 4.

TABLE 4
Drainage Design Criteria

Design Event	Major System: 100-yr
Pipe Flow Condition	Full gravity flow
Conveyance Design Method	Mannings equation
Allowable Storage Outflow	Historic Releases per NRCS Soil Groups (Criteria allows for release at pre-development runoff rates.)
Water Quality Criteria	Colorado Department of Transportation Drainage Design Manual

Drainage Design Concept

Drainage System

The proposed drainage plan for both the Existing I-25 Alignment Alternative and the Modified I-25 Alignment Alternative follow the same basic plan, making use of 14 detention facilities to reduce peak flows and a conveyance network to route flows either to the Arkansas River or to Fountain Creek. The detention ponds and conveyance network are shown in Figures 6 and 7 and are discussed in further detail below.

The delineation of offsite basins, as previously discussed, was accomplished by considering the existing drainage patterns. Pueblo is in the process of revising their Master Plan. It is unclear how the revision will alter the drainage patterns for the offsite areas. For the current hydrologic evaluation, it is assumed that the existing drainage patterns will be unchanged for the purposes of quantifying peak discharges. The effect of the revisions will be taken into account as the design progresses.

Stormwater runoff from the offsite basins will be conveyed through the proposed drainage system without flow attenuation and storm water quality treatment. This includes basin Q, located at the southwest corner of the Indiana Avenue interchange; basins R and S, which bound Northern Avenue to the west of I-25; basin T, a current industrial area to the southeast of the Abriendo interchange; basin U, the area between I-25 and Santa Fe Avenue south of the railroad tracks; basin W, located to the west of I-25 between 8th Street and 12th Street; and basins X, Y, and Z, which are west of I-25 between 13th Street and 24th Street.

The determination of which local streets contribute flow to the system was based on the proposed roadway grades. All streets that could drain to the system without excessive pipe depths were accepted into the system. Streets that could not feasibly flow into the system will follow their existing flow paths. Flood attenuation is likely not needed considering that the proposed designs will not increase the percent of impervious area appreciably.

The drainage system layout for the Existing I-25 Alignment Alternative and the Modified I-25 Alignment Alternative are identical for the north section, but vary for the southern

section. The three system segments, shown in Figures 6 and 7, collect and convey runoff as outlined below.

Existing I-25 Alignment Alternative-System Tributary to the Arkansas River

Stormwater runoff from drainage basin 1 is collected and detained in Pond 1 before being released to the existing Southgate Development drainage system. Runoff from drainage basins 2 through 6b will likely be conveyed in a drainage system which outfalls to the Arkansas River.

Detention ponds 2 through 6b will likely form an interconnected system that should include the following components.

- Flows from drainage basin 2 are collected into reach A and conveyed to Pond 2, which also receives runoff from drainage basin Q.
- The outfall of Pond 2 travels through reach B where it is joined by runoff from drainage basin 3 before entering Pond 3.
- Drainage from drainage basin 4 comes together with the outfall of Pond 3 into reach C, contributing to Pond 4 where drainage basin R joins the system.
- Reach D conveys the outfall of Pond 4 and the runoff from drainage basin 5 to Pond 5, which also accepts flow from drainage basin T, Northern Avenue, and Mesa Avenue.
- The release flows from Pond 5 pass through reach F where it is joined by runoff from drainage basin 6b before entering Pond 6b.
- Discharge from drainage basins 6a and S are collected in reach E and flows into Pond 6a.
- The outlet flows of both Pond 6a and 6b join together into reach G, which outfalls to the Arkansas River.

The final drainage basin that contributes to the Arkansas River is drainage basin 7. This drainage basin is collected in reach H and conveyed to Pond 7, which outfalls to the Arkansas River.

Modified I-25 Alignment Alternative-System Tributary to the Arkansas River

As in the Existing I-25 Alignment plan, stormwater runoff from drainage basin 1 will likely be collected and detained in Pond 1 before being released to the existing Southgate Development drainage system. Runoff from drainage basins 2 through 6b will likely be conveyed similarly to what is planned for the Existing I-25 Alignment Alternative using a collection and drainage system which outfalls to the Arkansas River.

The interconnected system of detention ponds 2 through 6 should include the following components.

- Flows from drainage basin 2 are collected into reach A and conveyed to Pond 2, which also receives runoff from drainage basin Q.
- The outfall of Pond 2 travels through reach B where it is joined by runoff from drainage basin 3 before entering Pond 3.

- Drainage from drainage basin 4 combines with the outfall of Pond 3 into reach C. Both drainage basin R and reach C contribute to ponds 4a and 4b, which are hydraulically connected.
- Reach D conveys the outfall of Pond 4b and the runoff from drainage basin 5 to Pond 5, which also accepts flow from drainage basin T, Northern Avenue, and Mesa Avenue.
- The release flows from Pond 5 pass through reach F where it is joined by runoff from drainage basins 6 and T before entering the dual pond system of 6a and 6b.
- Discharge from drainage basin S is collected in reach E and flows into Pond 6b, which then outfall through reach G to the Arkansas River.

Finally, as in the Existing I-25 Alignment Alternative, drainage basin 7 will likely be collected in reach H and conveyed to Pond 7, which outfalls to the Arkansas River.

Both Alignment Alternatives-System Tributary to Runyon Lake and Fountain Creek

- Flows from drainage basin 8 are collected in reach AA and conveyed to Pond 8. The outfall of Pond 8 is into the historic alignment of the Arkansas River, which flows into Runyon Lake.
- Reach BB collects runoff from drainage basin 8a and from 1st Street and takes it to Pond 8a, the release of which goes to the historic alignment of the Arkansas River eventually flowing into Runyon Lake.
- 8th Street flows directly into Pond 9, which receives the flow from drainage basins 9 and W via reach CC and outlets to Fountain Creek.
- Drainage basins 10, Y, and Z flow through reach DD to Pond 10, where runoff from 13th Street and drainage basin X join the system. Pond 10 then releases to Fountain Creek.
- Discharge from drainage basin 11 is conveyed via reach EE to Pond 11.
- Runoff from drainage basin 12 travels through reach FF to Pond 12, which also receives flow from the Frontage Road.
- The outfalls of ponds 11 and 12 join together to flow to Fountain Creek.

The pond volumes were based on detaining only the flows within the project area (onsite basins and side streets) while allowing the offsite basins to pass through undetained. Table 5 details the offsite basins and local streets that flow to each pond. Also affecting the pond volumes were the allowable release rates. Although the criteria allows for releases at pre-development rates, this design assumes release at the more conservative historic rates. When the project progresses further in the design phase, analysis of the allowable pre-development release rates may result in smaller pond sizes. Complete pond hydraulic calculations are included in Appendix 4.

TABLE 5
Additional Areas That Flow to Each Pond

Pond	Contributing Flows Existing Alignment		Contributing Flows Modified Alignment	
	Offsite Basins-Undetained	Streets-Detained	Offsite Basins-Undetained	Streets-Detained
1				
2	Q		Q	
3				
4	R		R	
5	T	Northern and Mesa		
6a	S		T	
6b			S	
7	U		U	
8				
8a		1st Street		1st Street
9		8th Street		8th Street
10	X, Y, and Z	13th Street	X, Y, and Z	13th Street
11				
12		Frontage Road		Frontage Road

In siting the detention facilities, the design goal was to minimize the additional ROW required. Therefore, detention ponds were sited in roadway interchanges and medians when possible. When extending ROW limits could not be avoided, ponds were shaped so as to minimize the additional land acquisition.

The hydraulic performance of the conveyance system layout and pond outfalls, shown in Figures 6 and 7, was verified using FlowMaster to check that reasonable slopes and pipe sizes could be achieved. The results of this evaluation is given in Appendix 5.

Water Quality BMPs

CDOT has a Colorado Discharge Permit System (CDPS) Permit for Municipal Separate Storm Sewer Systems (MS4). Because the New Pueblo Freeway Project would be considered a significant highway modification and the receiving waters are classified as sensitive, it requires Tier 1 permanent BMPs in order to comply with the permit.

Tier 1 BMPs require that 100% of the required water quality capture volume (WQCV) be provided for. From the acceptable BMPs that meet the Tier 1 requirements, Extended Detention Basins (EDB) were selected, because they can be used in conjunction with the peak flow control drainage system outlined above.

The required water quality capture volume was found using the method of sizing an EDB found in Urban Storm Drainage Criteria Manual, Volume III. In addition to the WQCV required for each of the delineated basins, three areas that did not required detention for peak flow regulation did need EDBs for water quality. These areas were Dillon Drive, US Highway 50 west of Fountain Creek, and US Highway 50 east of Fountain Creek. A summary of these WQCV values is shown in Table 6.

TABLE 6
Conceptual WQCVs

Area Served	Existing Alignment WQCV Storage Volume (ac-ft)	Modified Alignment WQCV Storage Volume (ac-ft)
Basin 1	1.6	1.9
Basin 2	0.6	0.5
Basin 3	0.6	0.3
Basin 4	0.6	1.1
Basin 5	0.5	0.3
Basin 6a	0.5	1.2
Basin 6b	0.3	NA
Basin 7	0.3	0.7
Basin 8	0.6	0.3
Basin 8a	0.5	0.5
Basin 9	0.5	0.5
Basin 10	0.6	0.6
Basin 11	1.0	1.0
Basin 12	0.3	0.3
Frontage Road	0.4	0.4
Dillon Avenue	0.3	0.3
US Hwy 50	0.4	0.4
Northern Avenue	0.4	0.2
Mesa Avenue	0.2	0.2
1st Street	0.2	0.2
4th Street	0.2	0.2
8th Street	0.2	0.2
13th Street	0.1	0.1
Indiana Avenue	NA	0.1
Pueblo Blvd	0.2	0.2

The total pond volume is calculated as the summation of the flood control storage volume and WQCVs. Table 7 summarizes the total pond volumes and assumed release rates for each of the alignment alternatives.

TABLE 7
Detention Pond Design

	Existing Alignment		Modified Alignment	
Pond	Total Volume (ac-ft)	Release Rate (cfs)	Total Volume (ac-ft)	Release Rate (cfs)
1	15	20	16	20
2	3	30	3	20
3	3	20	2	20
4	3	30	6	50
5	5	30	2	10
6a	3	30	7	60
6b	2	20	NA	NA
7	2	20	4	40
8	4	40	2	20
8a	3	30	3	30
9	4	30	4	30
10	4	30	4	30
11	5	50	5	50
12	4	10	4	10
WQ 1	1	*	1	*
WQ 2	1	*	1	*
WQ 3	1	*	1	*

[1] This rate reflects the historic release rate, which is less than the allowed pre-development release rate.

* WQCV shall be released in 40 hours.

Bessemer Ditch

The Bessemer Ditch diverts water from Pueblo Reservoir and carries it east of Pueblo. The ditch travels through the central portion of Pueblo and crosses under I-25 just south of Canal Street (see Figures 2 and 3). It is a trapezoidal concrete lined channel with an approximate bottom width of 12 feet and 2:1 side slopes. It passes under I-25 through a 8-ft x 15-ft box culvert. Both the Existing I-25 Alignment Alternative and the Modified I-25 Alignment Alternative propose maintaining the current configuration for the Bessemer Ditch crossing.

Hydraulic analysis using HY8 Software was conducted to verify that the capacity of the existing box culvert is sufficient to convey the irrigation flows conveyed by the Bessemer Ditch. From discussions with the City of Pueblo and review of the Master Plan, it was determined that the irrigation flows conveyed by the ditch is approximately 350cfs. The analysis verified that the existing box culvert has sufficient capacity to convey the irrigation flows of 350cfs without overtopping the road . The output file from HY8 can be found in Appendix 5. The Bessemer Ditch crossing will be evaluated further during design to confirm these conclusions when more detailed survey is available.

Summary

The Conceptual Drainage Design performed for the New Pueblo Freeway EIS has complied with the criteria prescribed by the CDOT Criteria Manual to mitigate for impacts to storm water runoff and water quality. In addition it has achieved the project goals of maintaining existing flow paths and minimizing ROW requirements.

Drainage infrastructure for the New Pueblo Freeway project was identified in this report for both the Existing I-25 Alignment Alternative and the Modified I-25 Alignment Alternative. Fourteen detention ponds were sited and sized to provide for flood control by releasing flows to the proposed conveyance network at the allowable release rates. Where possible, the detention ponds were expanded to extended detention basins for water quality enhancement. Drainage improvements were located within existing ROW where possible. Where additional ROW requirements could not be avoided, every effort was made to minimize the area used.

References

City of Pueblo Department of Public Works, *Storm Drainage Design Criteria and Drainage Policies for City of Pueblo, Colorado*, June 1997.

City of Pueblo, Master Storm Drainage Plan, May, 1995.

Colorado Department of Transportation, *Drainage Design Manual*, 2004.

Urban Drainage and Flood Control District, *Urban Storm Drainage Criteria Manual-Volume II*, June 2001.

Urban Drainage and Flood Control District, *Urban Storm Drainage Criteria Manual-Volume III*, June 2001.

Appendix 1: Figures

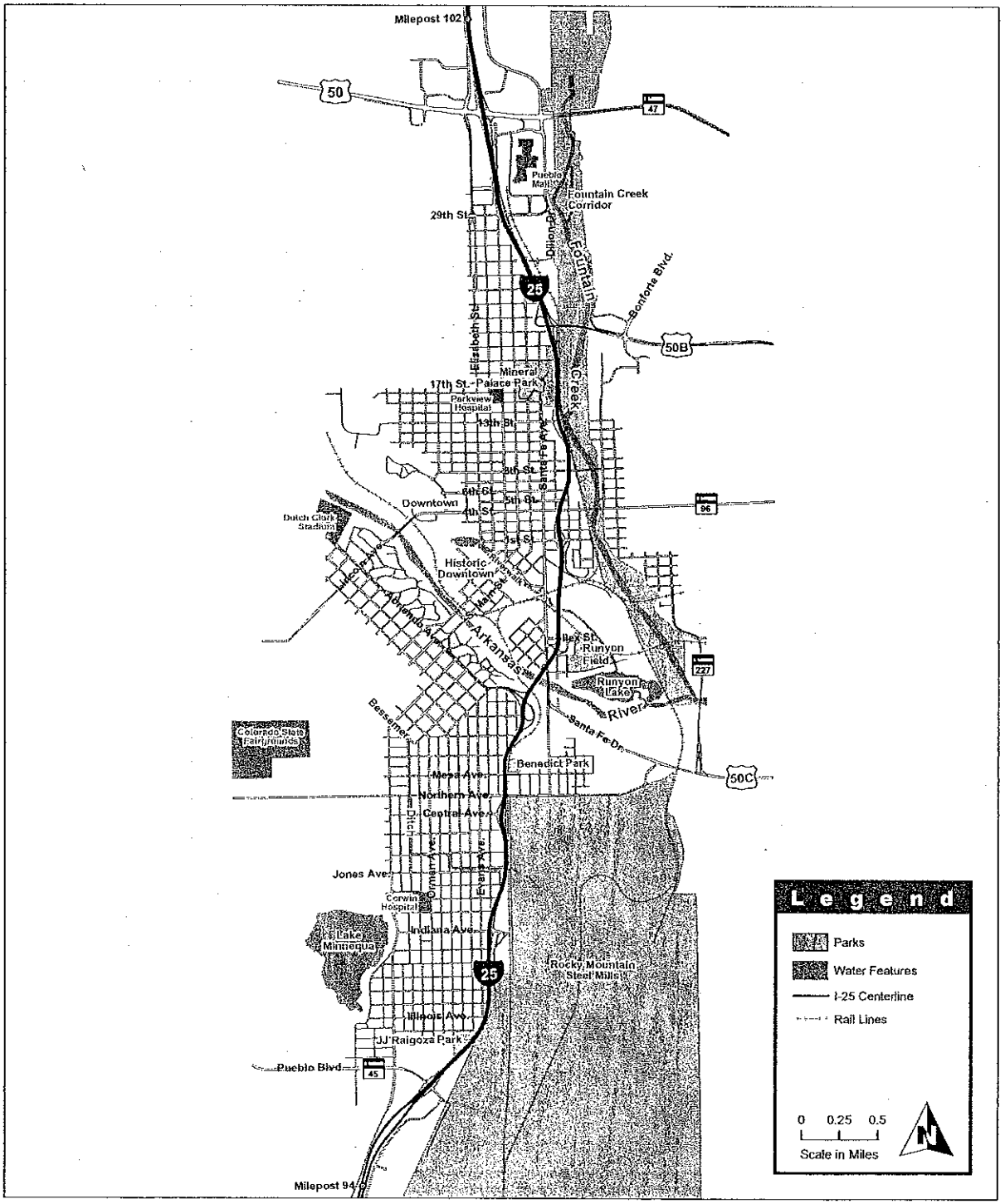


Figure 1: Vicinity Map

Appendix 2: Hydrology Parameters

Basin Characteristics

Purpose: To define basin characteristics used to calculate runoff rates and volumes.

Existing Alignment

Basin	Percent Imperviousness	Soil Type	Runoff Coefficient C (100 yr)	Area (Ac)
1	36	B	0.48	107
2	65	B	0.59	24
3	72	B	0.64	22
4	41	B	0.50	34
5	41	B	0.50	32
6a (Abr)	55	B	0.54	25
6b (east)	61	B	0.56	12
7	70	B	0.62	13
8	41	B	0.50	36
8a	41	B	0.50	31
9	44	D	0.59	30
10	61	C	0.63	30
11	61	C	0.63	47
12	90	C	0.83	8

Sources:

Percent Imperviousness	Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type	Natural Resources Conservation Service
Runoff Coefficient	Colorado Department of Transportation, Drainage Design Manual, 2004.

Data Presentation:
Values shown for area are rounded.

Purpose: To define basin characteristics used to calculate runoff rates and volumes.

Modified Alignment

Basin	Percent Imperviousness	Soil Type	Runoff Coefficient C (100 yr)	Area
1	50	B	0.52	107
2	61	B	0.56	23
3	41	B	0.50	16
4	61	B	0.56	52
5	41	A	0.41	17
6a&b	54	B	0.54	66
7	50	B	0.52	41
8	41	B	0.50	17
8a	41	B	0.50	31
9	44	D	0.59	30
10	61	C	0.63	30
11	61	C	0.63	47
12	90	C	0.83	8

Sources:

Percent Imperviousness	Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type	Natural Resources Conservation Service
Runoff Coefficient	Colorado Department of Transportation, Drainage Design Manual, 2004.

Data Presentation:
Values shown for area are rounded.

Purpose: To define the basin characteristics used to calculate runoff rates and volumes.

Offsite Basins - Apply to Both Alignments

Basin	Land Use	% Imperviousness	Soil Type	Runoff Coefficient C (100 yr)	Area (Ac)
Q	100% residential	85	B	0.75	18
R	14% residential, 86%comm	94	B	0.86	60
S	23% comm, 77% residential	87	B	0.78	59
T	14% open, 86% comm	82	B	0.72	12
U	100% commercial	95	B	0.88	5
W	100% commercial	95	C	0.89	11
X	47% open; 53% comm	53	C	0.61	3
Y	19%open; 81% residential	70	C	0.68	8
Z	100% residential	85	C	0.79	5

Sources:

Percent Imperviousness	Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type	Natural Resources Conservation Service
Runoff Coefficient	Colorado Department of Transportation, Drainage Design Manual, 2004.

Data Presentation:
Values shown for area are rounded.

Recommended Runoff Coefficients for Use in Rational Equation as a Function of Percent Impervious Area and Landuse Types

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		2	5	10	100
Business:					
Commercial Areas	95	0.87	0.87	0.88	0.89
Neighborhood Areas	70	0.60	0.65	0.70	0.80
Residential:					
Single-Family		0.40	0.45	0.50	0.60
Multi-Unit (detached)	50	0.45	0.50	0.60	0.70
Multi-Unit (attached)	70	0.60	0.65	0.70	0.80
1/2Acre Lot or Larger		0.30	0.35	0.40	0.60
Apartments	70	0.65	0.70	0.70	0.80
Industrial:					
Light Areas	80	0.71	0.72	0.76	0.82
Heavy Areas	90	0.80	0.80	0.85	0.90
Parks, Cemeteries:	7	0.10	0.10	0.35	0.60
Playgrounds:	13	0.15	0.25	0.35	0.65
Schools:	50	0.45	0.50	0.60	0.70
Railroad Yard Areas:	40	0.40	0.45	0.50	0.60
Undeveloped Areas:					
Historic Flow Analysis, Greenbelt, Agricultural:	2		See Lawns		
Offisite Flow Analysis: (when landuse not defined)	45	0.43	0.47	0.55	0.65
Streets:					
Paved	100	0.87	0.88	0.90	0.93
Gravel	13	0.15	0.25	0.35	0.65
Drive and Walks,	96	0.87	0.87	0.88	0.89
Roofs:	90	0.80	0.85	0.90	0.90
Lawns, Sandy Soil:	0	0.00	0.01	0.05	0.20
Lawns, Clayey Soil:	0	0.05	0.10	0.20	0.40

Note: These Rational Formula coefficients may not be valid for large basins.
Source: Urban Storm Drainage Criteria Manual (UDFCD, 2001).

Time of Concentration Calculations
Existing Alignment Onsite Basins

Purpose: Time of Concentration for Onsite Basins

Existing Alignment

Basin	Overland Flow min	Channel Flow min	Pipe Flow min	Total tc min	Regional tc min
1	39		18	56	58
2	8		7	15	28
3	7	5		12	19
4	10	8		18	24
5	10	10		20	28
6	5		8	13	31
6b	7		3	9	17
7	7		3	10	18
8		5		5	18
8a		12		12	29
9	9		3	12	18
10	8		7	14	27
11	8		9	17	34
12	5		2	7	16

Calculation Methods:

Overland Flow	Travel times were calculated using a design spreadsheet from the UDFCD as shown in the attachments.
Channel Flow	Travel times were calculated as the channel length (shown in attached spreadsheets) multiplied by the average flow velocity.
Pipe Flow	Travel times were calculated as the pipe length (shown in attached spreadsheets) multiplied by the average flow velocity.
Total tc	The sum of overland travel time, channel travel time, and flow travel time.
Regional tc	Using the equation:tc=L/180+10, where L is the total travel length.

Data Presentation:
Values shown for overland flow, channel flow, and pipe flow are rounded.
The total tc and regional tc are calculated from unrounded values, with the result rounded.

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 1 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 106.87 Acres — For catchments larger than 90 acres, CUHP hydrograph and routir
Percent Imperviousness = 36.00 %
NRCS Soil Type = B A, B, C, or D

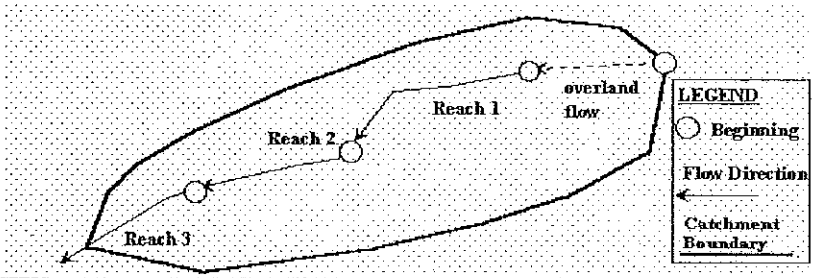
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.48
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.28
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0030	300	0.28		0.13	38.27
1		8,252		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		8,552			Computed Tc =	#VALUE!
					Regional Tc =	57.51

IV.

Peak Runoff Prediction using Computed Tc	ediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 2.78 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 143.83 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 2 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	23.92	Acres
Percent Imperviousness =	65.00	%
NRCS Soil Type =	B	A, B, C, or D

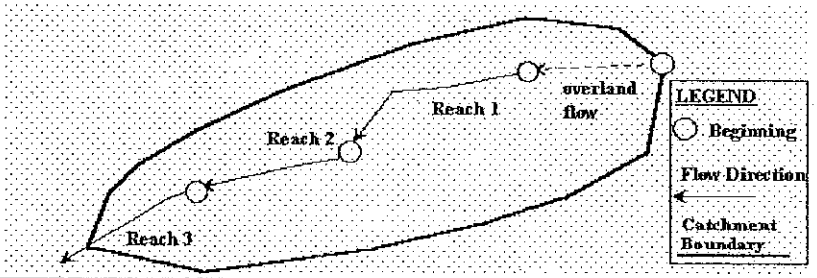
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.59	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.45	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	69	0.45		0.15	7.75
1		3,002		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		3,071				

Computed Tc = #VALUE!
Regional Tc = 27.06

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.45 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 62.76 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 3 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 21.01 Acres
Percent Imperviousness = 72.50 %
NRCS Soil Type = B A, B, C, or D

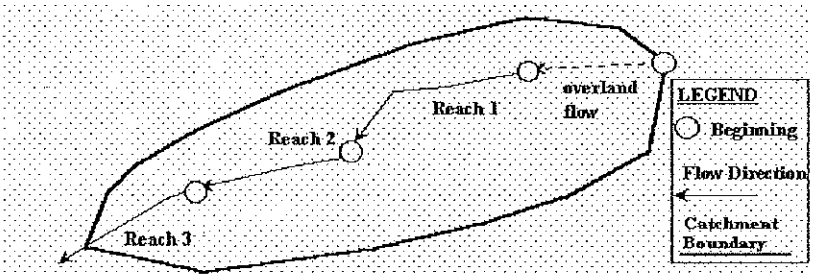
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.64
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.51
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0200	65	0.51		0.16	6.78
1		1,440		channel	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,505				

Computed Tc = #VALUE!
Regional Tc = 18.36

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 5.49 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 73.59 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 4 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	33.72	Acres
Percent Imperviousness =	40.00	%
NRCS Soil Type =	B	A, B, C, or D

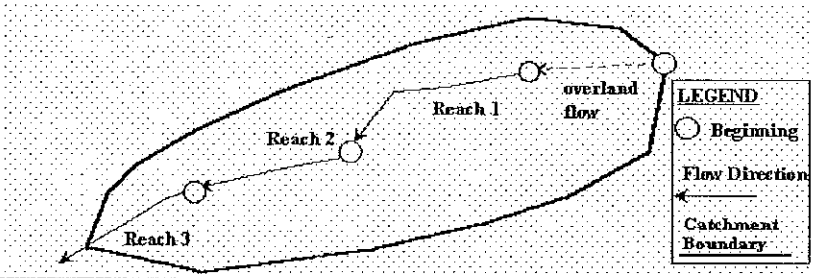
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.50	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.30	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0200	65	0.30		0.12	9.30
1		2,400		channel	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		2,465			Computed Tc =	#VALUE!
					Regional Tc =	23.69

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	4.79 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	80.03 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 5 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 31.71 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = B A, B, C, or D

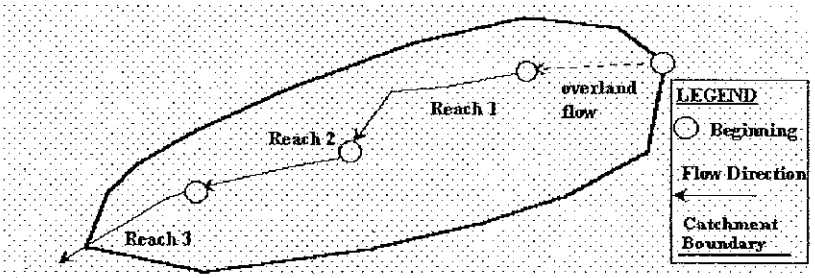
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.50
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.30
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0200	65	0.30		0.12	9.30
1		3,000		channel	#VALUE!	#VALUE!
2				channel		
3						
4						
5						
Sum		3,065				

Computed Tc = #VALUE!
Regional Tc = 27.03

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.45 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 69.88 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 6a Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 24.55 Acres
Percent Imperviousness = 55.00 %
NRCS Soil Type = B A, B, C, or D

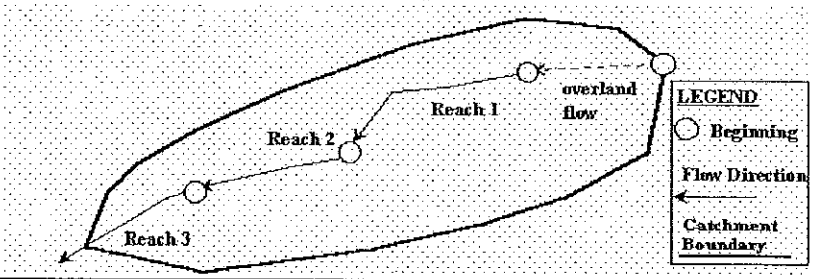
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.54
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.38
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	21	0.38		0.07	4.74
1		3,700		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		3,721				

Computed Tc = #VALUE!
Regional Tc = 30.67

IV.

Peak Runoff Prediction using Computed Tc	ediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.13 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 55.08 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 6b Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	11.83	Acres
Percent Imperviousness =	60.00	%
NRCS Soil Type =	B	A, B, C, or D

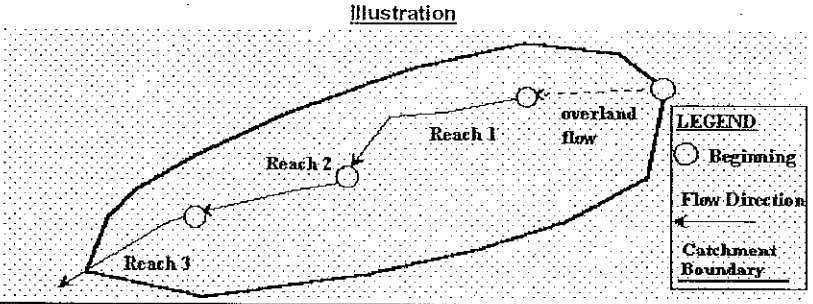
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.56	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.41	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	38	0.41		0.10	6.09
1		1,120		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,158				

Computed Tc = #VALUE!
Regional Tc = 16.43

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	5.80 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	38.72 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 7 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 12.22 Acres
Percent Imperviousness = 70.00 %
NRCS Soil Type = B A, B, C, or D

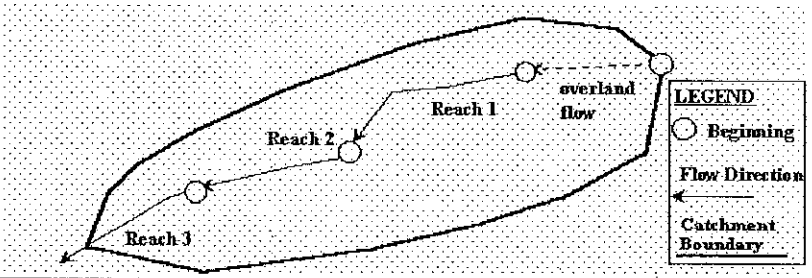
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.50 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 2.67 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.62
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.49
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	63	0.49		0.15	6.94
1		1,275		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,338				

Computed Tc = #VALUE!
Regional Tc = 17.43

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 5.63 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 42.73 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 8 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	35.90	Acres
Percent Imperviousness =	40.00	%
NRCS Soil Type =	B	A, B, C, or D

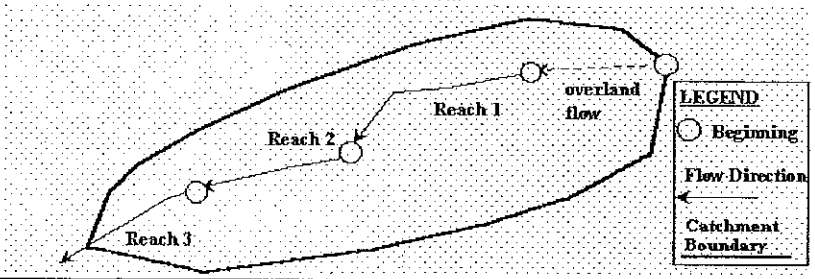
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.50	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.30	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0000	0	0.30		0.00	0.00
1		1,362		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,362			Computed Tc =	#VALUE!
					Regional Tc =	17.57

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	5.61 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	99.77 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 8a Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 31.00 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = B A, B, C, or D

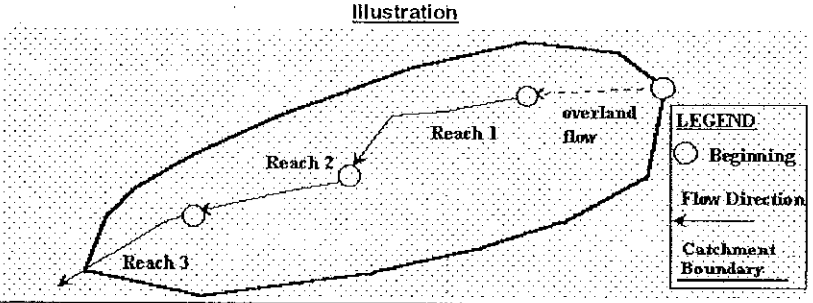
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.50
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.30
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0000	0	0.30		0.00	0.00
1		3,341		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		3,341				

Computed Tc = #VALUE!
Regional Tc = 28.56

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.31 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 66.17 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 9 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 29.14 Acres
Percent Imperviousness = 45.00 %
NRCS Soil Type = D A, B, C, or D

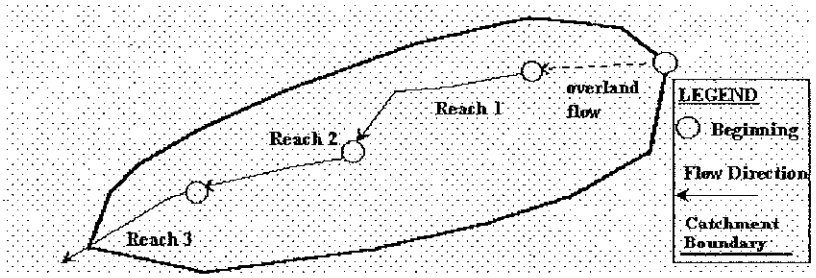
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.59
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.37
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	67	0.37		0.13	8.56
1		1,350		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,417				

Computed Tc = #VALUE!
Regional Tc = 17.87

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 5.56 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 95.97 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 10 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 29.26 Acres
Percent Imperviousness = 60.00 %
NRCS Soil Type = C A, B, C, or D

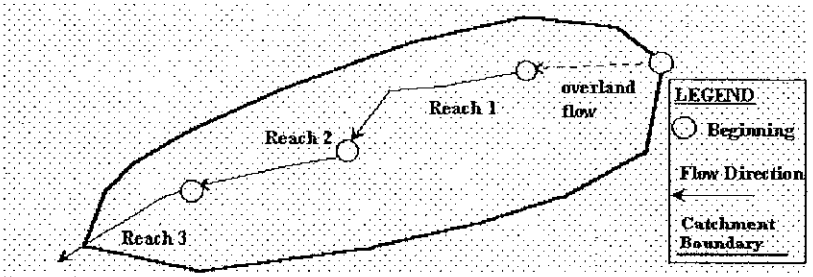
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.63
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.46
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	67	0.46		0.15	7.56
1		2,895		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		2,962				

Computed Tc = #VALUE!
Regional Tc = 26.46

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.51 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 83.43 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 11 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 47.00 Acres
Percent Imperviousness = 60.00 %
NRCS Soil Type = C A, B, C, or D

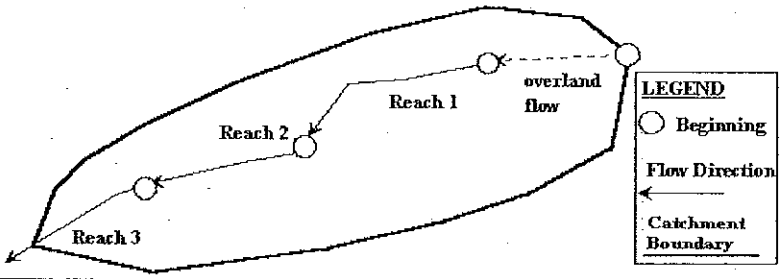
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.50 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 2.67 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.63
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.46
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	71	0.46		0.15	7.78
1		4,143		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		4,214				

Computed Tc = #VALUE!
Regional Tc = 33.41

IV.

Peak Runoff Prediction using Computed Tc	ediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 3.93 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 116.83 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 12 Existing Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	7.60	Acres
Percent Imperviousness =	90.00	%
NRCS Soil Type =	C	A, B, C, or D

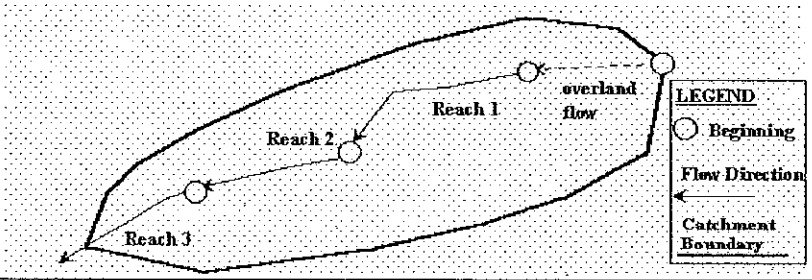
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.83	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.75	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0200	71	0.75		0.28	4.29
1		956		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,027				

Computed Tc = #VALUE!
Regional Tc = 15.71

IV.

Peak Runoff Prediction using Computed Tc		Peak Runoff Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	5.93 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	37.61 cfs

Time of Concentration Calculations
Modified Alignment Onsite Basins

Purpose: Time of Concentration for Onsite Basins

Modified Alignment

Basin	Overland Flow min	Channel Flow min	Pipe Flow min	Total tc min	Regional tc min
1	39		18	56	58
2	9	10		18	26
3	10	5		14	18
4	9	9		18	26
5	8	13		20	11
6	9		8	16	31
7	10		3	12	18
8	8		3	10	15
8a			12	12	29
9	9		3	12	18
10	8		7	14	27
11	8		9	17	34
12	5		2	7	16

Calculation Methods:

Overland Flow	Travel times were calculated using a design spreadsheet from the UDFCD as shown in the attachments.
Channel Flow	Travel times were calculated as the channel length (shown in attached spreadsheets) multiplied by the average flow velocity.
Pipe Flow	Travel times were calculated as the pipe length (shown in attached spreadsheets) multiplied by the average flow velocity.
Total tc	The sum of overland travel time, channel travel time, and flow travel time.
Regional tc	Using the equation:tc=L/180+10, where L is the total travel length.

Data Presentation:
Values shown for overland flow, channel flow, and pipe flow are rounded.
The total tc and regional tc are calculated from unrounded values, with the result rounded.

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 1 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =			
Area =	106.87	Acres	For catchments larger than 90 acres, CUHP hydrograph and routir
Percent Imperviousness =	36.00	%	
NRCS Soil Type =	B	A, B, C, or D	

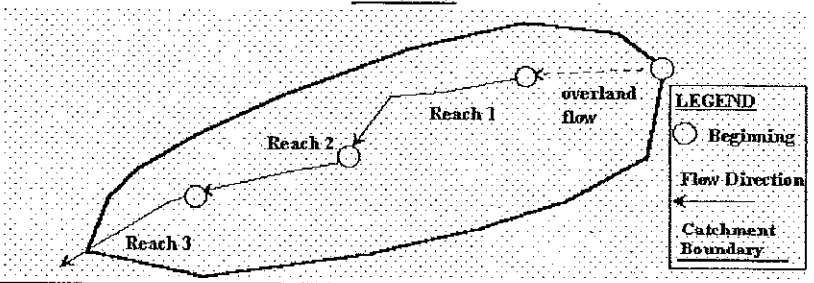
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.48	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.28	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0030	300	0.28		0.13	38.27
1		8,252		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		8,552			Computed Tc =	#VALUE!
					Regional Tc =	57.51

IV.

Peak Runoff Prediction using Computed Tc		ediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	2.78 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	143.83 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 2 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	22.92	Acres
Percent Imperviousness =	60.00	%
NRCS Soil Type =	B	A, B, C, or D

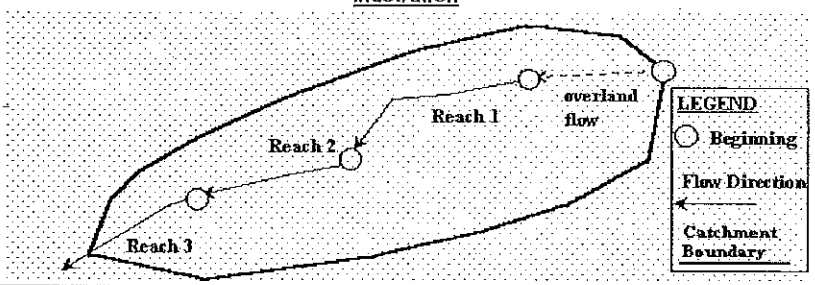
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.56	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.41	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	69	0.41		0.14	8.21
1		2,800		channel	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		2,869			Computed Tc =	#VALUE!
					Regional Tc =	25.94

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	4.56 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	58.93 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 3 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 15.81 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = B A, B, C, or D

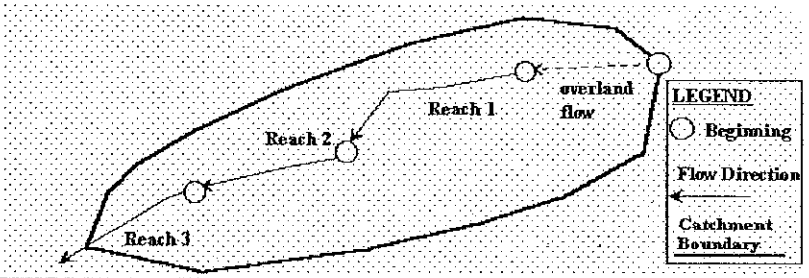
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.50
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.30
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	65	0.30		0.12	9.30
1		1,313		channel	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,378			Computed Tc =	#VALUE!
					Regional Tc =	17.66

IV.

Peak Runoff Prediction using Computed Tc	ediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 5.60 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 43.83 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 4 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 51.81 Acres
Percent Imperviousness = 60.00 %
NRCS Soil Type = B A, B, C, or D

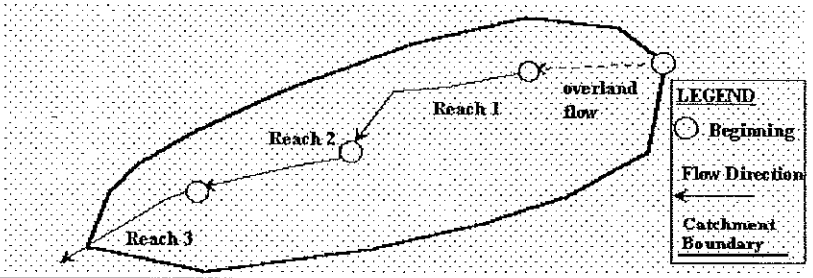
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.56
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.41
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	69	0.41		0.14	8.21
1		2,700		channel	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		2,769				

Computed Tc = #VALUE!
Regional Tc = 25.38

IV.

Peak Runoff Prediction using Computed Tc	Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.61 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 134.84 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 5 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 16.28 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = A A, B, C, or D

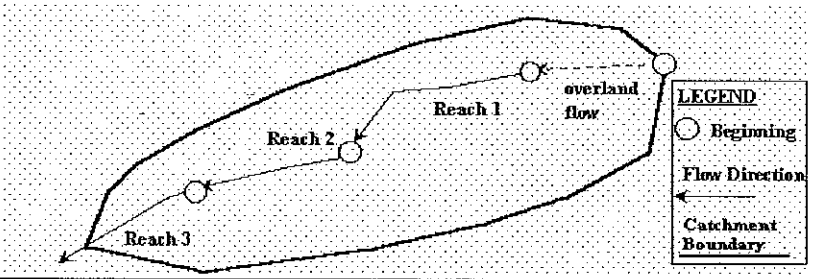
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.50 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 2.67 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.41
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.25
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	37	0.25		0.08	7.47
1		3,646		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		3,683				

Computed Tc = #VALUE!
Regional Tc = 30.46

IV.

Peak Runoff Prediction using Computed Tc	ediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.15 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 27.54 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 6 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	65.84	Acres
Percent Imperviousness =	55.00	%
NRCS Soil Type =	B	A, B, C, or D

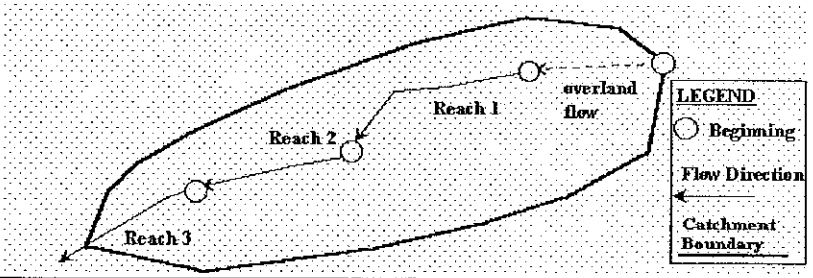
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.54	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.38	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	62	0.38		0.13	8.15
1		3,650		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		3,712				

Computed Tc = #VALUE!
Regional Tc = 30.62

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	4.14 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	147.87 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 7 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 40.23 Acres
Percent Imperviousness = 50.00 %
NRCS Soil Type = B A, B, C, or D

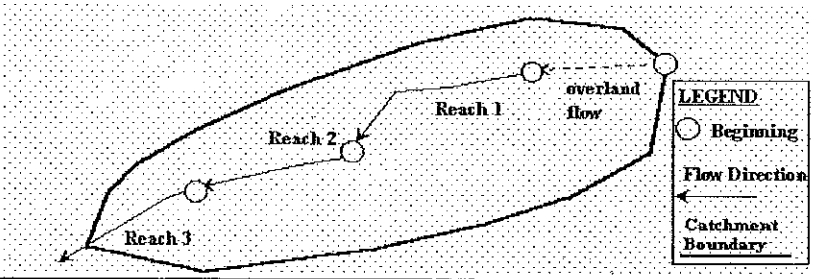
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.52
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	71	0.35		0.13	9.08
1		1,222		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,293				

Computed Tc = #VALUE!
Regional Tc = 17.18

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 5.68 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 119.76 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 8 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	16.11	Acres
Percent Imperviousness =	40.00	%
NRCS Soil Type =	B	A, B, C, or D

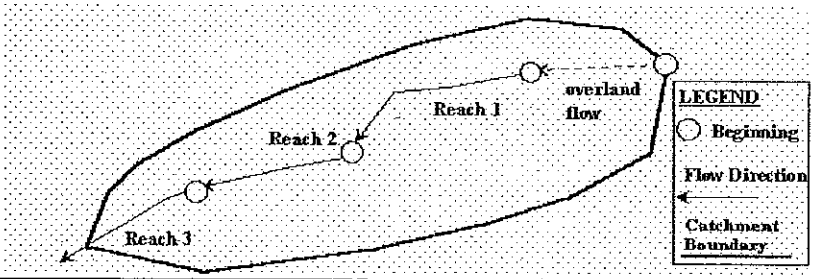
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.50	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.30	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.2100	178	0.30		0.42	7.08
1		707		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		885				

Computed Tc = #VALUE!
Regional Tc = 14.92

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	6.08 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	48.47 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 8a Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 31.00 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = B A, B, C, or D

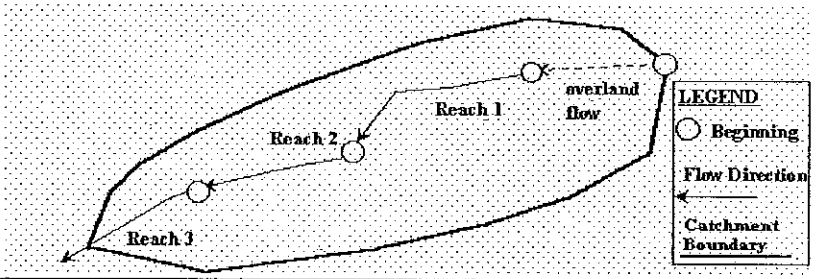
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.50 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 2.67 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.50
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.30
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0000	0	0.30		0.00	0.00
1		3,341		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		3,341				

Computed Tc = #VALUE!
Regional Tc = 28.56

IV.

Peak Runoff Prediction using Computed Tc	Peak Runoff Prediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 4.31 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 66.17 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 9 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	29.14	Acres
Percent Imperviousness =	45.00	%
NRCS Soil Type =	D	A, B, C, or D

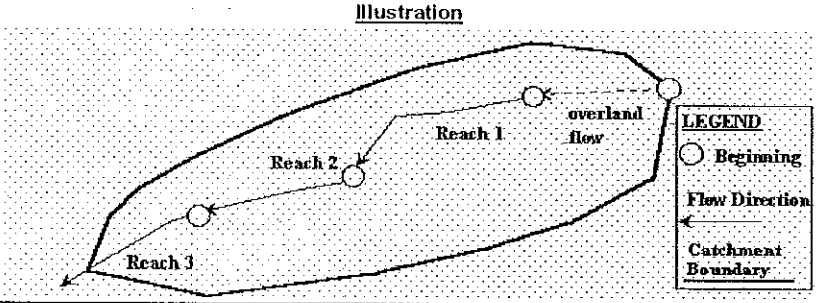
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.59	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.37	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	67	0.37		0.13	8.56
1		1,350		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,417				

Computed Tc = #VALUE!
Regional Tc = 17.87

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	5.56 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	95.97 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 10 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =		
Area =	29.26	Acres
Percent Imperviousness =	60.00	%
NRCS Soil Type =	C	A, B, C, or D

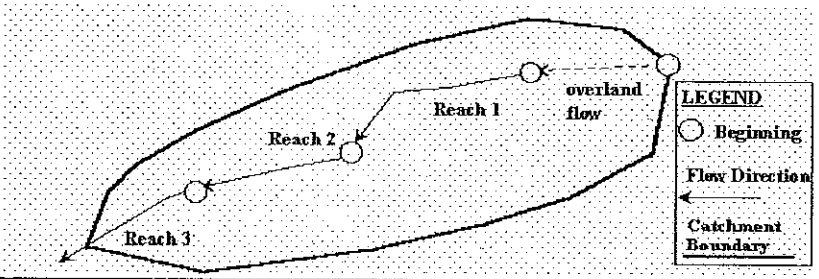
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.63	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.46	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0200	67	0.46		0.15	7.56
1		2,895		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		2,962				

Computed Tc = #VALUE!
Regional Tc = 26.46

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	4.51 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	83.43 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 11 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 47.00 Acres
Percent Imperviousness = 60.00 %
NRCS Soil Type = C A, B, C, or D

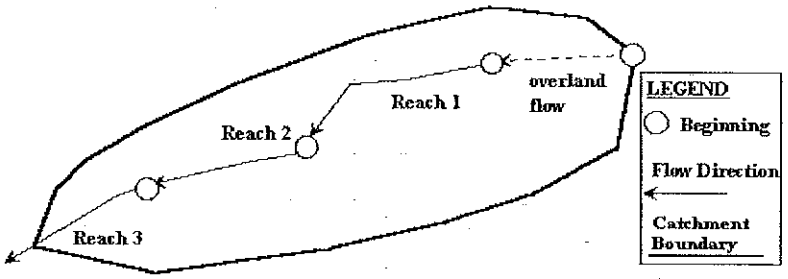
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.63
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.46
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0200	71	0.46		0.15	7.78
1		4,143		pipe	#VALUE!	#VALUE!
2				pipe		
3						
4						
5						
Sum		4,214				

Computed Tc = #VALUE!
Regional Tc = 33.41

IV.

Peak Runoff Prediction using Computed Tc	ediction using Regional Tc
Rainfall Intensity at Tc, I = #VALUE! inch/hr	Rainfall Intensity at Tc, I = 3.93 inch/hr
Peak Flowrate, Qp = #VALUE! cfs	Peak Flowrate, Qp = 116.83 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin 12 Modified Alignment

I. Catchment Hydrologic Data

Catchment ID =
Area = 7.60 Acres
Percent Imperviousness = 90.00 %
NRCS Soil Type = C A, B, C, or D

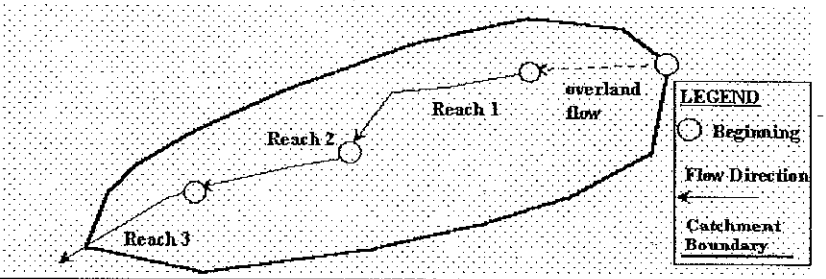
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.83
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.75
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	71	0.75		0.28	4.29
1		956		pipe	#VALUE!	#VALUE!
2						
3						
4						
5						
Sum		1,027				

Computed Tc = #VALUE!
Regional Tc = 15.71

IV.

Peak Runoff Prediction using Computed Tc		Peak Runoff Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	#VALUE! inch/hr	Rainfall Intensity at Tc, I =	5.93 inch/hr
Peak Flowrate, Qp =	#VALUE! cfs	Peak Flowrate, Qp =	37.61 cfs

Appendix 3: Hydrology Calculations

Peak Discharge and Detention Volume Calculations
Existing Alignment Onsite Basins

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 1 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
*(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	36 percent
Catchment Drainage Area	A =	106.87 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	55 minutes
Allowable Unit Release Rate (See Table A)	q =	0.11 cfs/acre *
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.46
Inflow Peak Runoff	Qp-in =	143.49 cfs
Allowable Peak Outflow Rate	Qp-out =	11.76 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.08

* Release rate was adjusted to produce a release of 12cfs or less per the Southgate Development Drainage Report

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

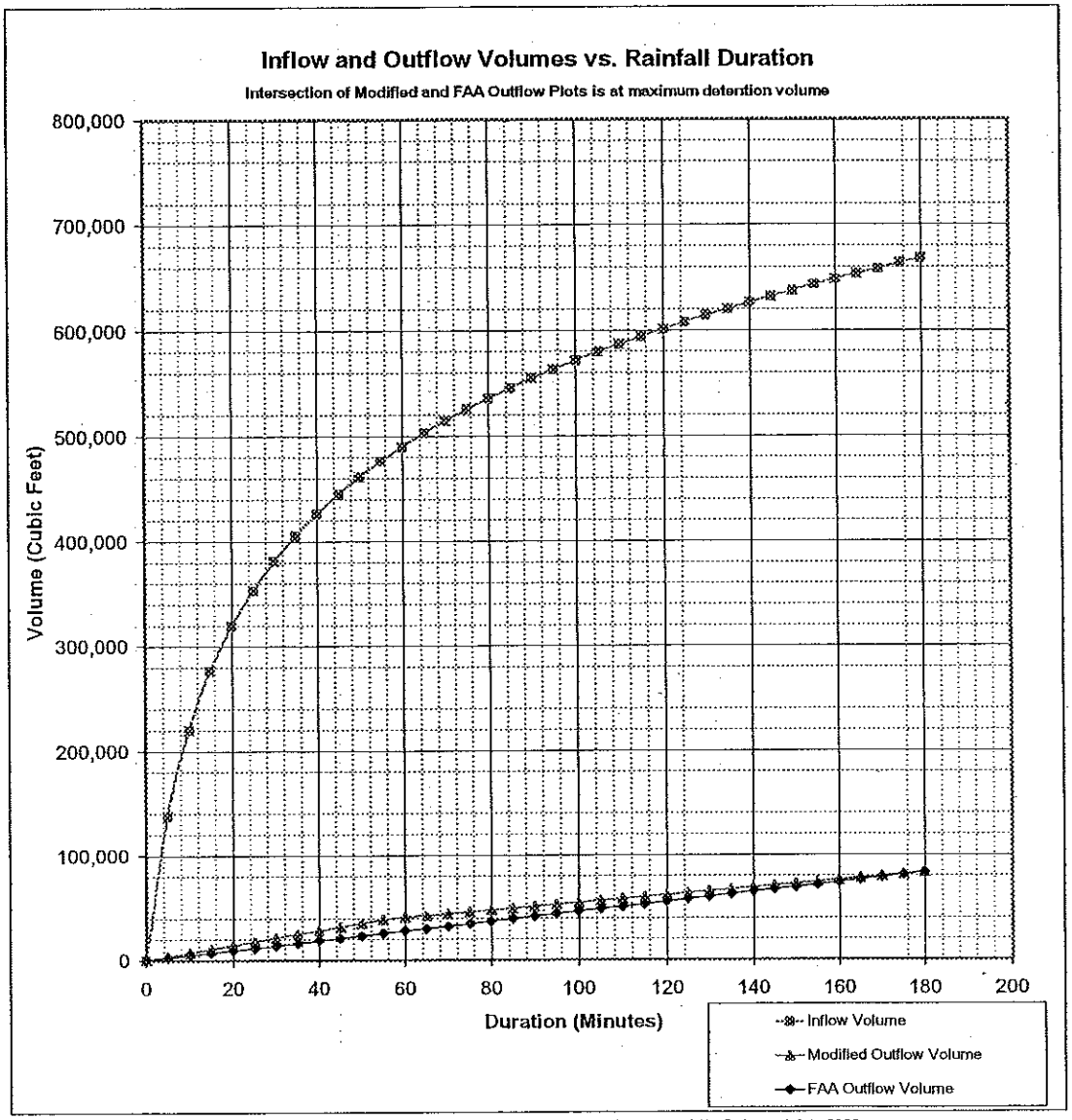
Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	137,868	1.00	11.76	3,527	134,341
10	7.14	219,880	1.00	11.76	7,053	212,827
15	5.98	276,263	1.00	11.76	10,580	265,683
20	5.16	318,540	1.00	11.76	14,107	304,433
25	4.59	352,964	1.00	11.76	17,634	336,331
30	4.13	381,152	1.00	11.76	21,160	359,992
35	3.76	405,167	1.00	11.76	24,687	380,481
40	3.46	426,067	1.00	11.76	28,214	397,854
45	3.21	444,560	1.00	11.76	31,740	412,820
50	3.00	461,142	1.00	11.76	35,267	425,876
55	2.81	476,174	1.00	11.76	38,794	437,380
60	2.65	489,923	0.96	11.31	40,719	449,204
65	2.51	502,586	0.93	10.89	42,483	460,114
70	2.39	514,353	0.90	10.53	44,246	470,107
75	2.28	525,321	0.87	10.22	46,009	479,312
80	2.18	535,603	0.85	9.95	47,773	487,830
85	2.08	545,283	0.83	9.71	49,536	495,747
90	2.00	554,430	0.81	9.50	51,300	503,131
95	1.93	563,104	0.79	9.31	53,063	510,041
100	1.86	571,353	0.78	9.14	54,826	516,526
105	1.79	579,216	0.76	8.98	56,590	522,629
110	1.73	586,731	0.75	8.84	58,353	528,385
115	1.68	593,941	0.74	8.71	60,116	533,825
120	1.63	600,856	0.73	8.59	61,880	538,976
125	1.58	607,506	0.72	8.49	63,643	543,863
130	1.53	613,913	0.71	8.39	65,406	548,506
135	1.49	620,094	0.71	8.29	67,170	552,924
140	1.45	626,066	0.70	8.21	68,933	557,133
145	1.42	631,845	0.69	8.13	70,696	561,148
150	1.38	637,442	0.68	8.05	72,460	564,983
155	1.35	642,871	0.68	7.98	74,223	568,648
160	1.32	648,141	0.67	7.92	75,986	572,155
165	1.29	653,263	0.67	7.86	77,750	575,514
170	1.26	658,246	0.66	7.80	79,513	578,733
175	1.23	663,097	0.66	7.74	81,277	581,820
180	1.21	667,823	0.65	7.69	83,040	584,783

Stormwater Detention Volume (Cubic Feet) = 584,783
Stormwater Detention Volume (Acre Feet) = 13.4248

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003



UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(Use USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 2 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	65	percent
Catchment Drainage Area	A =	23.92	acres
Predevelopment NRCS Soil Group	Type =	B	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	14	minutes
Allowable Unit Release Rate (See Table A)	q =	0.85	cfs/acre
One-hour Precipitation	P1 =	2.67	inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3			
Coefficient One	C1 =	26.50	
Coefficient Two	C2 =	10.00	
Coefficient Three	C3 =	0.79	

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.59	
Inflow Peak Runoff	Qp-in =	67.19	cfs
Allowable Peak Outflow Rate	Qp-out =	20.33	cfs
Ratio of Qp-out/Qp-in	Ratio =	0.25	

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.66	37,930	1.00	20.33	6,100	31,830
10	7.14	60,438	1.00	20.33	12,199	48,238
15	5.98	75,004	0.97	19.65	17,099	58,310
20	5.16	87,745	0.89	17.29	20,745	67,001
25	4.59	97,106	0.78	15.86	23,795	73,312
30	4.13	104,861	0.73	14.91	26,844	78,017
35	3.76	111,458	0.70	14.24	29,894	81,574
40	3.46	117,218	0.68	13.73	32,944	84,274
45	3.21	122,306	0.66	13.33	35,994	86,312
50	3.00	126,858	0.64	13.01	39,044	87,824
55	2.81	131,003	0.63	12.78	42,093	88,910
60	2.65	134,786	0.62	12.54	45,143	89,643
65	2.51	138,272	0.61	12.36	48,193	90,078
70	2.39	141,507	0.60	12.20	51,243	90,264
75	2.28	144,524	0.59	12.07	54,293	90,232
80	2.18	147,353	0.59	11.95	57,342	90,011
85	2.08	150,016	0.58	11.84	60,392	89,624
90	2.00	152,532	0.58	11.75	63,442	89,091
95	1.93	154,919	0.57	11.67	66,492	88,427
100	1.86	157,188	0.57	11.59	69,542	87,647
105	1.79	159,352	0.57	11.52	72,591	86,761
110	1.73	161,421	0.56	11.46	75,641	85,780
115	1.68	163,403	0.56	11.40	78,691	84,712
120	1.63	165,305	0.56	11.35	81,741	83,564
125	1.58	167,135	0.56	11.31	84,791	82,344
130	1.53	168,897	0.55	11.26	87,840	81,057
135	1.49	170,598	0.55	11.22	90,890	79,708
140	1.45	172,241	0.55	11.18	93,940	78,301
145	1.42	173,831	0.55	11.15	96,990	76,841
150	1.38	175,371	0.56	11.12	100,040	75,331
155	1.35	176,864	0.59	11.08	103,089	73,775
160	1.32	178,314	0.54	11.08	106,139	72,175
165	1.29	179,723	0.54	11.03	109,189	70,534
170	1.26	181,094	0.54	11.00	112,239	68,855
175	1.23	182,429	0.54	10.98	115,289	67,140
180	1.21	183,729	0.54	10.96	118,338	65,391

Stormwater Detention Volume (Cubic Feet) = 90,264
Stormwater Detention Volume (Acre Feet) = 2.0722

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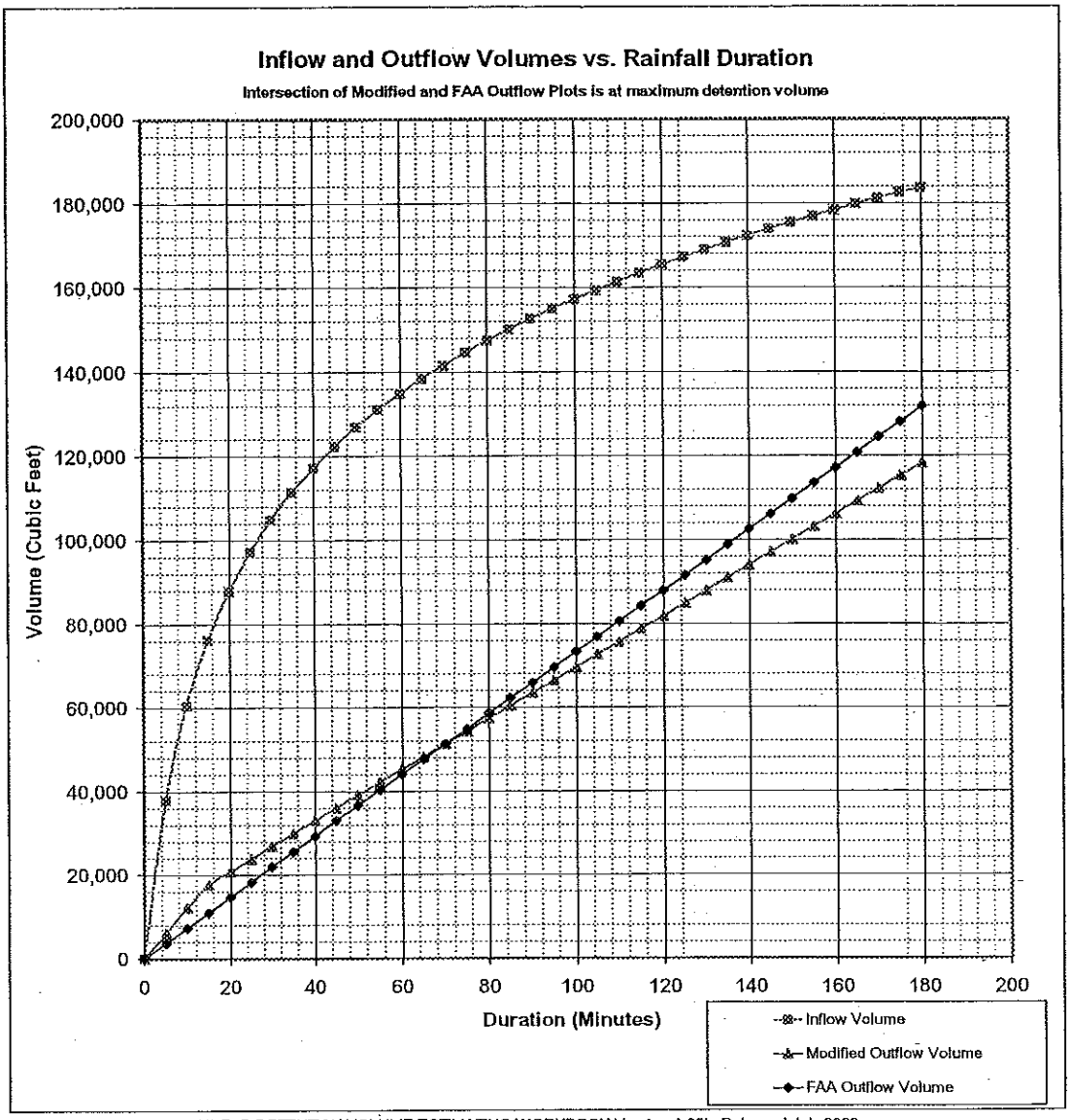

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 3 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	73	percent
Catchment Drainage Area	A =	21.01	acres
Predevelopment NRCS Soil Group	Type =	B	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	12	minutes
Allowable Unit Release Rate (See Table A)	q =	0.86	cfs/acre
One-hour Precipitation	P1 =	2.67	inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3			
Coefficient One	C1 =	28.50	
Coefficient Two	C2 =	10.00	
Coefficient Three	C3 =	0.79	

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.84	
Inflow Peak Runoff	Qp-in =	99.38	cfs
Allowable Peak Outflow Rate	Qp-out =	17.86	cfs
Ratio of Qp-out/Qp-in	Ratio =	0.20	

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	36,139	1.00	17.86	5,358	30,781
10	7.14	57,584	1.00	17.86	10,715	46,869
15	5.98	72,416	0.89	15.62	14,240	58,175
20	5.18	83,602	0.79	14.10	16,919	66,683
25	4.59	92,521	0.79	13.07	19,598	72,923
30	4.13	99,910	0.69	12.38	22,277	77,633
35	3.76	106,205	0.67	11.86	24,955	81,249
40	3.46	111,683	0.64	11.51	27,634	84,049
45	3.21	116,530	0.63	11.23	30,313	86,217
50	3.00	120,877	0.62	11.00	32,992	87,885
55	2.81	124,817	0.61	10.81	35,671	89,147
60	2.65	128,421	0.60	10.66	38,349	90,072
65	2.51	131,749	0.59	10.52	41,028	90,715
70	2.39	134,825	0.58	10.41	43,707	91,118
75	2.28	137,700	0.58	10.31	46,386	91,314
80	2.18	140,395	0.57	10.22	49,064	91,331
85	2.09	142,942	0.57	10.15	51,743	91,199
90	2.00	145,330	0.56	10.08	54,422	90,908
95	1.93	147,604	0.56	10.02	57,101	90,503
100	1.86	149,786	0.56	9.96	59,780	89,006
105	1.79	151,826	0.56	9.91	62,458	89,370
110	1.73	153,799	0.56	9.87	65,137	88,662
115	1.68	155,687	0.55	9.83	67,816	87,871
120	1.63	157,508	0.55	9.79	70,495	87,005
125	1.58	159,243	0.55	9.76	73,173	86,069
130	1.53	160,922	0.54	9.72	75,852	85,070
135	1.49	162,542	0.54	9.70	78,531	84,011
140	1.45	164,108	0.54	9.67	81,210	82,898
145	1.42	165,623	0.54	9.64	83,889	81,734
150	1.38	167,090	0.54	9.62	86,567	80,522
155	1.35	168,513	0.54	9.60	89,246	79,267
160	1.32	169,894	0.54	9.58	91,925	77,969
165	1.29	171,237	0.54	9.56	94,604	76,633
170	1.26	172,542	0.53	9.54	97,282	75,260
175	1.23	173,814	0.53	9.52	99,961	73,853
180	1.21	175,053	0.53	9.50	102,640	72,413

Stormwater Detention Volume (Cubic Feet) = 91,231
Stormwater Detention Volume (Acre Feet) = 2.0947

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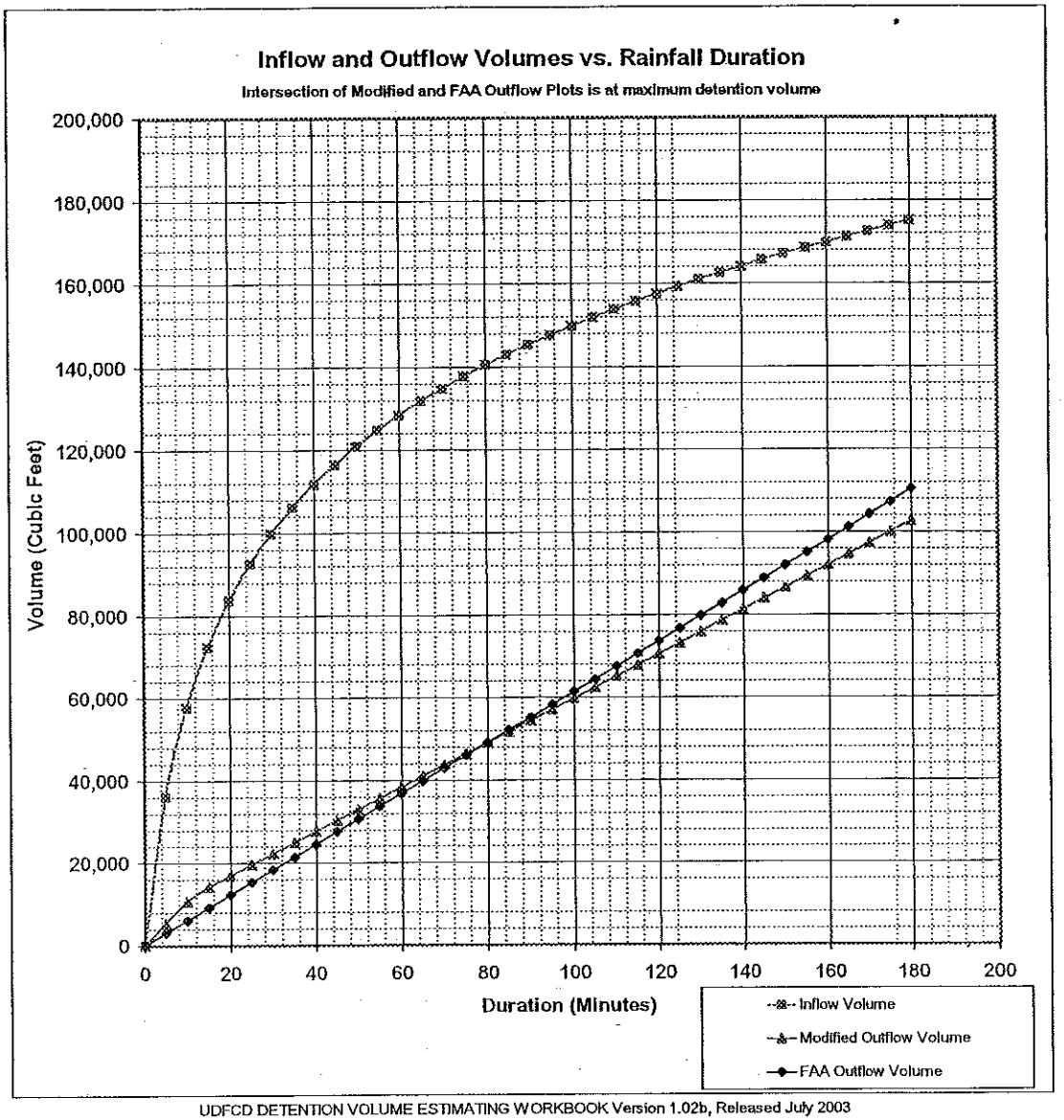

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 4 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_A =	40 percent
Catchment Drainage Area	A =	33.72 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	17 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.50
Inflow Peak Runoff	Qp-in =	54.11 cfs
Allowable Peak Outflow Rate	Qp-out =	28.66 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.30

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	45,313	1.00	28.66	8,599	36,714
10	7.14	72,202	1.00	28.66	17,197	55,005
15	5.98	90,600	1.00	28.66	29,796	60,804
20	5.18	104,826	0.93	26.73	32,073	72,753
25	4.59	116,009	0.85	24.25	36,372	79,647
30	4.14	125,271	0.79	22.80	40,671	84,592
35	3.76	133,187	0.75	21.41	44,971	88,196
40	3.46	140,036	0.72	20.59	49,270	90,765
45	3.21	146,114	0.69	19.84	53,569	92,544
50	3.00	151,564	0.67	19.29	57,868	93,695
55	2.81	156,504	0.65	18.84	62,168	94,336
60	2.65	161,023	0.64	18.46	66,467	94,556
65	2.51	165,189	0.63	18.15	70,766	94,423
70	2.39	169,053	0.62	17.87	75,066	93,987
75	2.28	172,657	0.62	17.64	79,365	93,292
80	2.18	176,037	0.61	17.43	83,664	92,373
85	2.08	179,218	0.60	17.25	87,964	91,256
90	2.00	182,225	0.60	17.09	92,263	89,962
95	1.93	185,076	0.59	16.94	96,562	88,513
100	1.86	187,787	0.59	16.81	100,862	86,925
105	1.79	190,377	0.58	16.69	105,161	85,211
110	1.73	192,843	0.58	16.58	109,460	83,383
115	1.68	195,211	0.58	16.49	113,759	81,451
120	1.63	197,484	0.57	16.40	118,059	79,425
125	1.58	199,668	0.57	16.31	122,358	77,311
130	1.53	201,779	0.57	16.24	126,657	75,118
135	1.49	203,806	0.56	16.17	130,957	72,850
140	1.45	205,769	0.56	16.10	135,256	70,513
145	1.42	207,669	0.56	16.04	139,555	68,113
150	1.38	209,508	0.56	15.98	143,855	65,654
155	1.35	211,293	0.56	15.93	148,154	63,139
160	1.32	213,025	0.55	15.88	152,453	60,572
165	1.29	214,706	0.55	15.83	156,752	57,956
170	1.26	216,346	0.55	15.79	161,052	55,294
175	1.23	217,940	0.55	15.75	165,351	52,589
180	1.21	219,494	0.55	15.71	169,650	49,843

Stormwater Detention Volume (Cubic Feet) = 94,556
Stormwater Detention Volume (Acre Feet) = 2.1707

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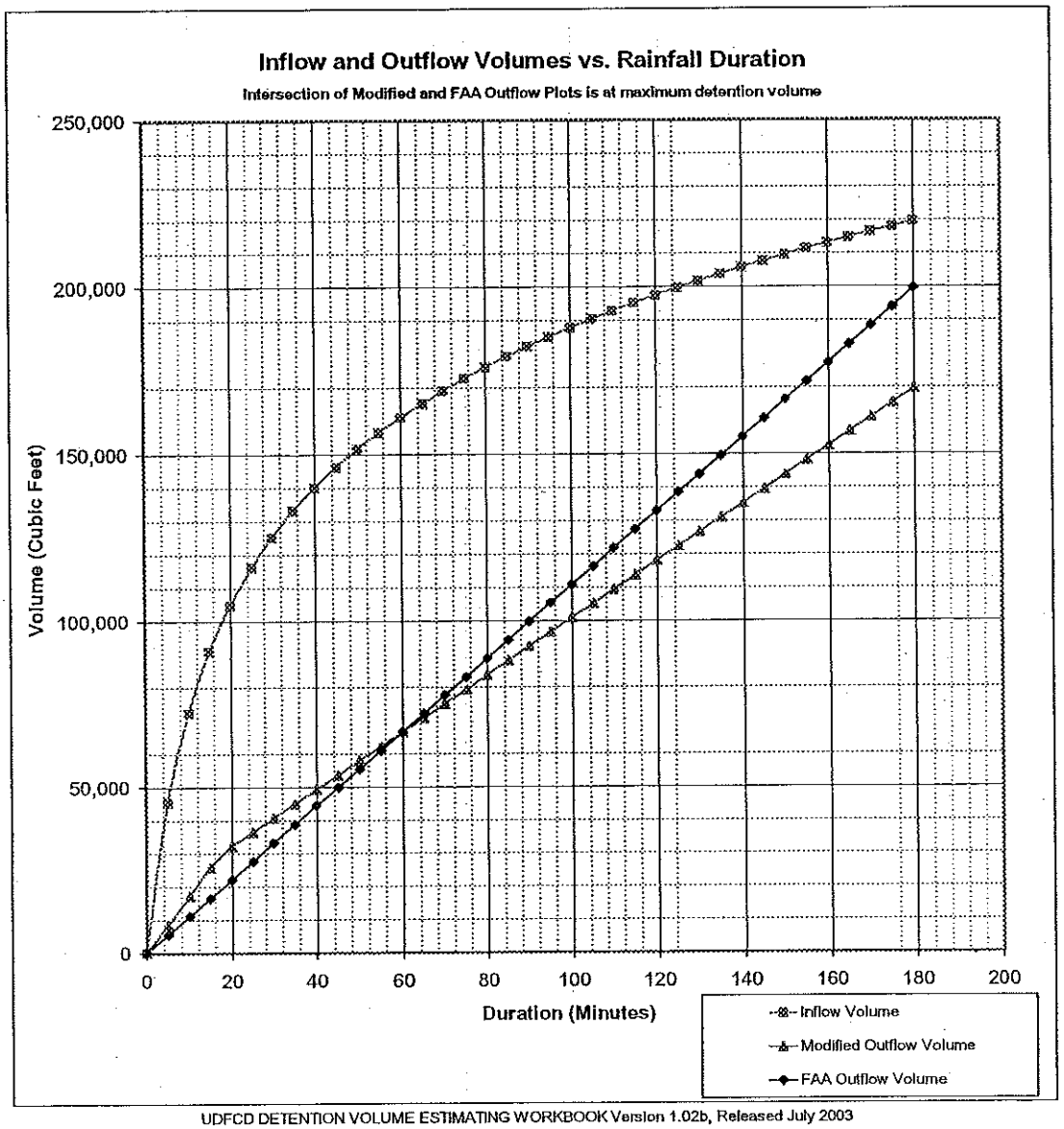

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 5 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	40 percent
Catchment Drainage Area	A =	31.71 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	19 minutes
Allowable Unit Release Rate (See Table A)	q =	0.65 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.50
Inflow Peak Runoff	Qp-in =	83.69 cfs
Allowable Peak Outflow Rate	Qp-out =	20.96 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.32

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	6.96	42,617	1.00	20.95	6,086	14,526
10	7.14	87,898	1.00	20.95	16,172	51,726
15	5.98	85,387	1.00	20.95	24,258	61,129
20	5.16	88,578	0.96	20.46	31,773	66,799
25	4.59	109,084	0.89	23.66	35,821	73,273
30	4.13	117,806	0.82	22.16	39,884	77,942
35	3.76	125,229	0.76	20.91	43,907	81,321
40	3.46	131,685	0.74	19.98	47,950	83,738
45	3.21	137,404	0.71	19.26	51,993	85,411
50	3.00	142,929	0.69	18.66	56,036	86,893
55	2.81	147,175	0.65	18.21	60,079	87,096
60	2.65	151,425	0.66	17.81	64,122	87,303
65	2.51	155,342	0.65	17.46	68,165	87,176
70	2.39	158,975	0.64	17.19	72,208	86,767
75	2.28	162,366	0.63	16.94	76,251	86,114
80	2.18	165,543	0.62	16.73	80,294	85,249
85	2.09	168,535	0.61	16.54	84,336	84,198
90	2.00	171,363	0.61	16.37	88,381	82,982
95	1.93	174,043	0.60	16.21	92,424	81,620
100	1.86	176,593	0.60	16.08	96,467	80,126
105	1.79	179,024	0.59	15.95	100,510	78,515
110	1.73	181,348	0.59	15.84	104,553	76,796
115	1.68	183,575	0.58	15.74	108,598	74,979
120	1.63	185,717	0.58	15.64	112,639	73,073
125	1.58	187,787	0.58	15.56	116,682	71,086
130	1.53	189,747	0.57	15.48	120,725	69,023
135	1.49	191,658	0.57	15.40	124,768	66,890
140	1.45	193,504	0.57	15.33	128,811	64,693
145	1.42	195,290	0.67	15.27	132,854	62,436
150	1.38	197,020	0.56	15.21	136,897	60,123
155	1.35	198,696	0.56	15.15	140,940	57,756
160	1.32	200,327	0.56	15.10	144,983	55,344
165	1.29	201,910	0.56	15.06	149,026	52,884
170	1.26	203,450	0.56	15.01	153,069	50,381
175	1.23	204,948	0.56	14.96	157,112	47,837
180	1.21	206,410	0.55	14.92	161,155	45,255

Stormwater Detention Volume (Cubic Feet) = 87,303
Stormwater Detention Volume (Acre Feet) = 2.0042

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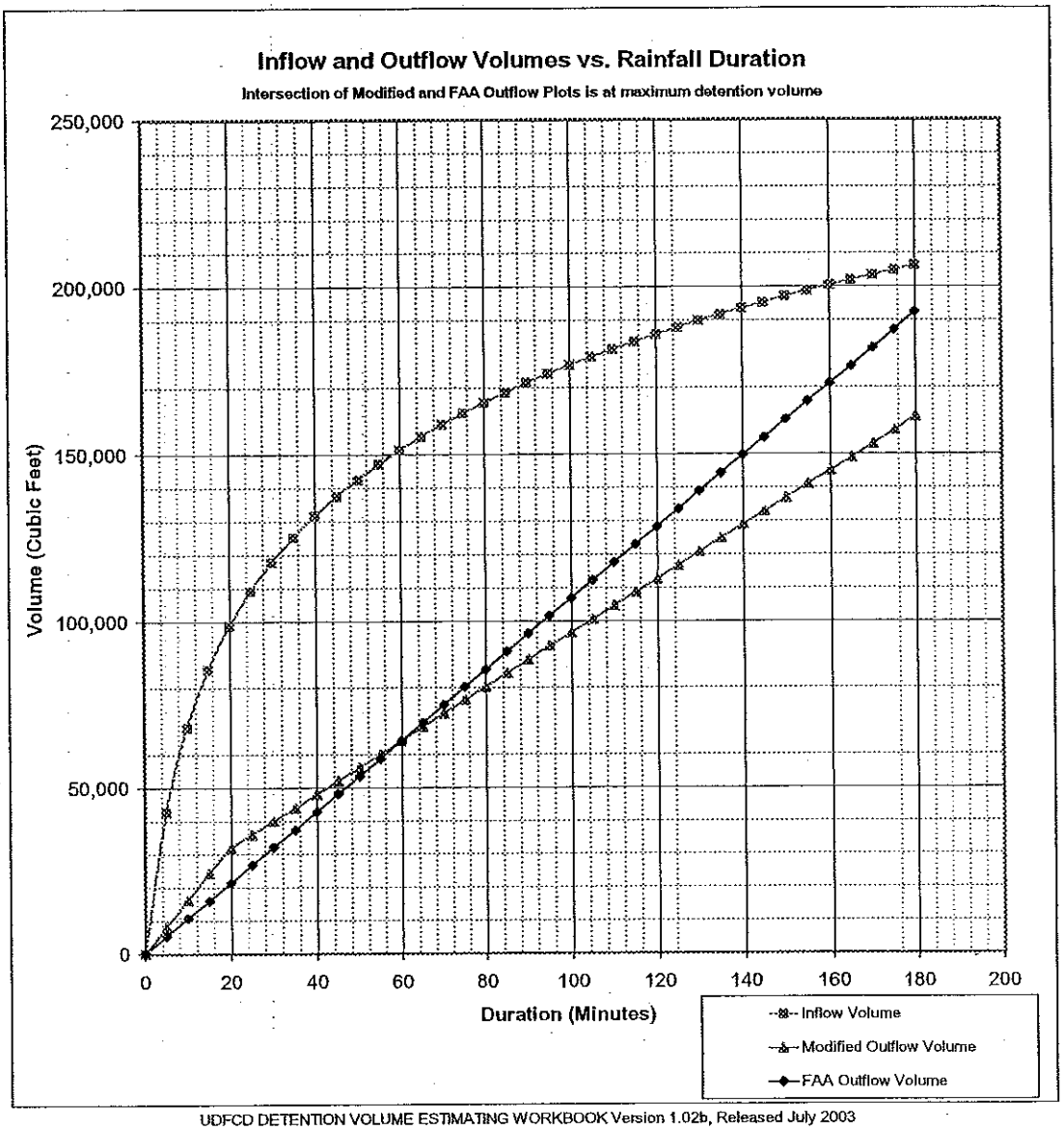

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume 1 Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 6a Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	55 percent
Catchment Drainage Area	A =	24.55 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	12 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.54
Inflow Peak Runoff	Qp-in =	88.37 cfs
Allowable Peak Outflow Rate	Qp-out =	20.87 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.24

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	35,630	1.00	20.87	6,260	29,369
10	7.14	56,773	1.00	20.87	12,521	44,252
15	5.96	71,396	0.92	18.00	17,184	54,211
20	5.16	82,425	0.81	16.93	20,315	62,110
25	4.56	91,218	0.75	15.63	23,445	67,773
30	4.13	98,502	0.71	14.76	26,575	71,928
35	3.76	104,709	0.68	14.15	29,705	75,004
40	3.46	110,110	0.66	13.68	32,835	77,275
45	3.21	114,868	0.64	13.32	35,965	78,904
50	3.00	119,174	0.62	13.03	39,095	80,079
55	2.81	123,099	0.61	12.80	42,229	80,870
60	2.65	126,612	0.60	12.60	45,356	81,257
65	2.51	129,868	0.60	12.41	48,486	81,402
70	2.39	132,926	0.59	12.29	51,616	81,310
75	2.28	135,750	0.58	12.17	54,746	81,014
80	2.18	138,418	0.58	12.06	57,876	80,541
85	2.08	140,918	0.57	11.96	61,006	79,913
90	2.00	143,283	0.57	11.88	64,136	79,147
95	1.93	145,525	0.57	11.80	67,266	78,258
100	1.86	147,656	0.56	11.73	70,397	77,260
105	1.79	149,680	0.56	11.67	73,527	76,163
110	1.73	151,602	0.56	11.61	76,657	74,976
115	1.68	153,494	0.55	11.56	79,787	73,707
120	1.63	155,281	0.55	11.52	82,917	72,364
125	1.58	157,000	0.55	11.47	86,047	70,953
130	1.53	158,655	0.55	11.43	89,177	69,478
135	1.49	160,253	0.55	11.40	92,307	67,945
140	1.45	161,796	0.54	11.36	95,436	66,359
145	1.42	163,290	0.54	11.33	98,566	64,723
150	1.38	164,736	0.54	11.30	101,696	63,038
155	1.35	166,139	0.54	11.27	104,826	61,313
160	1.32	167,501	0.54	11.25	107,956	59,545
165	1.29	168,825	0.54	11.22	111,086	57,739
170	1.26	170,113	0.54	11.20	114,215	55,894
175	1.23	171,365	0.54	11.18	117,345	54,018
180	1.21	172,588	0.53	11.16	120,475	52,109

Stormwater Detention Volume (Cubic Feet) = 81,402
Stormwater Detention Volume (Acre Feet) = 1.8687

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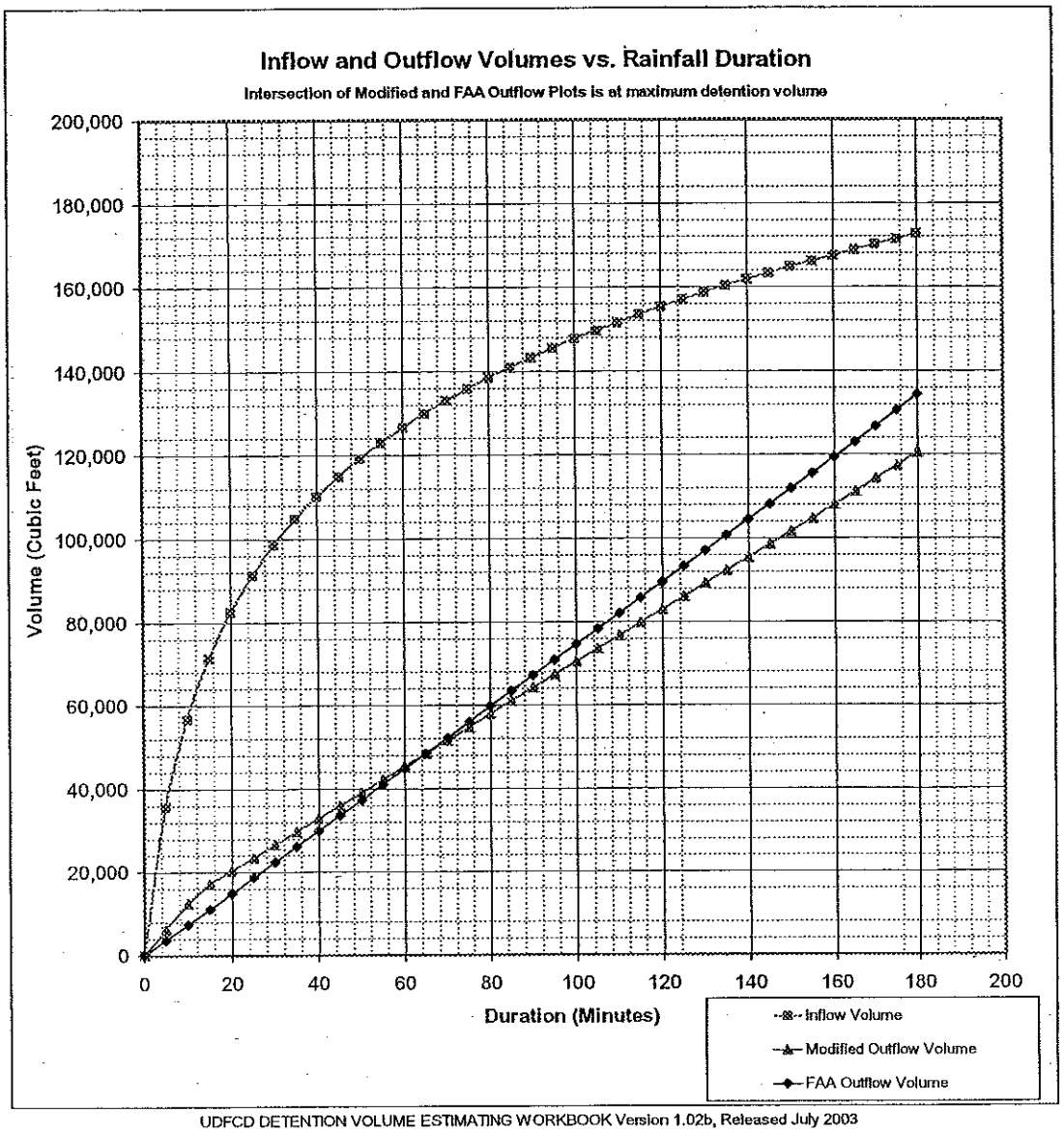

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 5b Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	60 percent
Catchment Drainage Area	A =	11.83 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	24.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.56
Inflow Peak Runoff	Qp-in =	59.46 cfs
Allowable Peak Outflow Rate	Qp-out =	10.06 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.20

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.43	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <-- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	17,805	1.00	10.06	3,017	14,788
10	7.14	28,370	0.92	9.28	5,557	22,814
15	5.98	35,676	0.78	7.85	7,085	28,613
20	5.18	41,189	0.71	7.14	8,573	32,616
25	4.59	45,583	0.67	6.72	10,082	35,502
30	4.13	49,224	0.64	6.44	11,590	37,634
35	3.76	52,325	0.62	6.24	13,098	39,227
40	3.46	55,024	0.61	6.09	14,607	40,418
45	3.21	57,412	0.59	5.97	16,115	41,296
50	3.00	59,554	0.58	5.87	17,623	41,931
55	2.81	61,495	0.58	5.80	19,132	42,364
60	2.65	63,271	0.57	5.73	20,640	42,631
65	2.51	64,908	0.56	5.68	22,148	42,759
70	2.39	66,426	0.56	5.63	23,657	42,769
75	2.28	67,842	0.56	5.59	25,165	42,677
80	2.18	69,170	0.55	5.56	26,673	42,497
85	2.09	70,420	0.55	5.53	28,182	42,239
90	2.00	71,602	0.55	5.50	29,690	41,912
95	1.93	72,722	0.54	5.47	31,198	41,524
100	1.86	73,787	0.54	5.45	32,707	41,080
105	1.79	74,803	0.54	5.43	34,215	40,588
110	1.73	75,774	0.54	5.41	35,727	40,051
115	1.68	76,704	0.54	5.40	37,231	39,473
120	1.63	77,597	0.54	5.38	38,740	38,857
125	1.58	78,456	0.53	5.37	40,248	38,208
130	1.53	79,283	0.53	5.35	41,756	37,527
135	1.49	80,082	0.53	5.34	43,265	36,817
140	1.45	80,853	0.53	5.33	44,773	36,080
145	1.42	81,599	0.53	5.32	46,281	35,318
150	1.38	82,322	0.53	5.31	47,790	34,532
155	1.35	83,023	0.53	5.30	49,298	33,725
160	1.32	83,704	0.53	5.29	50,806	32,897
165	1.29	84,365	0.53	5.28	52,315	32,051
170	1.26	85,009	0.52	5.28	53,823	31,186
175	1.23	85,635	0.52	5.27	55,331	30,304
180	1.21	86,246	0.52	5.26	56,840	29,406

Stormwater Detention Volume (Cubic Feet) = 42,769
Stormwater Detention Volume (Acre Feet) = 0.9818

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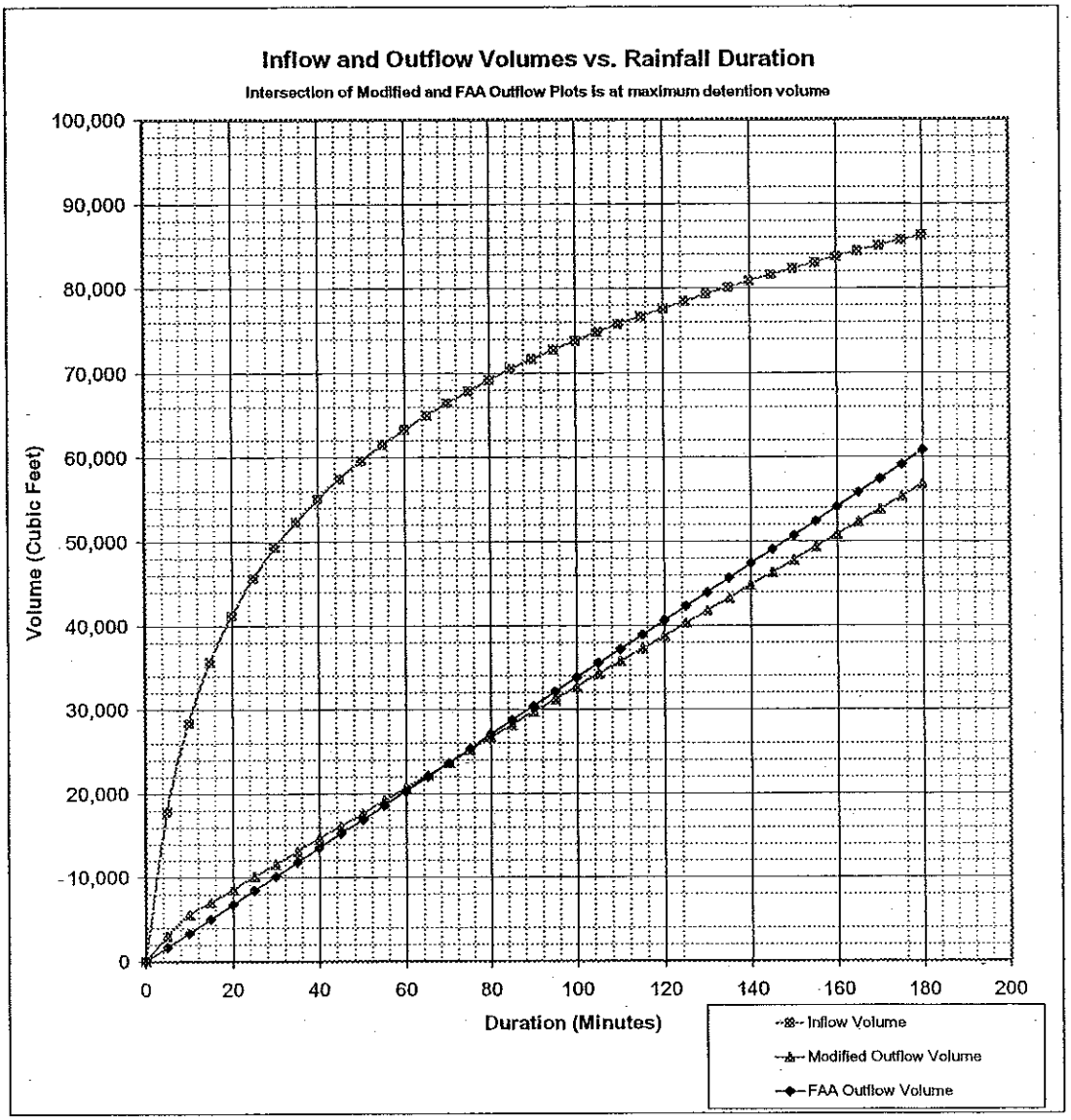

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 7 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	70 percent
Catchment Drainage Area	A =	12.22 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	10 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.82
Inflow Peak Runoff	Qp-in =	54.95 cfs
Allowable Peak Outflow Rate	Qp-out =	10.39 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.19

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.04	0.04
5-year	0.07	0.13	0.17
10-year	0.19	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	20,962	1.00	10.39	3,118	17,246
10	7.14	33,446	0.98	10.18	6,108	27,338
15	5.98	40,603	0.82	8.52	7,668	33,137
20	5.16	47,106	0.74	7.69	9,224	37,882
25	4.59	52,431	0.69	7.19	10,782	41,649
30	4.12	56,794	0.66	6.88	12,340	43,956
35	3.76	59,841	0.64	6.62	13,898	45,943
40	3.46	62,928	0.62	6.44	15,456	47,472
45	3.21	65,659	0.61	6.30	17,014	48,645
50	3.00	68,108	0.60	6.19	18,572	49,536
55	2.81	70,329	0.59	6.10	20,130	50,199
60	2.65	72,359	0.58	6.02	21,688	50,671
65	2.51	74,231	0.57	5.96	23,246	50,985
70	2.39	75,967	0.57	5.91	24,804	51,163
75	2.28	77,587	0.56	5.86	26,362	51,225
80	2.18	79,106	0.56	5.82	27,920	51,186
85	2.08	80,536	0.56	5.78	29,478	51,057
90	2.00	81,887	0.55	5.75	31,036	50,850
95	1.93	83,166	0.55	5.72	32,594	50,573
100	1.86	84,384	0.55	5.69	34,152	50,233
105	1.79	85,548	0.55	5.67	35,711	49,837
110	1.74	86,668	0.54	5.65	37,269	49,399
115	1.68	87,722	0.54	5.63	38,827	48,896
120	1.63	88,743	0.54	5.61	40,385	48,359
125	1.58	89,726	0.54	5.59	41,943	47,783
130	1.53	90,672	0.54	5.58	43,501	47,171
135	1.49	91,585	0.54	5.56	45,059	46,526
140	1.45	92,467	0.53	5.55	46,617	45,850
145	1.42	93,320	0.53	5.54	48,176	45,145
150	1.38	94,147	0.53	5.53	49,733	44,414
155	1.35	94,949	0.53	5.52	51,291	43,658
160	1.32	95,727	0.53	5.51	52,849	42,878
165	1.29	96,484	0.53	5.50	54,407	42,077
170	1.26	97,220	0.53	5.49	55,965	41,254
175	1.23	97,936	0.53	5.48	57,523	40,413
180	1.21	98,634	0.53	5.47	59,081	39,553

Stormwater Detention Volume (Cubic Feet) = 51,225
Stormwater Detention Volume (Acre Feet) = 1.1760

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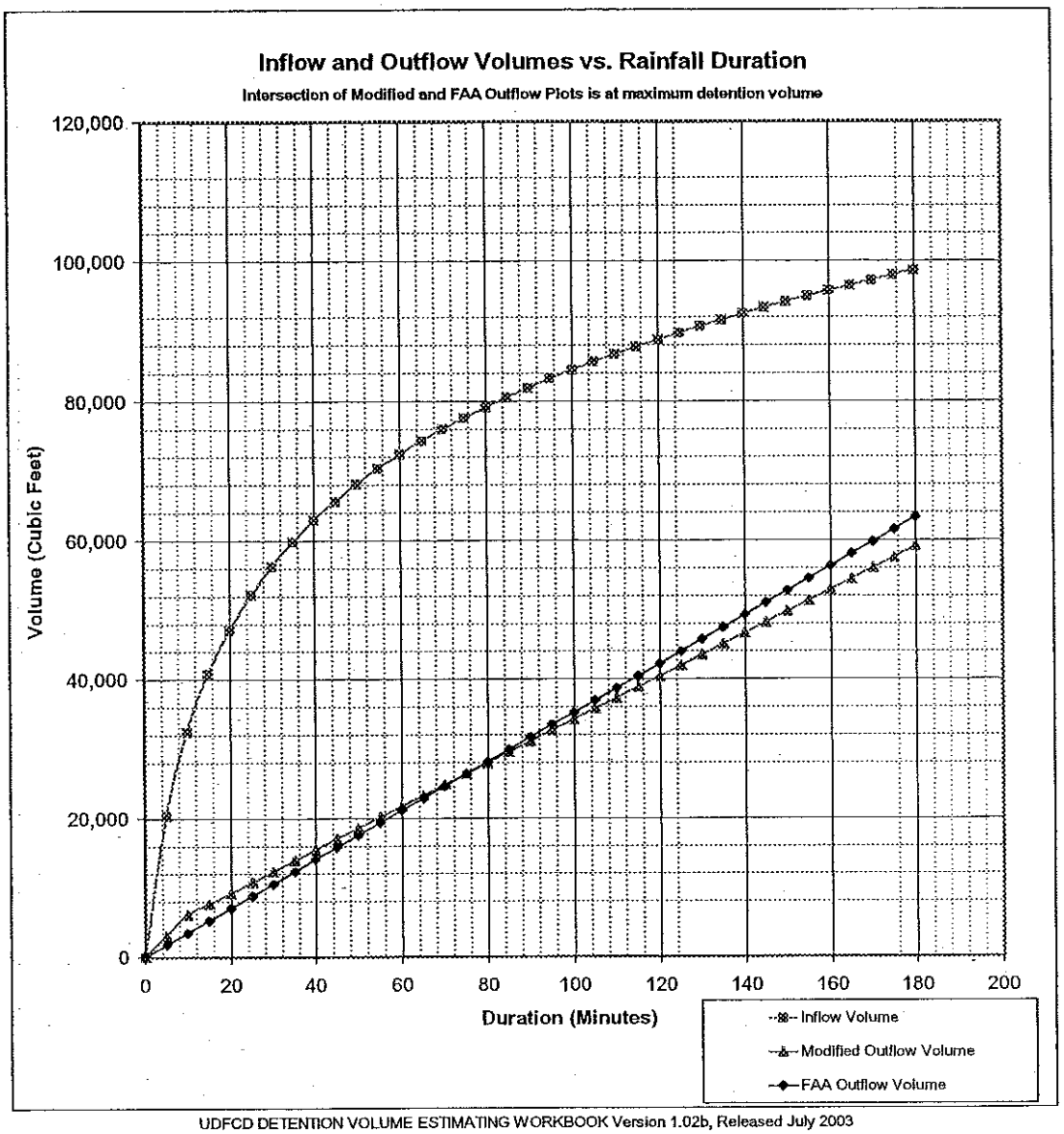

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 8 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	40 percent
Catchment Drainage Area	A =	35.90 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.50
Inflow Peak Runoff	Qp-in =	164.81 cfs
Allowable Peak Outflow Rate	Qp-out =	30.52 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.19

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (Input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	48,242	0.35	29.11	8,733	39,509
10	7.14	76,870	0.71	22.18	13,311	63,560
15	5.98	96,670	0.65	19.88	17,888	78,782
20	5.16	111,603	0.61	18.72	22,465	89,138
25	4.59	123,509	0.59	18.03	27,042	96,466
30	4.13	133,372	0.58	17.57	31,620	101,752
35	3.76	141,776	0.56	17.24	36,197	105,578
40	3.46	149,089	0.56	16.99	40,774	108,315
45	3.21	156,569	0.55	16.80	45,351	110,209
50	3.00	161,362	0.55	16.64	49,928	111,434
55	2.81	166,522	0.54	16.52	54,506	112,116
60	2.65	171,433	0.54	16.41	59,083	112,350
65	2.51	175,668	0.53	16.32	63,660	112,208
70	2.39	179,802	0.53	16.26	68,238	111,744
75	2.28	183,620	0.53	16.18	72,815	111,005
80	2.18	187,416	0.53	16.12	77,392	110,025
85	2.09	190,805	0.53	16.07	81,969	108,835
90	2.00	194,008	0.53	16.03	86,547	107,459
95	1.93	197,041	0.52	15.99	91,124	105,917
100	1.86	199,927	0.52	15.96	95,701	104,226
105	1.79	202,680	0.52	15.92	100,278	102,401
110	1.73	205,311	0.52	15.89	104,856	100,455
115	1.68	207,831	0.52	15.86	109,433	98,398
120	1.63	210,251	0.52	15.83	114,010	96,241
125	1.58	212,578	0.52	15.81	118,587	93,991
130	1.53	214,820	0.52	15.79	123,165	91,655
135	1.49	216,983	0.52	15.77	127,742	89,241
140	1.45	219,072	0.52	15.75	132,319	86,753
145	1.42	221,094	0.52	15.74	136,896	84,198
150	1.38	223,053	0.52	15.72	141,474	81,579
155	1.35	224,953	0.51	15.70	146,051	78,902
160	1.32	226,797	0.51	15.69	150,628	76,169
165	1.29	228,588	0.51	15.68	155,205	73,384
170	1.26	230,333	0.51	15.66	159,783	70,550
175	1.23	232,030	0.51	15.65	164,360	67,670
180	1.21	233,684	0.51	15.64	168,937	64,747

Stormwater Detention Volume (Cubic Feet) = 112,350
Stormwater Detention Volume (Acre Feet) = 2.5792

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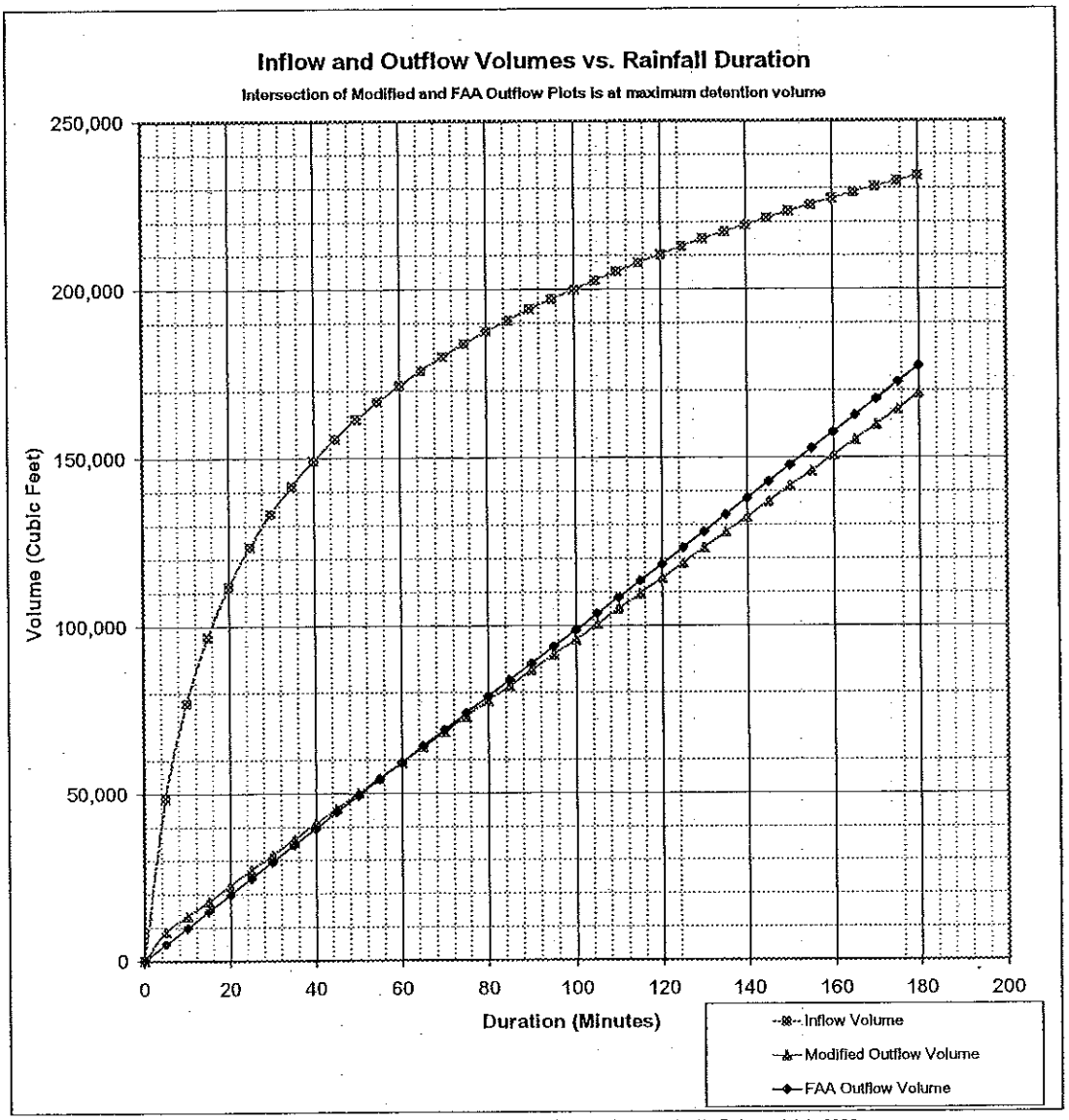

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 8a Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	40 percent
Catchment Drainage Area	A =	31.00 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	11 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.50
Inflow Peak Runoff	Qp-in =	105.69 cfs
Allowable Peak Outflow Rate	Qp-out =	26.35 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.25

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	41,668	1.00	26.35	7,905	33,763
10	7.14	66,378	1.00	26.35	15,810	50,568
15	5.98	83,479	0.87	22.96	20,664	62,812
20	5.18	96,370	0.78	20.54	24,616	71,754
25	4.59	106,651	0.72	19.05	28,569	78,082
30	4.13	115,188	0.69	18.07	32,521	82,667
35	3.76	122,425	0.66	17.37	36,474	85,951
40	3.46	128,748	0.64	16.84	40,426	88,314
45	3.21	134,328	0.62	16.44	44,379	89,949
50	3.00	139,338	0.61	16.11	48,331	91,007
55	2.81	143,880	0.60	15.84	52,284	91,596
60	2.65	148,034	0.59	15.62	56,236	91,798
65	2.51	151,864	0.59	15.43	60,189	91,675
70	2.39	156,410	0.58	16.27	64,141	91,270
75	2.28	158,730	0.57	15.13	68,094	90,636
80	2.18	161,837	0.57	15.01	72,046	89,791
85	2.08	164,762	0.57	14.90	75,999	88,763
90	2.00	167,529	0.56	14.81	79,951	87,578
95	1.93	170,147	0.56	14.72	83,904	86,243
100	1.86	172,639	0.56	14.64	87,856	84,783
105	1.79	175,016	0.55	14.57	91,809	83,207
110	1.73	177,288	0.55	14.51	95,761	81,527
115	1.68	179,464	0.55	14.45	99,714	79,751
120	1.63	181,564	0.55	14.40	103,666	77,898
125	1.58	183,583	0.54	14.35	107,619	75,944
130	1.53	185,489	0.54	14.30	111,571	73,918
135	1.49	187,307	0.54	14.26	115,524	71,843
140	1.45	189,171	0.54	14.22	119,475	69,696
145	1.42	190,917	0.54	14.19	123,429	67,489
150	1.38	192,609	0.54	14.16	127,381	65,227
155	1.35	194,249	0.54	14.12	131,334	62,915
160	1.32	195,841	0.53	14.09	135,286	60,555
165	1.29	197,389	0.53	14.06	139,239	58,150
170	1.26	198,894	0.53	14.04	143,191	55,703
175	1.23	200,360	0.53	14.01	147,144	53,217
180	1.21	201,788	0.53	13.99	151,096	50,692

Stormwater Detention Volume (Cubic Feet) = 91,798
Stormwater Detention Volume (Acre Feet) = 2.1074

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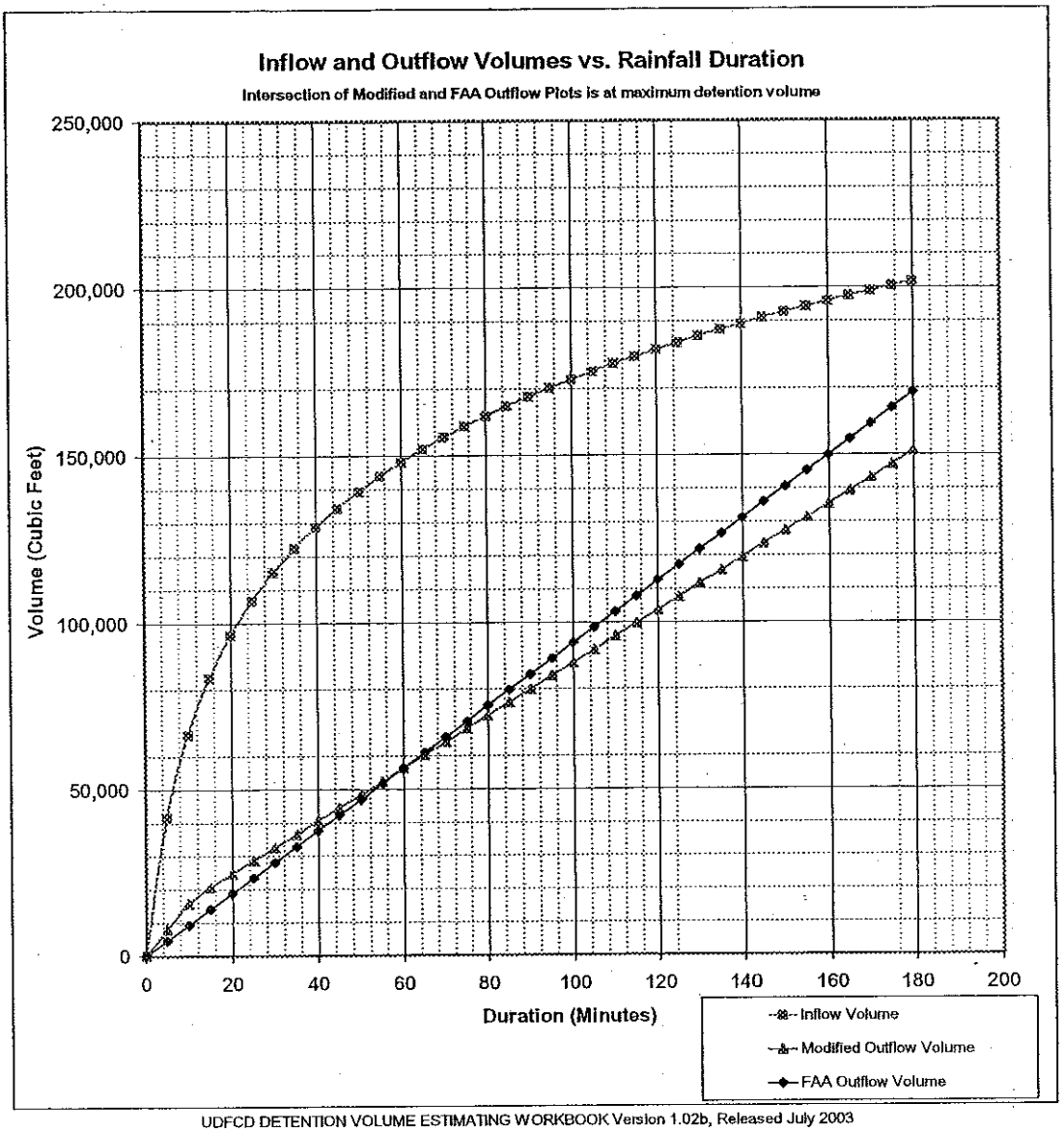

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 9 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):		
Catchment Drainage Imperviousness	I_a =	45 percent
Catchment Drainage Area	A =	29.14 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	13 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):		
Runoff Coefficient	C =	0.59
Inflow Peak Runoff	Qp-in =	116.45 cfs
Allowable Peak Outflow Rate	Qp-out =	29.14 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.25

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	46,207	1.00	29.14	8,742	37,466
10	7.14	79,627	1.00	29.14	17,484	56,143
15	5.98	92,591	0.88	25.61	23,053	69,538
20	5.16	106,894	0.78	22.89	27,424	79,470
25	4.59	118,267	0.79	21.20	31,795	86,509
30	4.13	127,745	0.69	20.09	36,166	91,579
35	3.76	135,784	0.58	19.30	40,537	95,257
40	3.46	142,796	0.64	18.71	44,908	97,891
45	3.21	148,896	0.63	18.25	49,279	99,717
50	3.00	154,554	0.61	17.88	53,650	100,904
55	2.81	159,592	0.60	17.58	58,021	101,571
60	2.65	164,200	0.59	17.33	62,392	101,808
65	2.51	168,447	0.59	17.12	66,763	101,685
70	2.39	172,368	0.58	16.94	71,134	101,234
75	2.28	176,083	0.58	16.78	75,505	100,559
80	2.18	179,503	0.57	16.64	79,876	99,634
85	2.08	182,754	0.57	16.52	84,247	98,507
90	2.00	185,820	0.56	16.41	88,618	97,202
95	1.93	188,727	0.56	16.31	92,989	95,738
100	1.86	191,491	0.56	16.23	97,360	94,131
105	1.79	194,127	0.55	16.15	101,731	92,397
110	1.73	196,648	0.55	16.08	106,102	90,546
115	1.68	199,062	0.55	16.01	110,473	88,589
120	1.63	201,379	0.55	15.95	114,844	86,536
125	1.58	203,606	0.55	15.90	119,215	84,394
130	1.53	205,755	0.54	15.84	123,586	82,170
135	1.49	207,827	0.54	15.80	127,957	79,870
140	1.45	209,829	0.54	15.75	132,328	77,501
145	1.42	211,765	0.54	15.71	136,699	75,067
150	1.38	213,641	0.54	15.67	141,070	72,572
155	1.35	215,461	0.54	15.64	145,441	70,020
160	1.32	217,227	0.54	15.61	149,812	67,416
165	1.29	218,944	0.53	15.57	154,183	64,761
170	1.26	220,614	0.53	15.54	158,554	62,060
175	1.23	222,240	0.53	15.52	162,925	59,315
180	1.21	223,824	0.53	15.49	167,296	56,528

Stormwater Detention Volume (Cubic Feet) = 101,808
Stormwater Detention Volume (Acre Feet) = 2.3372

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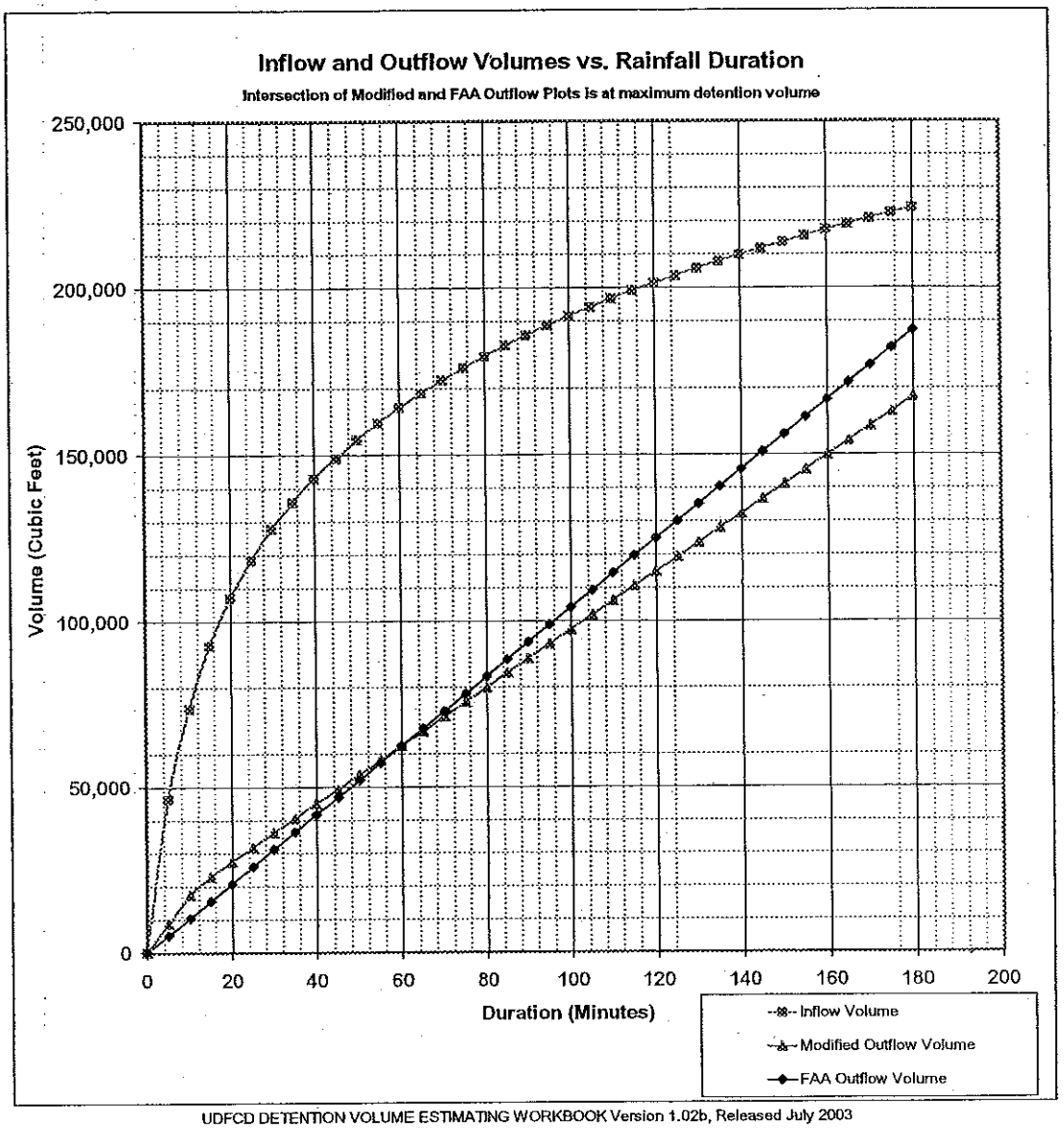

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 10 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	60 percent
Catchment Drainage Area	A =	29.26 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D)
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	14 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.63
Inflow Peak Runoff	Qp-in =	115.48 cfs
Allowable Peak Outflow Rate	Qp-out =	29.26 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.25

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	49,543	1.00	29.26	8,776	40,766
10	7.14	78,942	1.00	29.26	17,553	61,388
15	6.06	99,275	0.95	27.68	25,098	74,179
20	5.18	114,611	0.84	24.57	29,485	85,126
25	4.59	126,636	0.77	22.58	33,674	92,963
30	4.13	136,667	0.71	21.28	38,262	98,704
35	3.76	145,587	0.69	20.31	42,652	102,935
40	3.46	153,107	0.67	19.60	47,041	106,066
45	3.21	159,783	0.66	19.06	51,430	108,352
50	3.00	165,712	0.64	18.61	55,819	109,892
55	2.81	171,113	0.62	18.24	60,208	110,905
60	2.65	176,054	0.61	17.94	64,597	111,457
65	2.51	180,608	0.60	17.69	68,986	111,622
70	2.39	184,833	0.60	17.47	73,375	111,458
75	2.28	188,774	0.59	17.28	77,764	111,010
80	2.18	192,469	0.58	17.12	82,153	110,316
85	2.08	195,947	0.58	16.97	86,542	109,405
90	2.00	199,238	0.58	16.84	90,931	108,308
95	1.93	202,391	0.57	16.73	95,320	107,071
100	1.86	205,316	0.57	16.62	99,709	105,606
105	1.79	208,147	0.56	16.52	104,098	104,044
110	1.73	210,844	0.56	16.44	108,487	102,357
115	1.68	213,433	0.56	16.36	112,878	100,557
120	1.63	215,816	0.56	16.29	117,266	98,552
125	1.58	218,307	0.55	16.22	121,654	96,653
130	1.53	220,610	0.55	16.16	126,043	94,566
135	1.49	222,831	0.55	16.10	130,432	92,399
140	1.45	224,977	0.55	16.05	134,821	90,156
145	1.42	227,054	0.55	16.00	139,210	87,843
150	1.38	229,065	0.55	15.96	143,599	85,466
155	1.35	231,016	0.54	15.91	147,988	83,027
160	1.32	232,910	0.54	15.87	152,377	80,532
165	1.29	234,750	0.54	15.83	156,766	77,984
170	1.26	236,541	0.54	15.80	161,156	75,385
175	1.23	238,284	0.54	15.77	165,549	72,740
180	1.21	239,982	0.54	15.73	169,933	70,049

Stormwater Detention Volume (Cubic Feet) = 111,622
Stormwater Detention Volume (Acre Feet) = 2.5625

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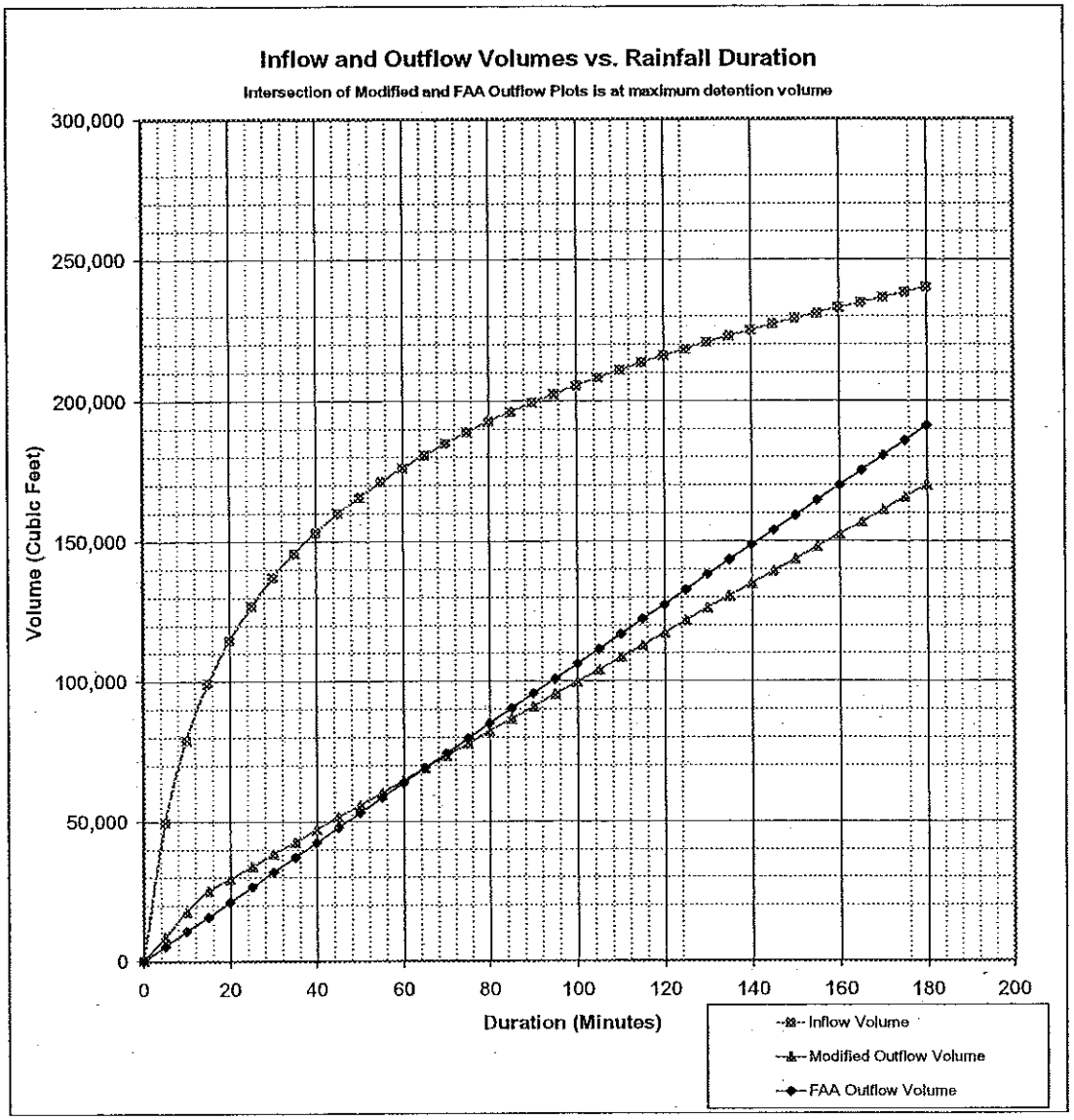

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 11 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	60	percent
Catchment Drainage Area	A =	47.00	acres
Predevelopment NRCS Soil Group	Type =	C	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	16	minutes
Allowable Unit Release Rate (See Table A)	q =	1.00	cfs/acre
One-hour Precipitation	P1 =	2.67	inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3			
Coefficient One	C1 =	28.50	
Coefficient Two	C2 =	10.00	
Coefficient Three	C3 =	0.79	

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.63	
Inflow Peak Runoff	Qp-in =	169.67	cfs
Allowable Peak Outflow Rate	Qp-out =	47.00	cfs
Ratio of Qp-out/Qp-in	Ratio =	0.28	

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (Input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	79,580	1.00	47.00	14,100	65,480
10	7.14	126,804	1.00	47.00	28,200	98,604
15	5.98	159,465	1.00	47.00	42,300	117,165
20	5.18	184,098	0.91	42.78	51,338	132,760
25	4.59	203,738	0.83	38.93	58,388	145,350
30	4.13	220,009	0.77	36.35	65,438	154,570
35	3.76	233,871	0.73	34.52	72,488	161,383
40	3.46	245,935	0.71	33.14	79,538	166,396
45	3.21	256,609	0.68	32.07	86,588	170,021
50	3.00	266,181	0.66	31.21	93,638	172,542
55	2.81	274,857	0.65	30.51	100,688	174,169
60	2.65	282,794	0.64	29.93	107,738	175,056
65	2.51	290,109	0.63	29.43	114,788	175,321
70	2.39	296,895	0.62	29.01	121,838	175,057
75	2.28	303,226	0.61	28.64	128,888	174,338
80	2.18	309,161	0.60	28.32	135,938	173,223
85	2.08	314,748	0.60	28.04	142,988	171,760
90	2.00	320,028	0.59	27.78	150,038	169,990
95	1.93	325,035	0.59	27.56	157,088	167,947
100	1.86	329,796	0.58	27.36	164,138	165,658
105	1.79	334,336	0.58	27.17	171,188	163,148
110	1.73	338,677	0.57	27.01	178,238	160,439
115	1.68	342,835	0.57	26.85	185,288	157,547
120	1.63	346,826	0.57	26.71	192,338	154,488
125	1.58	350,665	0.57	26.59	199,388	151,277
130	1.53	354,363	0.56	26.47	206,438	147,925
135	1.49	357,931	0.56	26.36	213,488	144,442
140	1.45	361,378	0.56	26.25	220,538	140,840
145	1.42	364,713	0.56	26.16	227,588	137,125
150	1.38	367,944	0.55	26.07	234,638	133,306
155	1.35	371,078	0.55	25.99	241,688	129,390
160	1.32	374,120	0.55	25.91	248,738	125,382
165	1.29	377,077	0.55	25.84	255,788	121,289
170	1.26	379,953	0.55	25.77	262,838	117,115
175	1.23	382,753	0.55	25.70	269,888	112,865
180	1.21	385,481	0.55	25.64	276,938	108,543

Stormwater Detention Volume (Cubic Feet) = 175,321
Stormwater Detention Volume (Acre Feet) = 4.0248

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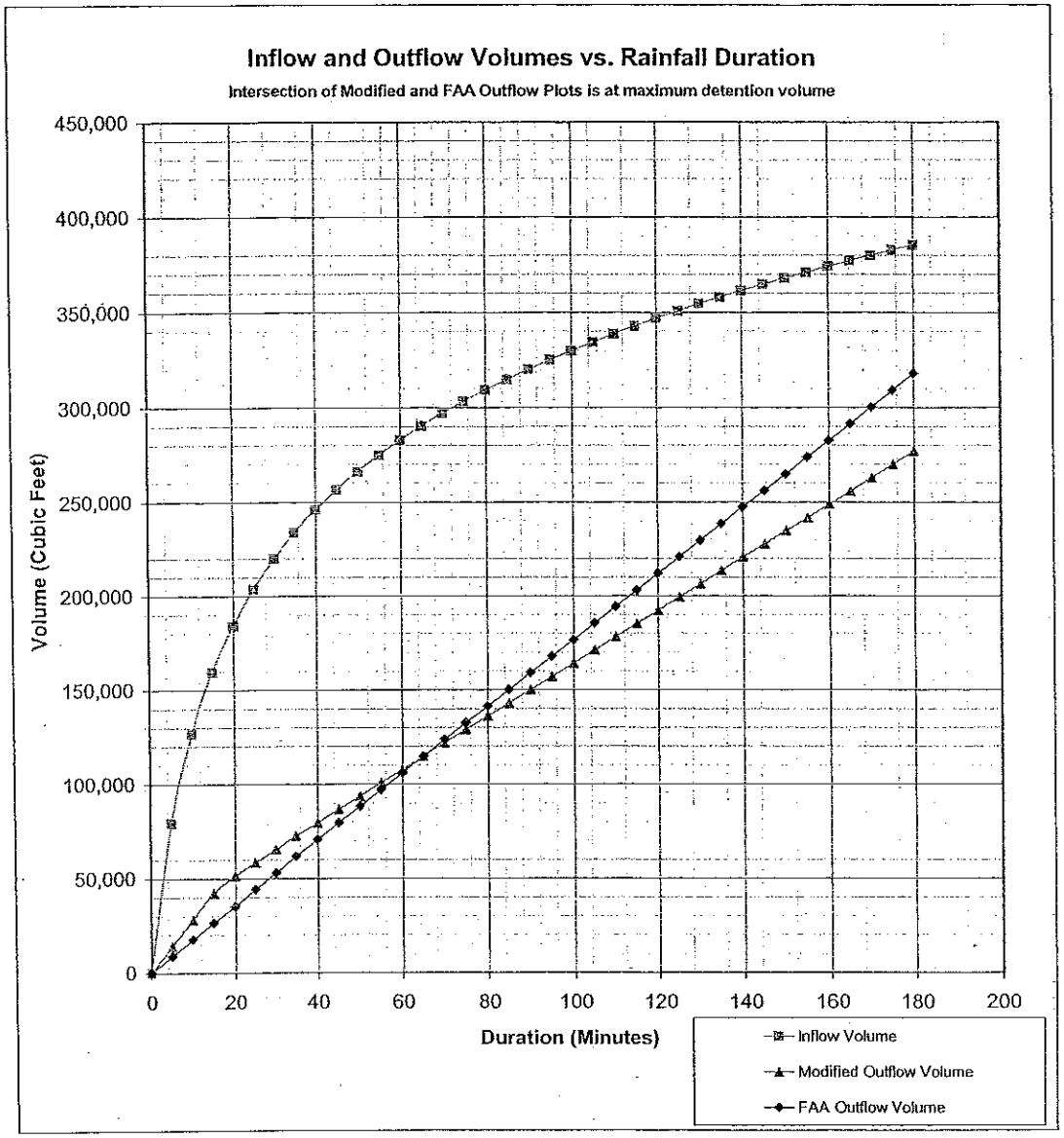


UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 12 Existing Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	90 percent
Catchment Drainage Area	A =	7.60 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	6 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	26.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.83
Inflow Peak Runoff	Qp-in =	32.97 cfs
Allowable Peak Outflow Rate	Qp-out =	7.60 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.14

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

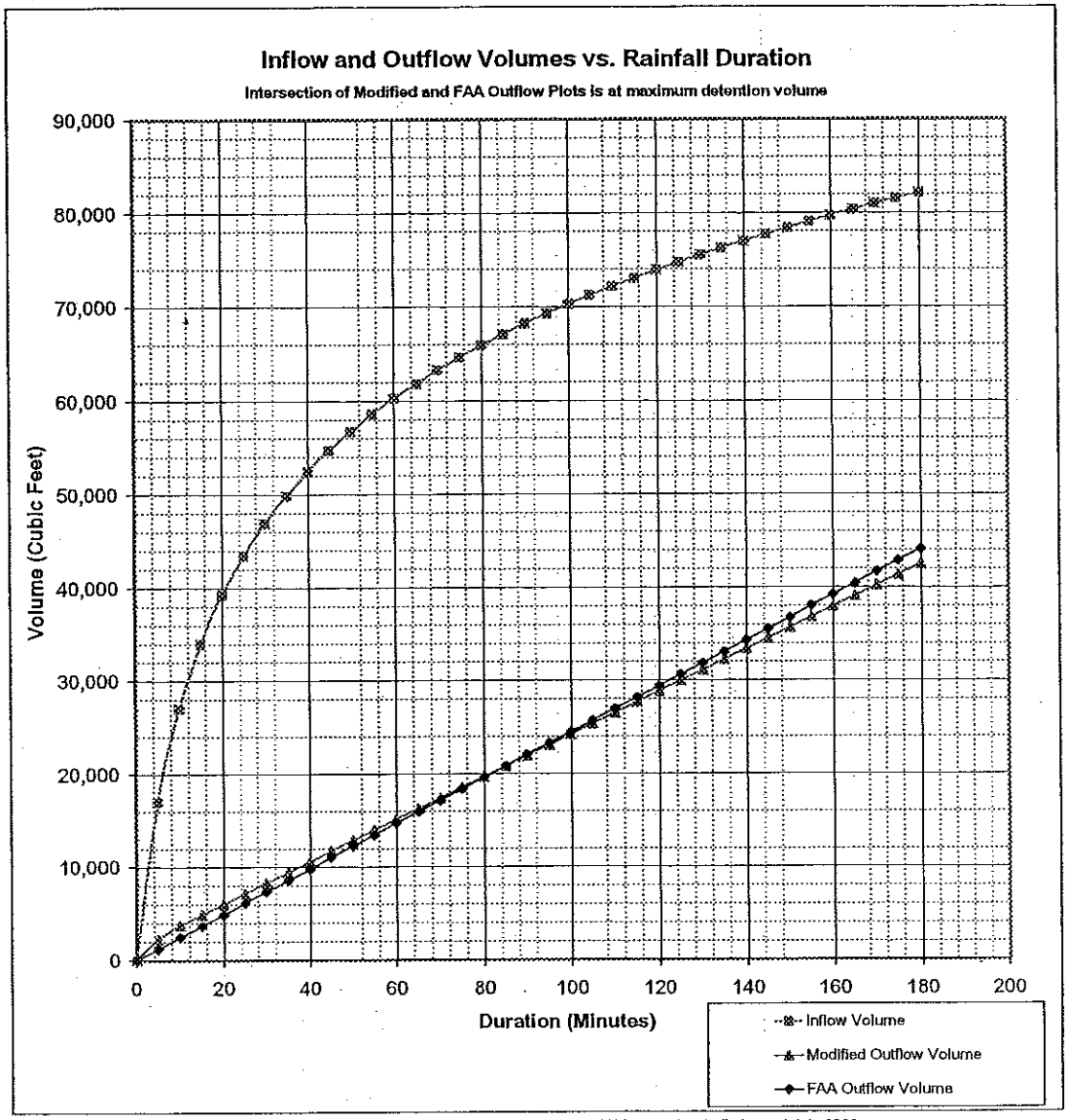
Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	16,963	1.00	7.60	2,280	14,673
10	7.14	27,014	0.81	6.19	3,712	23,302
15	5.96	33,972	0.71	5.39	4,852	29,120
20	5.18	39,220	0.66	4.99	5,992	33,228
25	4.56	43,404	0.63	4.75	7,132	36,272
30	4.13	46,870	0.60	4.60	8,272	38,598
35	3.76	49,823	0.59	4.48	9,412	40,411
40	3.48	52,393	0.58	4.40	10,552	41,841
45	3.21	54,667	0.57	4.33	11,692	42,975
50	3.00	56,706	0.56	4.26	12,832	43,874
55	2.81	58,554	0.55	4.23	13,972	44,583
60	2.65	60,245	0.55	4.20	15,112	45,133
65	2.51	61,804	0.55	4.17	16,252	45,552
70	2.39	63,249	0.54	4.14	17,392	45,858
75	2.28	64,598	0.54	4.12	18,532	46,066
80	2.18	65,862	0.54	4.10	19,672	46,191
85	2.08	67,053	0.54	4.08	20,812	46,241
90	2.00	68,178	0.53	4.07	21,952	46,226
95	1.93	69,244	0.53	4.05	23,092	46,152
100	1.86	70,258	0.53	4.04	24,232	46,027
105	1.79	71,226	0.53	4.03	25,373	45,854
110	1.73	72,150	0.53	4.02	26,512	45,638
115	1.68	73,036	0.53	4.01	27,652	45,384
120	1.63	73,886	0.53	4.00	28,792	45,095
125	1.58	74,704	0.53	3.99	29,932	44,772
130	1.53	75,492	0.52	3.98	31,072	44,420
135	1.49	76,252	0.52	3.98	32,212	44,040
140	1.45	76,987	0.52	3.97	33,352	43,635
145	1.42	77,697	0.52	3.96	34,492	43,205
150	1.38	78,385	0.52	3.96	35,632	42,754
155	1.35	79,053	0.52	3.95	36,772	42,281
160	1.32	79,701	0.52	3.95	37,912	41,789
165	1.29	80,331	0.52	3.94	39,052	41,279
170	1.26	80,944	0.52	3.94	40,192	40,752
175	1.23	81,540	0.52	3.94	41,332	40,208
180	1.21	82,121	0.52	3.93	42,472	39,650

Stormwater Detention Volume (Cubic Feet) = 46,241
Stormwater Detention Volume (Acre Feet) = 1.0615

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003



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Peak Discharge and Detention Volume Calculations
Modified Alignment Onsite Basins

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 1 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
*(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	36 percent
Catchment Drainage Area	A =	106.87 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	55 minutes
Allowable Unit Release Rate (See Table A)	q =	0.11 cfs/acre *
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.48
Inflow Peak Runoff	Qp-in =	143.49 cfs
Allowable Peak Outflow Rate	Qp-out =	11.76 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.08

* Unit release rate was adjusted to produce a release of 12cfs or less per the Southgate Development Drainage Report

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	6.66	137,868	1.00	11.76	3,527	134,341
10	7.14	219,680	1.00	11.76	7,053	212,627
15	5.98	276,263	1.00	11.76	10,580	265,683
20	5.18	318,940	1.00	11.76	14,107	304,833
25	4.59	352,964	1.00	11.76	17,634	335,331
30	4.13	381,152	1.00	11.76	21,160	359,992
35	3.76	405,187	1.00	11.76	24,687	380,481
40	3.46	426,067	1.00	11.76	28,214	397,854
45	3.21	444,660	1.00	11.76	31,740	412,920
50	3.00	461,142	1.00	11.76	35,267	426,875
55	2.81	476,174	1.00	11.76	38,794	437,380
60	2.65	489,923	0.96	11.31	40,719	449,204
65	2.51	502,598	0.94	10.89	42,463	460,114
70	2.39	514,353	0.90	10.53	44,246	470,107
75	2.28	525,321	0.87	10.22	46,009	479,312
80	2.18	535,603	0.85	9.95	47,773	487,830
85	2.09	545,283	0.83	9.71	49,536	495,747
90	2.00	554,430	0.81	9.50	51,300	503,131
95	1.93	563,104	0.79	9.31	53,063	510,041
100	1.86	571,353	0.78	9.14	54,826	516,526
105	1.79	579,216	0.76	8.96	56,590	522,626
110	1.73	586,728	0.75	8.84	58,353	528,375
115	1.68	593,941	0.74	8.71	60,116	533,825
120	1.63	600,856	0.73	8.59	61,880	538,976
125	1.58	607,506	0.72	8.48	63,643	543,863
130	1.53	613,912	0.71	8.30	65,406	548,506
135	1.49	620,094	0.71	8.29	67,170	552,924
140	1.45	626,056	0.70	8.21	68,933	557,133
145	1.42	631,845	0.69	8.13	70,696	561,148
150	1.38	637,442	0.68	8.05	72,460	564,983
155	1.35	642,871	0.68	7.98	74,223	568,648
160	1.32	648,141	0.67	7.92	75,986	572,155
165	1.29	653,263	0.67	7.85	77,750	575,514
170	1.26	658,248	0.66	7.80	79,513	578,735
175	1.23	663,097	0.65	7.74	81,277	581,820
180	1.21	667,823	0.65	7.69	83,040	584,783

Stormwater Detention Volume (Cubic Feet) = 584,783
Stormwater Detention Volume (Acre Feet) = 13.4248

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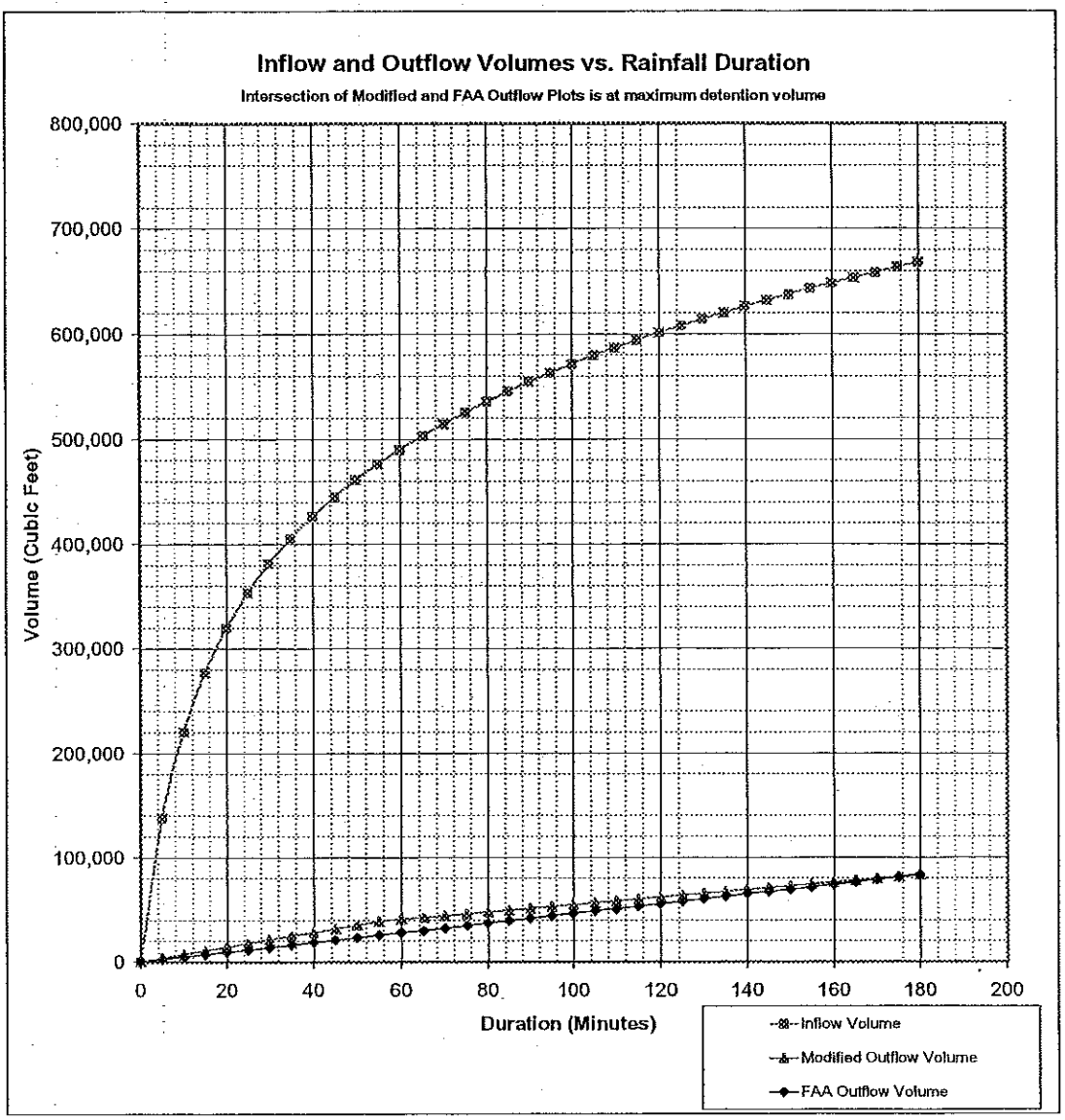

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 2 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	60 percent
Catchment Drainage Area	A =	22.92 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	18 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.78

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.56
Inflow Peak Runoff	Qp-in =	71.25 cfs
Allowable Peak Outflow Rate	Qp-out =	19.48 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.27

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	34,496	1.00	19.48	5,845	28,651
10	7.14	54,966	1.00	19.48	11,689	43,277
15	5.98	69,124	1.00	19.48	17,534	51,590
20	5.18	79,802	0.94	18.27	21,923	57,879
25	4.59	88,316	0.85	16.56	24,845	63,470
30	4.13	95,368	0.79	15.43	27,768	67,601
35	3.76	101,377	0.75	14.61	30,690	70,687
40	3.46	106,607	0.72	14.01	33,612	72,994
45	3.21	111,234	0.69	13.51	36,535	74,699
50	3.00	115,383	0.66	13.15	39,457	75,926
55	2.81	119,144	0.66	12.84	42,379	76,766
60	2.65	122,584	0.65	12.56	45,301	77,283
65	2.51	125,765	0.63	12.37	48,224	77,541
70	2.39	128,697	0.63	12.18	51,146	77,550
75	2.28	131,441	0.62	12.02	54,068	77,372
80	2.18	134,013	0.61	11.87	56,991	77,023
85	2.08	136,435	0.60	11.75	59,913	76,522
90	2.00	138,724	0.60	11.64	62,835	75,889
95	1.93	140,895	0.59	11.54	65,758	75,137
100	1.86	142,958	0.59	11.45	68,680	74,279
105	1.79	144,927	0.58	11.37	71,602	73,324
110	1.73	146,808	0.58	11.29	74,524	72,283
115	1.68	148,610	0.58	11.22	77,447	71,164
120	1.63	150,341	0.57	11.15	80,369	69,973
125	1.58	152,004	0.57	11.11	83,291	68,713
130	1.53	153,607	0.57	11.05	86,214	67,394
135	1.49	155,154	0.56	11.00	89,136	66,018
140	1.45	156,648	0.56	10.96	92,058	64,590
145	1.42	158,094	0.56	10.92	94,981	63,114
150	1.38	159,495	0.56	10.88	97,903	61,592
155	1.35	160,853	0.56	10.84	100,825	60,028
160	1.32	162,172	0.55	10.81	103,747	58,424
165	1.29	163,453	0.55	10.77	106,670	56,784
170	1.26	164,700	0.55	10.74	109,592	55,108
175	1.23	165,914	0.55	10.72	112,514	53,399
180	1.21	167,096	0.55	10.69	115,437	51,660

Stormwater Detention Volume (Cubic Feet) = 77,550
Stormwater Detention Volume (Acre Feet) = 1.7803

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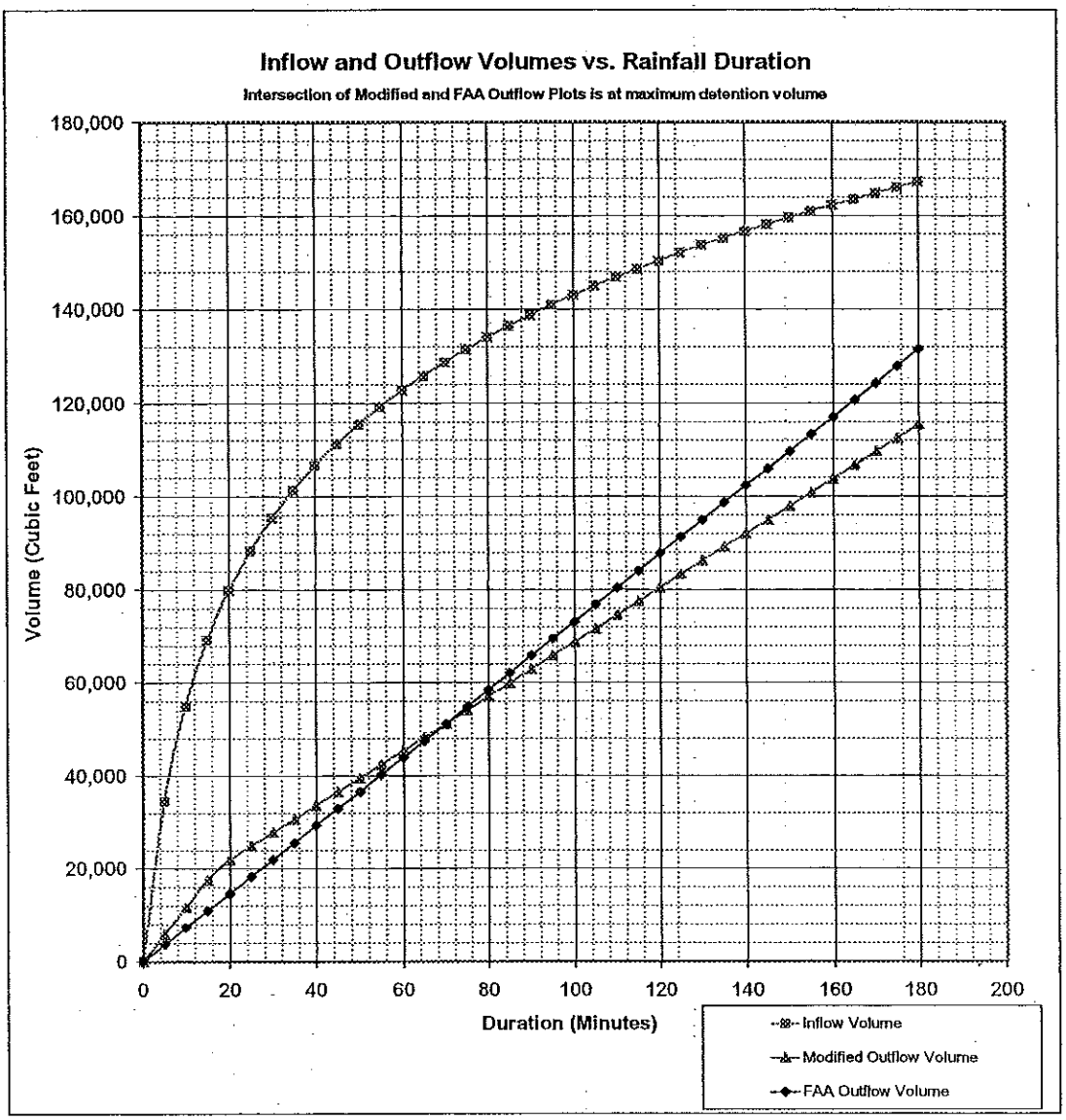

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 3 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	40 percent
Catchment Drainage Area	A =	16.01 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	14 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.50
Inflow Peak Runoff	Qp-in =	45.37 cfs
Allowable Peak Outflow Rate	Qp-out =	13.44 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.27

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	6.96	21,746	1.00	13.44	4,032	17,714
10	7.14	33,553	1.00	13.44	8,063	25,790
15	5.98	42,572	0.96	12.85	11,962	31,010
20	5.18	49,149	0.84	11.32	13,576	35,571
25	4.59	54,392	0.77	10.40	16,594	38,798
30	4.13	58,736	0.73	9.78	17,610	41,126
35	3.76	62,437	0.70	9.39	19,626	42,811
40	3.46	65,657	0.67	9.02	21,641	44,016
45	3.21	68,507	0.65	8.76	23,657	44,850
50	3.00	71,062	0.64	8.58	25,673	45,389
55	2.81	73,379	0.62	8.39	27,689	45,690
60	2.65	75,498	0.61	8.25	29,704	45,793
65	2.51	77,450	0.61	8.13	31,720	45,730
70	2.39	79,262	0.60	8.03	33,736	45,526
75	2.28	80,952	0.59	7.94	35,752	45,201
80	2.18	82,537	0.59	7.87	37,768	44,769
85	2.09	84,028	0.58	7.80	39,783	44,245
90	2.00	85,438	0.58	7.74	41,799	43,639
95	1.93	86,775	0.57	7.69	43,815	42,960
100	1.86	88,046	0.57	7.64	45,831	42,215
105	1.79	89,256	0.57	7.59	47,846	41,412
110	1.73	90,417	0.56	7.55	49,862	40,556
115	1.68	91,527	0.56	7.52	51,878	39,649
120	1.63	92,592	0.56	7.48	53,894	38,699
125	1.58	93,617	0.56	7.46	55,910	37,706
130	1.53	94,604	0.55	7.43	57,925	36,679
135	1.49	95,557	0.55	7.40	59,941	35,616
140	1.45	96,477	0.55	7.38	61,957	34,520
145	1.42	97,366	0.55	7.35	63,973	33,395
150	1.38	98,230	0.56	7.33	65,988	32,242
155	1.35	99,067	0.54	7.31	68,004	31,063
160	1.32	99,879	0.54	7.29	70,020	29,859
165	1.29	100,668	0.54	7.28	72,036	28,633
170	1.26	101,436	0.54	7.26	74,052	27,385
175	1.23	102,184	0.54	7.24	76,067	26,118
180	1.21	102,912	0.54	7.23	78,083	24,829

Stormwater Detention Volume (Cubic Feet) = 45,793
Stormwater Detention Volume (Acre Feet) = 1.0513

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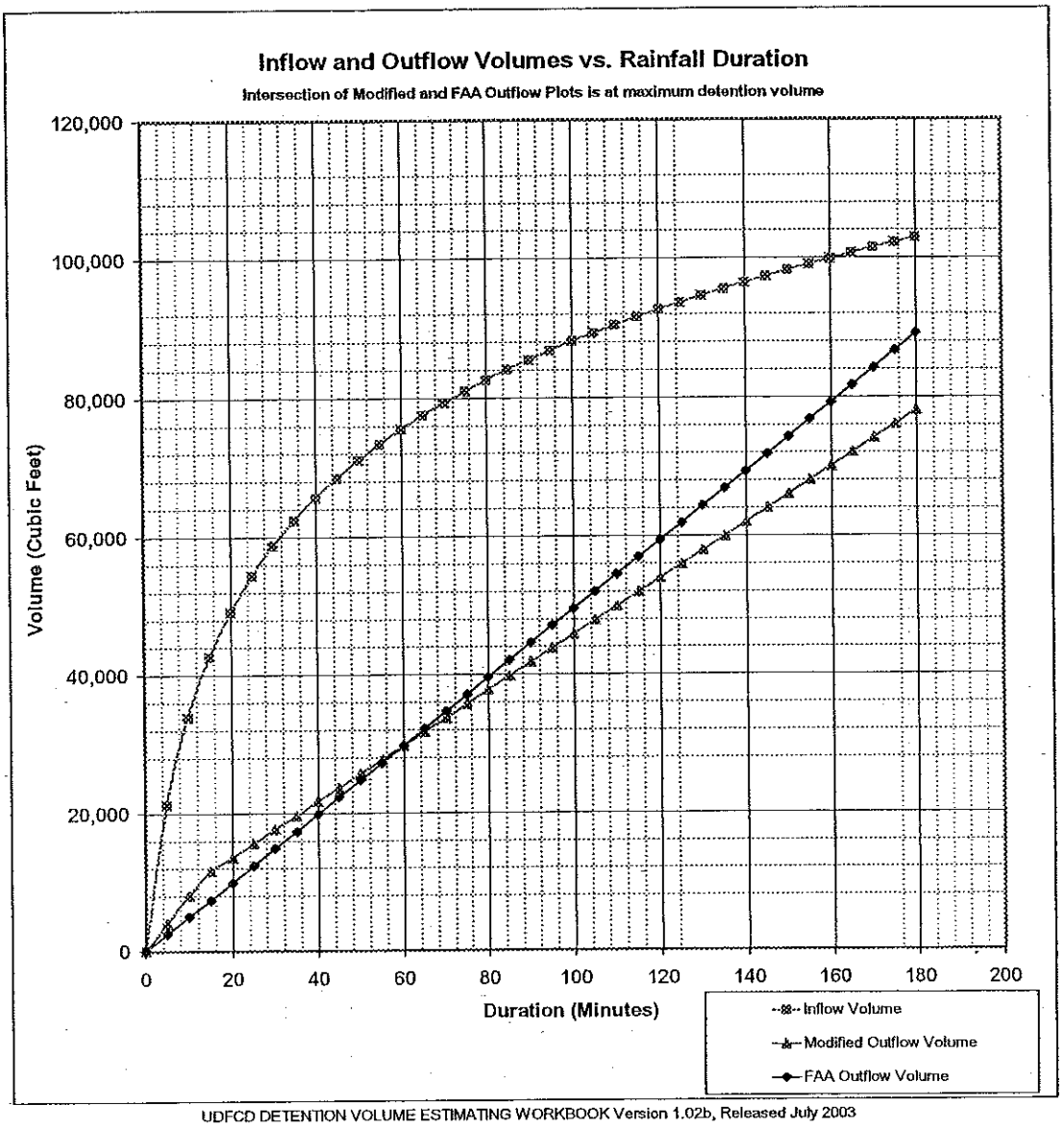

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 4 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	60	percent
Catchment Drainage Area	A =	51.80	acres
Predevelopment NRCS Soil Group	Type =	B	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	17	minutes
Allowable Unit Release Rate (See Table A)	q =	0.85	cfs/acre
One-hour Precipitation	P1 =	2.67	inches

Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3

Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.56	
Inflow Peak Runoff	Qp-in =	162.34	cfs
Allowable Peak Outflow Rate	Qp-out =	44.03	cfs
Ratio of Qp-out/Qp-in	Ratio =	0.27	

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (Input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	72,962	1.00	44.03	13,209	64,753
10	7.14	124,229	1.00	44.03	26,418	97,808
15	5.98	156,223	1.00	44.03	39,627	116,596
20	5.18	180,355	0.93	40.96	49,151	131,205
25	4.59	199,566	0.84	37.17	55,755	143,841
30	4.13	215,526	0.79	34.64	62,360	153,176
35	3.76	229,116	0.75	32.84	68,964	160,152
40	3.46	240,934	0.72	31.49	75,569	165,366
45	3.21	251,302	0.69	30.43	82,173	169,219
50	3.00	260,789	0.67	29.59	88,778	171,991
55	2.81	269,209	0.66	28.90	95,382	173,687
60	2.65	277,044	0.64	28.33	101,987	175,057
65	2.51	284,210	0.63	27.84	108,591	175,619
70	2.39	290,859	0.62	27.43	115,196	175,663
75	2.28	297,051	0.61	27.07	121,800	175,251
80	2.18	302,875	0.61	26.75	128,405	174,470
85	2.09	308,349	0.60	26.47	135,009	173,340
90	2.00	313,522	0.60	26.22	141,614	171,908
95	1.93	318,427	0.59	26.00	148,218	170,208
100	1.86	323,091	0.59	25.80	154,823	168,268
105	1.79	327,539	0.58	25.62	161,427	166,112
110	1.73	331,791	0.58	25.46	168,032	163,759
115	1.68	335,864	0.57	25.31	174,636	161,228
120	1.63	339,775	0.57	25.17	181,241	158,534
125	1.58	343,535	0.57	25.05	187,845	155,690
130	1.53	347,156	0.57	24.93	194,450	152,706
135	1.49	350,654	0.56	24.82	201,054	149,599
140	1.45	354,041	0.56	24.72	207,659	146,372
145	1.42	357,296	0.56	24.63	214,263	143,035
150	1.38	360,464	0.56	24.54	220,868	139,596
155	1.35	363,534	0.56	24.46	227,472	136,061
160	1.32	366,514	0.55	24.38	234,077	132,437
165	1.29	369,410	0.55	24.31	240,681	128,729
170	1.26	372,226	0.55	24.24	247,286	124,942
175	1.23	374,971	0.55	24.18	253,890	121,081
180	1.21	377,644	0.55	24.12	260,495	117,149

Stormwater Detention Volume (Cubic Feet) = 175,663
Stormwater Detention Volume (Acre Feet) = 4.0327

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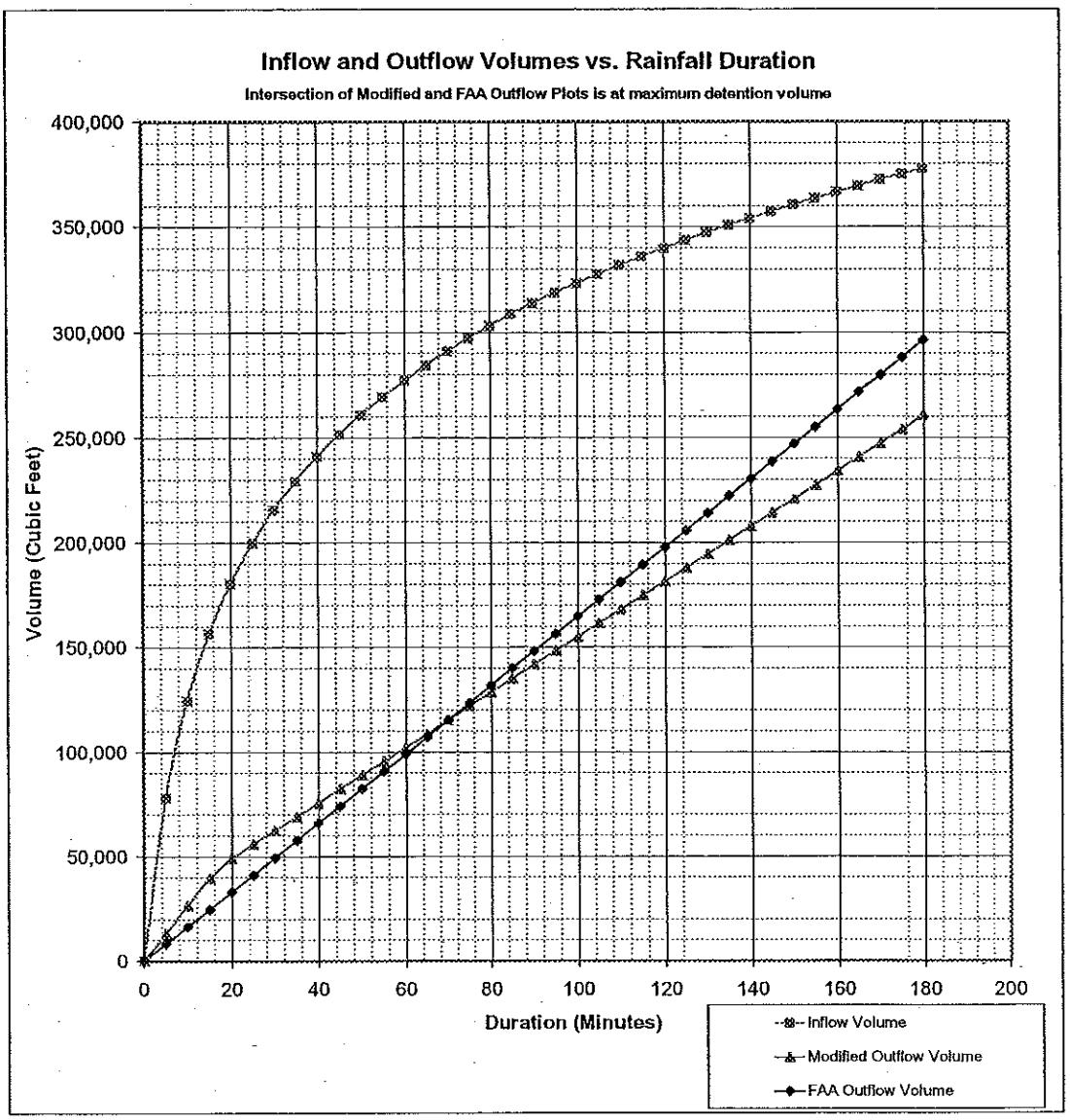

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 5 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	40 percent
Catchment Drainage Area	A =	16.25 acres
Predevelopment NRCS Soil Group	Type =	A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	20 minutes
Allowable Unit Release Rate (See Table A)	q =	0.50 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.41
Inflow Peak Runoff	Qp-in =	34.05 cfs
Allowable Peak Outflow Rate	Qp-out =	8.14 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.23

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	17,939	1.00	8.14	2,442	15,497
10	7.14	28,586	1.00	8.14	4,884	23,701
15	5.98	35,947	1.00	8.14	7,326	28,621
20	5.18	41,500	0.99	8.06	9,670	31,830
25	4.59	45,927	0.89	7.26	10,891	35,036
30	4.13	49,505	0.83	6.73	12,112	37,393
35	3.76	52,720	0.78	6.35	13,333	39,387
40	3.46	55,440	0.75	6.05	14,554	40,885
45	3.21	57,846	0.72	5.84	15,775	42,070
50	3.00	60,003	0.70	5.67	16,995	43,007
55	2.81	61,959	0.68	5.52	18,217	43,742
60	2.65	63,748	0.66	5.40	19,436	44,310
65	2.51	65,397	0.65	5.30	20,659	44,738
70	2.39	66,927	0.64	5.21	21,880	45,047
75	2.28	68,354	0.63	5.13	23,101	45,253
80	2.18	69,692	0.62	5.07	24,322	45,370
85	2.08	70,952	0.62	5.01	25,543	45,408
90	2.00	72,142	0.61	4.96	26,764	45,378
95	1.93	73,271	0.60	4.91	27,985	45,285
100	1.86	74,344	0.60	4.87	29,206	45,138
105	1.79	75,367	0.59	4.83	30,427	44,940
110	1.73	76,349	0.59	4.80	31,646	44,697
115	1.68	77,293	0.59	4.76	32,869	44,414
120	1.63	78,183	0.58	4.73	34,090	44,093
125	1.58	79,046	0.58	4.71	35,311	43,737
130	1.53	79,882	0.58	4.68	36,532	43,349
135	1.49	80,686	0.57	4.66	37,753	42,933
140	1.45	81,463	0.57	4.64	38,974	42,489
145	1.42	82,216	0.57	4.62	40,195	42,020
150	1.38	82,943	0.57	4.60	41,416	41,527
155	1.35	83,650	0.56	4.58	42,637	41,013
160	1.32	84,336	0.56	4.57	43,858	40,477
165	1.29	85,002	0.56	4.56	45,079	39,923
170	1.26	85,650	0.56	4.54	46,300	39,350
175	1.23	86,282	0.55	4.53	47,521	38,760
180	1.21	86,897	0.55	4.51	48,742	38,154

Stormwater Detention Volume (Cubic Feet) = 45,408
Stormwater Detention Volume (Acre Feet) = 1.0424

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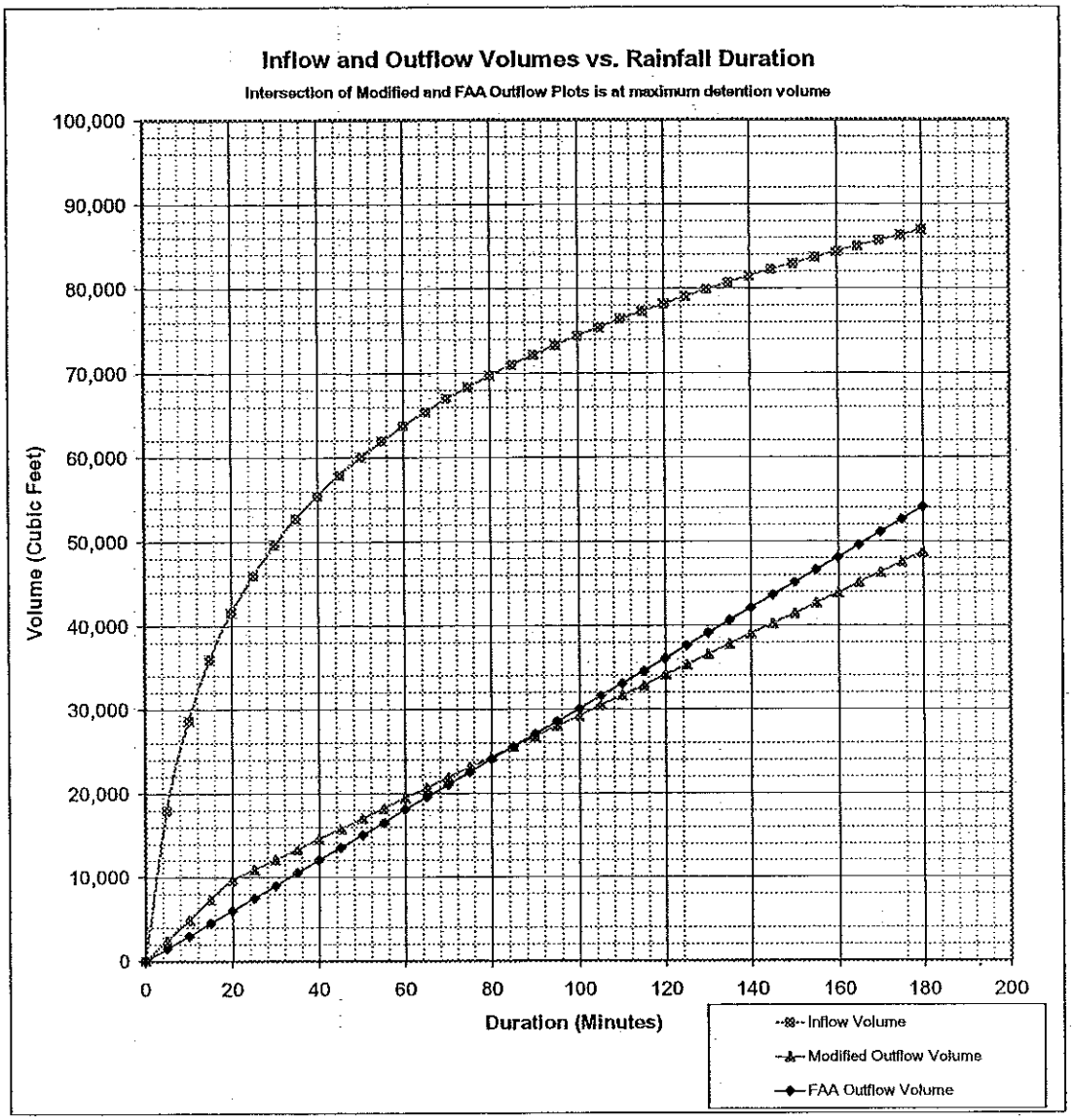

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 6 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	55 percent
Catchment Drainage Area	A =	85.84 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	18 minutes
Allowable Unit Release Rate (See Table A)	q =	0.65 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.54
Inflow Peak Runoff	Qp-in =	207.84 cfs
Allowable Peak Outflow Rate	Qp-out =	55.96 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.27

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	95,564	1.00	55.96	16,789	78,765
10	7.14	152,257	1.00	55.96	33,578	118,679
15	5.98	191,474	1.00	55.96	50,368	141,106
20	5.16	221,052	0.89	50.02	60,021	161,031
25	4.59	244,634	0.82	45.61	68,416	176,218
30	4.13	264,171	0.76	42.97	76,811	187,360
35	3.76	280,818	0.73	40.57	85,205	195,610
40	3.46	295,301	0.70	39.00	93,600	201,701
45	3.21	308,118	0.68	37.78	101,994	206,124
50	3.00	319,611	0.66	36.80	110,389	209,222
55	2.81	330,029	0.64	35.80	118,784	211,245
60	2.65	339,559	0.63	35.33	127,178	212,380
65	2.51	348,342	0.62	34.78	135,573	212,768
70	2.39	356,499	0.61	34.28	143,967	212,532
75	2.28	364,092	0.61	33.86	152,362	211,730
80	2.18	371,218	0.60	33.49	160,757	210,462
85	2.08	377,927	0.60	33.17	169,151	208,776
90	2.00	384,267	0.59	32.88	177,546	206,722
95	1.93	390,278	0.58	32.62	185,940	204,338
100	1.86	395,986	0.58	32.39	194,335	201,651
105	1.79	401,448	0.58	32.18	202,730	198,718
110	1.73	406,659	0.57	31.99	211,124	195,535
115	1.68	411,652	0.57	31.81	219,519	192,133
120	1.63	416,444	0.57	31.65	227,913	188,531
125	1.58	421,054	0.56	31.51	236,308	184,746
130	1.53	425,494	0.56	31.37	244,703	180,791
135	1.49	429,778	0.56	31.25	253,097	176,681
140	1.45	433,917	0.56	31.13	261,492	172,425
145	1.42	437,922	0.55	31.02	269,886	168,036
150	1.38	441,802	0.55	30.92	278,281	163,521
155	1.35	445,564	0.55	30.83	286,676	158,889
160	1.32	449,217	0.55	30.74	295,070	154,147
165	1.29	452,767	0.55	30.66	303,465	149,302
170	1.26	456,220	0.55	30.57	311,859	144,361
175	1.23	459,582	0.55	30.50	320,254	139,328
180	1.21	462,858	0.54	30.43	328,649	134,210

Stormwater Detention Volume (Cubic Feet) = 212,769
Stormwater Detention Volume (Acre Feet) = 4.8845

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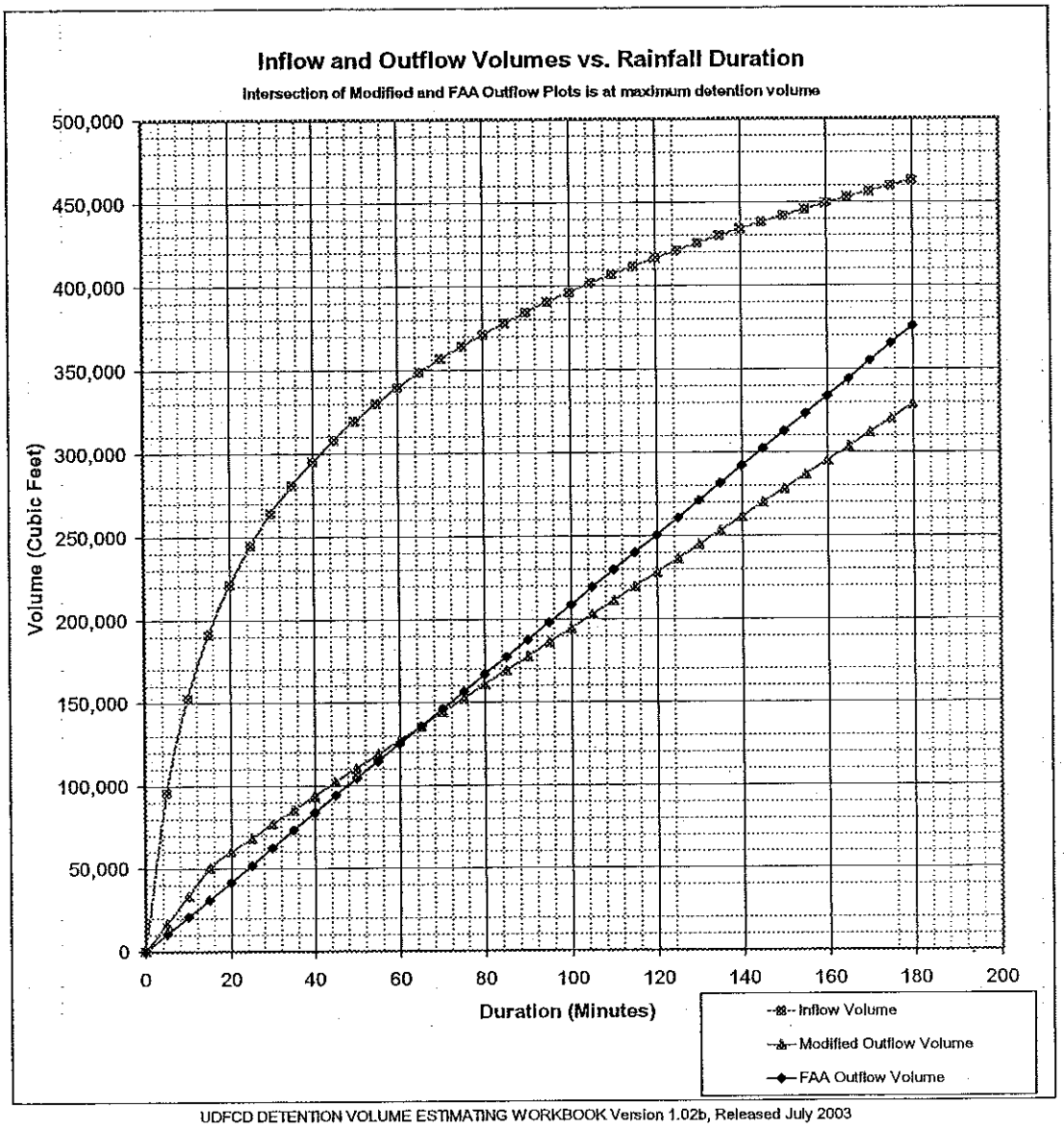

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume 1 Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 7 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	50 percent
Catchment Drainage Area	A =	40.23 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	12 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.52
Inflow Peak Runoff	Qp-in =	49.35 cfs
Allowable Peak Outflow Rate	Qp-out =	34.20 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.24

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	56,224	1.00	34.20	10,259	45,965
10	7.14	89,587	1.00	34.20	20,517	69,070
15	5.96	112,883	0.89	30.35	27,319	85,344
20	5.16	130,066	0.79	27.04	32,446	97,618
25	4.58	143,942	0.73	25.05	37,577	106,364
30	4.12	155,437	0.69	23.73	42,707	112,730
35	3.76	165,231	0.67	22.78	47,836	117,395
40	3.46	173,754	0.65	22.07	52,965	120,788
45	3.21	181,296	0.63	21.52	58,095	123,201
50	3.00	188,058	0.62	21.07	63,224	124,834
55	2.81	194,168	0.61	20.71	68,353	125,814
60	2.65	199,793	0.60	20.41	73,483	126,312
65	2.51	204,964	0.59	20.16	78,612	126,351
70	2.39	209,758	0.58	19.94	83,741	126,018
75	2.28	214,230	0.58	19.75	88,871	125,360
80	2.18	218,423	0.57	19.58	94,000	124,423
85	2.09	222,371	0.57	19.44	99,129	123,242
90	2.00	226,101	0.56	19.31	104,259	121,843
95	1.93	229,639	0.56	19.19	109,388	120,251
100	1.86	233,002	0.56	19.09	114,517	118,485
105	1.79	236,210	0.56	18.99	119,647	116,564
110	1.73	239,277	0.56	18.91	124,776	114,501
115	1.68	242,214	0.55	18.83	129,905	112,309
120	1.63	245,034	0.55	18.75	135,035	110,000
125	1.58	247,746	0.55	18.69	140,164	107,582
130	1.53	250,359	0.54	18.63	145,293	105,066
135	1.49	252,880	0.54	18.57	150,423	102,457
140	1.45	255,315	0.54	18.52	155,552	99,763
145	1.42	257,672	0.54	18.47	160,681	96,990
150	1.38	259,954	0.54	18.42	165,811	94,144
155	1.35	262,168	0.54	18.38	170,940	91,228
160	1.32	264,318	0.54	18.34	176,069	88,248
165	1.29	266,406	0.54	18.30	181,199	85,208
170	1.26	268,436	0.53	18.27	186,328	82,110
175	1.23	270,415	0.53	18.23	191,457	78,959
180	1.21	272,344	0.53	18.20	196,587	75,758

Stormwater Detention Volume (Cubic Feet) = 126,351
Stormwater Detention Volume (Acre Feet) = 2.9006

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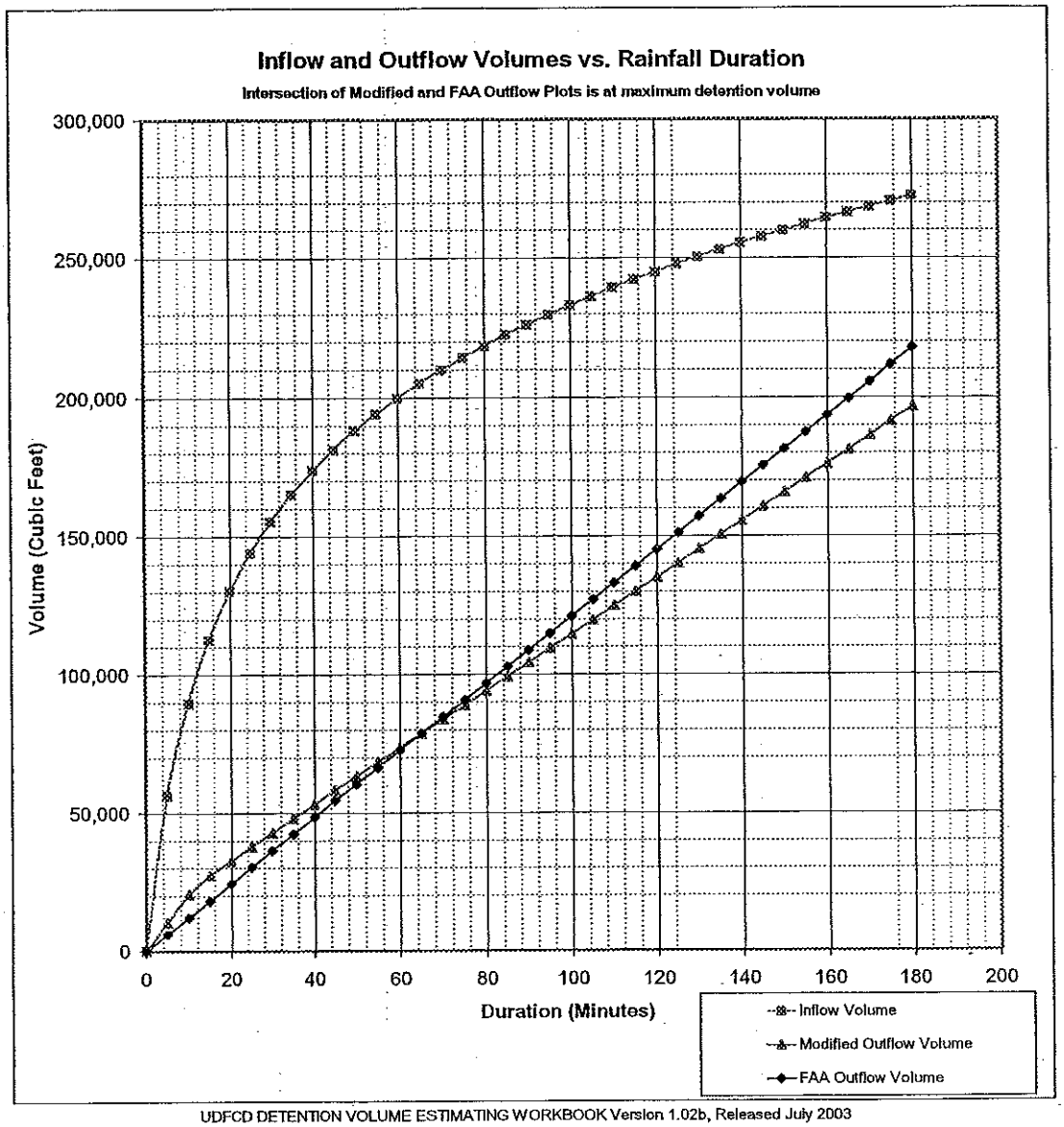

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 8 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	40 percent
Catchment Drainage Area	A =	16.11 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	9 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.50
Inflow Peak Runoff	Qp-in =	58.60 cfs
Allowable Peak Outflow Rate	Qp-out =	13.69 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.23

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.29	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	4.96	21,649	1.00	13.69	4,106	17,541
10	7.14	34,495	0.97	13.31	7,988	26,509
15	5.96	43,380	0.81	11.18	10,040	33,340
20	5.18	50,051	0.74	10.08	12,094	37,957
25	4.59	55,424	0.69	9.43	14,148	41,276
30	4.13	59,850	0.66	9.00	16,202	43,648
35	3.76	63,621	0.63	8.69	18,256	45,365
40	3.46	66,903	0.62	8.45	20,310	46,593
45	3.21	69,807	0.60	8.26	22,364	47,443
50	3.00	72,411	0.59	8.14	24,418	47,993
55	2.81	74,771	0.59	8.02	26,472	48,299
60	2.65	76,930	0.58	7.92	28,526	48,404
65	2.51	78,920	0.57	7.84	30,580	48,340
70	2.39	80,766	0.57	7.77	32,634	48,132
75	2.28	82,488	0.56	7.71	34,688	47,800
80	2.18	84,103	0.56	7.65	36,742	47,361
85	2.09	85,623	0.56	7.61	38,796	46,827
90	2.00	87,059	0.55	7.58	40,850	46,209
95	1.93	88,421	0.55	7.53	42,904	45,517
100	1.86	89,717	0.55	7.49	44,958	44,758
105	1.79	90,952	0.54	7.46	47,013	43,939
110	1.72	92,132	0.54	7.43	49,067	43,066
115	1.66	93,264	0.54	7.41	51,121	42,143
120	1.63	94,349	0.54	7.39	53,175	41,175
125	1.58	95,394	0.54	7.36	55,229	40,166
130	1.53	96,400	0.54	7.34	57,283	39,117
135	1.49	97,370	0.53	7.33	59,337	38,034
140	1.45	98,306	0.53	7.31	61,391	36,917
145	1.42	99,215	0.53	7.29	63,445	35,771
150	1.38	100,094	0.53	7.28	65,499	34,596
155	1.35	100,947	0.53	7.26	67,553	33,394
160	1.32	101,774	0.53	7.25	69,607	32,168
165	1.29	102,578	0.53	7.24	71,661	30,918
170	1.26	103,361	0.53	7.22	73,715	29,646
175	1.23	104,123	0.53	7.22	75,769	28,354
180	1.21	104,865	0.53	7.21	77,823	27,042

Stormwater Detention Volume (Cubic Feet) = 48,404
Stormwater Detention Volume (Acre Feet) = 1.1112

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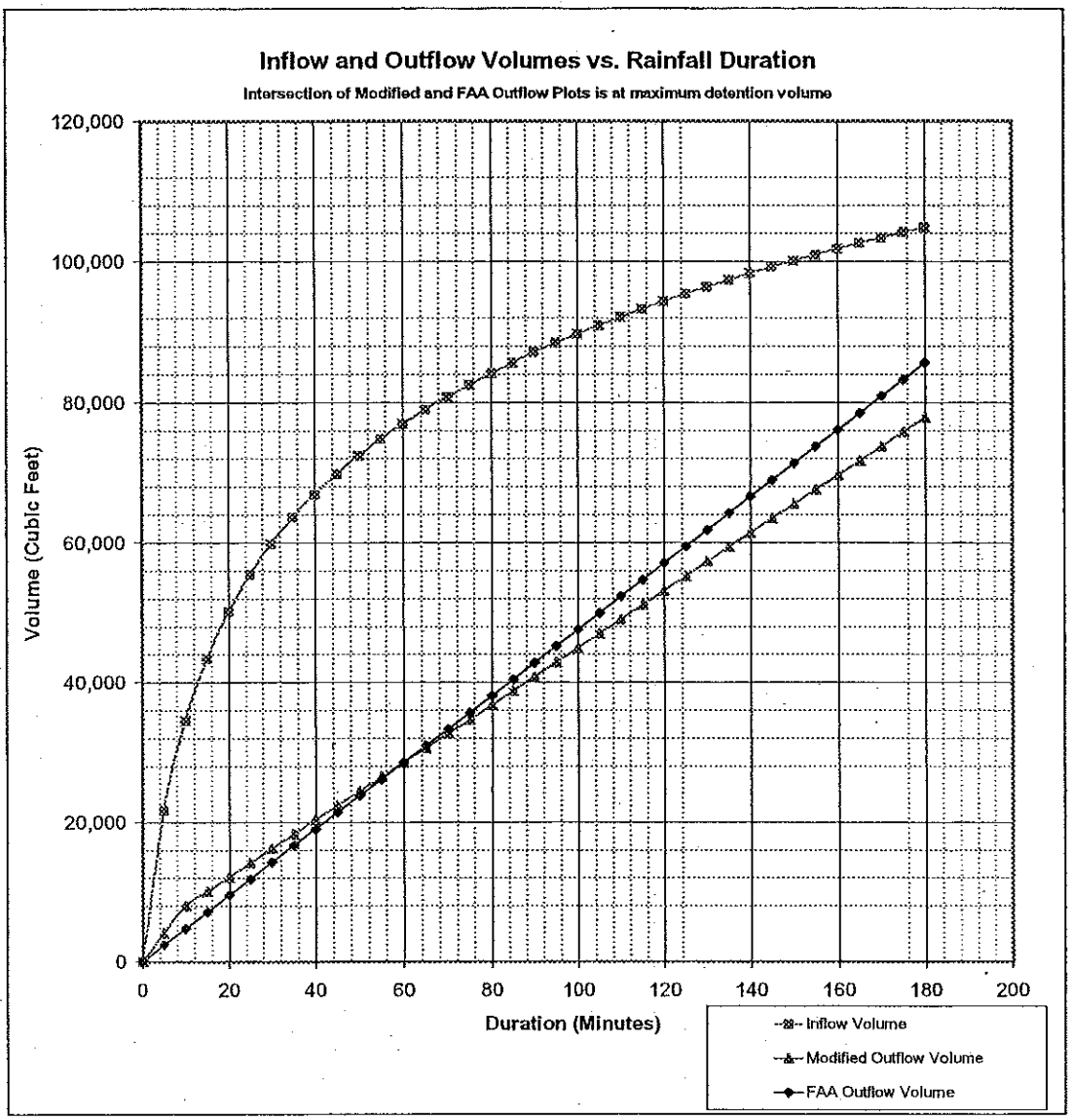

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Public Freeway
Basin ID: Pond 8a Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):		
Catchment Drainage Imperviousness	I_a =	40 percent
Catchment Drainage Area	A =	31.00 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	11 minutes
Allowable Unit Release Rate (See Table A)	q =	0.65 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	24.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):		
Runoff Coefficient	C =	0.50
Inflow Peak Runoff	Qp-in =	105.89 cfs
Allowable Peak Outflow Rate	Qp-out =	20.35 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.25

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	4.96	41,653	1.90	26.35	7,905	33,748
10	7.14	59,978	1.00	20.35	15,810	50,568
15	5.98	83,475	0.87	22.96	20,664	62,812
20	5.16	96,370	0.78	20.51	24,616	71,754
25	4.59	106,661	0.72	19.05	28,569	78,092
30	4.19	115,188	0.68	18.07	32,521	82,667
35	3.76	122,425	0.66	17.37	36,474	85,951
40	3.46	128,740	0.64	16.84	40,426	88,314
45	3.21	134,378	0.62	16.44	44,379	89,999
50	3.00	139,438	0.61	16.11	48,331	91,107
55	2.83	143,892	0.60	15.84	52,284	91,608
60	2.65	148,034	0.59	15.62	56,236	91,798
65	2.51	151,664	0.59	15.43	60,189	91,475
70	2.39	156,416	0.58	15.27	64,141	91,276
75	2.28	158,730	0.57	15.13	68,094	90,636
80	2.18	161,637	0.57	15.01	72,046	89,791
85	2.08	164,763	0.57	14.90	75,999	88,763
90	2.00	167,528	0.56	14.81	79,951	87,575
95	1.93	170,147	0.56	14.72	83,904	86,243
100	1.86	172,639	0.56	14.64	87,856	84,783
105	1.79	175,016	0.55	14.57	91,809	83,207
110	1.73	177,288	0.55	14.51	95,761	81,527
115	1.68	179,464	0.55	14.45	99,714	79,751
120	1.63	181,554	0.55	14.40	103,666	77,888
125	1.58	183,563	0.54	14.35	107,619	75,944
130	1.53	185,499	0.54	14.30	111,571	73,928
135	1.49	187,367	0.54	14.26	115,524	71,843
140	1.45	189,171	0.54	14.22	119,476	69,695
145	1.42	190,917	0.54	14.19	123,429	67,488
150	1.38	192,609	0.54	14.15	127,381	65,227
155	1.35	194,249	0.54	14.12	131,334	62,915
160	1.32	195,841	0.53	14.09	135,286	60,555
165	1.29	197,388	0.53	14.06	139,239	58,150
170	1.26	198,894	0.53	14.04	143,191	55,703
175	1.23	200,360	0.53	14.01	147,144	53,217
180	1.21	201,788	0.53	13.99	151,096	50,692

Stormwater Detention Volume (Cubic Feet) = 91,798
Stormwater Detention Volume (Acre Feet) = 2.1074

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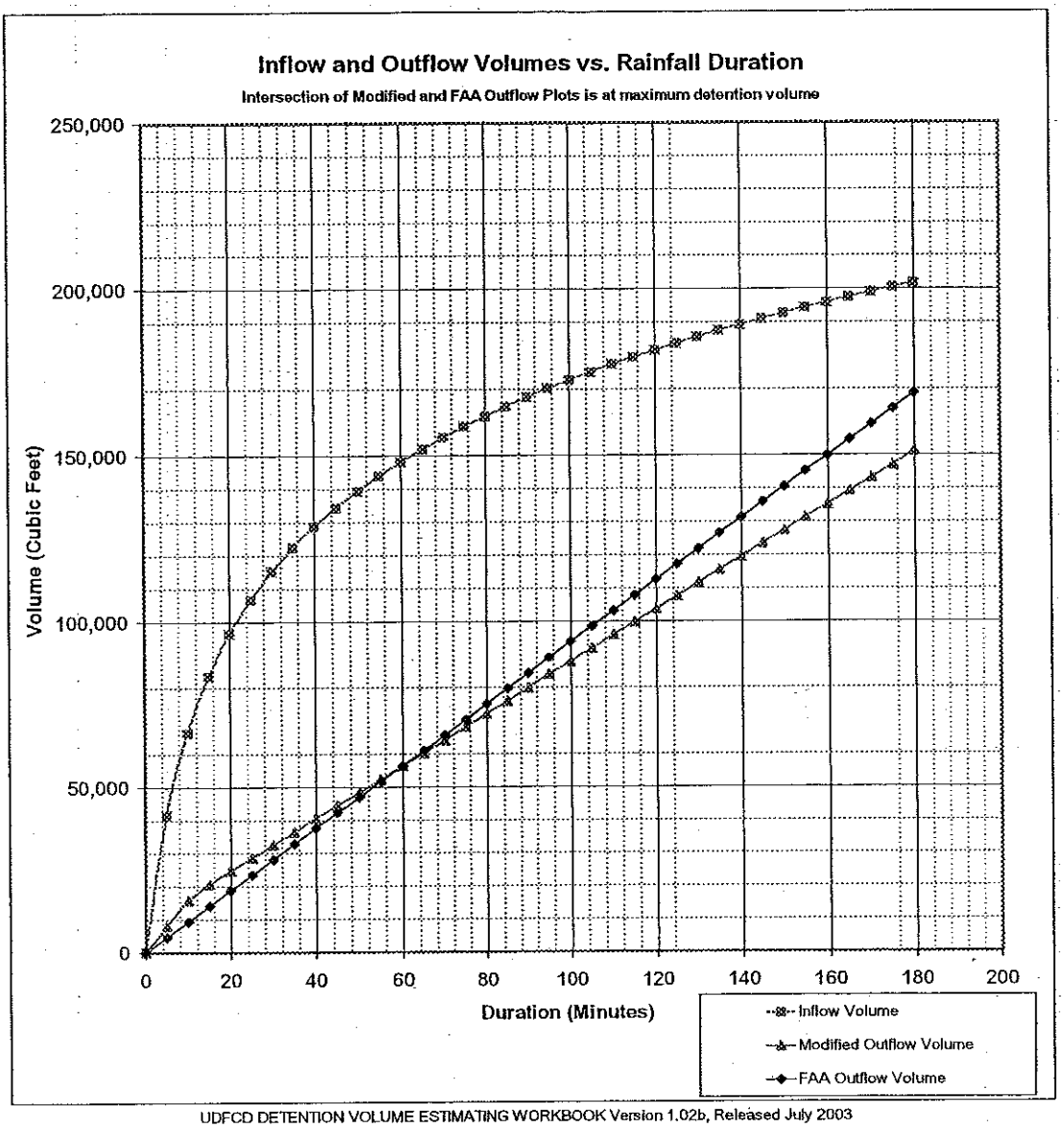

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 9 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	45 percent
Catchment Drainage Area	A =	29.14 acres
Predevelopment NRCS Soil Group	Type =	D (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	11 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.59
Inflow Peak Runoff	Qp-in =	116.45 cfs
Allowable Peak Outflow Rate	Qp-out =	29.14 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.25

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	6.56	46,207	1.00	29.14	8,742	37,465
10	7.14	73,627	1.00	29.14	17,484	56,143
15	5.98	92,591	0.88	25.61	23,053	69,538
20	5.16	106,884	0.78	22.86	27,424	79,460
25	4.59	118,297	0.73	21.20	31,795	86,503
30	4.13	127,745	0.69	20.09	36,166	91,579
35	3.79	135,784	0.66	19.30	40,537	95,247
40	3.46	142,796	0.64	18.71	44,908	97,891
45	3.21	148,996	0.63	18.25	49,279	99,717
50	3.00	154,564	0.61	17.88	53,650	100,914
55	2.81	159,592	0.60	17.58	58,021	101,571
60	2.65	164,200	0.59	17.33	62,392	101,808
65	2.51	168,447	0.59	17.12	66,763	101,685
70	2.39	172,386	0.58	16.94	71,134	101,254
75	2.28	176,083	0.58	16.78	75,505	100,559
80	2.18	179,504	0.57	16.64	79,876	99,634
85	2.08	182,754	0.57	16.52	84,247	98,507
90	2.00	185,820	0.56	16.41	88,618	97,202
95	1.93	188,727	0.56	16.31	92,989	95,738
100	1.86	191,491	0.56	16.23	97,360	94,131
105	1.79	194,127	0.55	16.15	101,731	92,397
110	1.73	196,648	0.55	16.08	106,102	90,546
115	1.68	199,062	0.55	16.01	110,473	88,589
120	1.63	201,378	0.55	15.95	114,844	86,536
125	1.58	203,606	0.55	15.90	119,215	84,394
130	1.53	205,755	0.54	15.84	123,586	82,170
135	1.49	207,827	0.54	15.80	127,957	79,870
140	1.45	209,829	0.54	15.75	132,328	77,501
145	1.42	211,765	0.54	15.71	136,699	75,067
150	1.38	213,641	0.54	15.67	141,070	72,572
155	1.35	215,461	0.54	15.64	145,441	70,020
160	1.32	217,227	0.54	15.61	149,812	67,416
165	1.29	218,944	0.53	15.57	154,183	64,761
170	1.26	220,614	0.53	15.54	158,554	62,060
175	1.23	222,240	0.53	15.52	162,925	59,315
180	1.21	223,824	0.53	15.49	167,296	56,528

Stormwater Detention Volume (Cubic Feet) = 101,808
Stormwater Detention Volume (Acre Feet) = 2.3372

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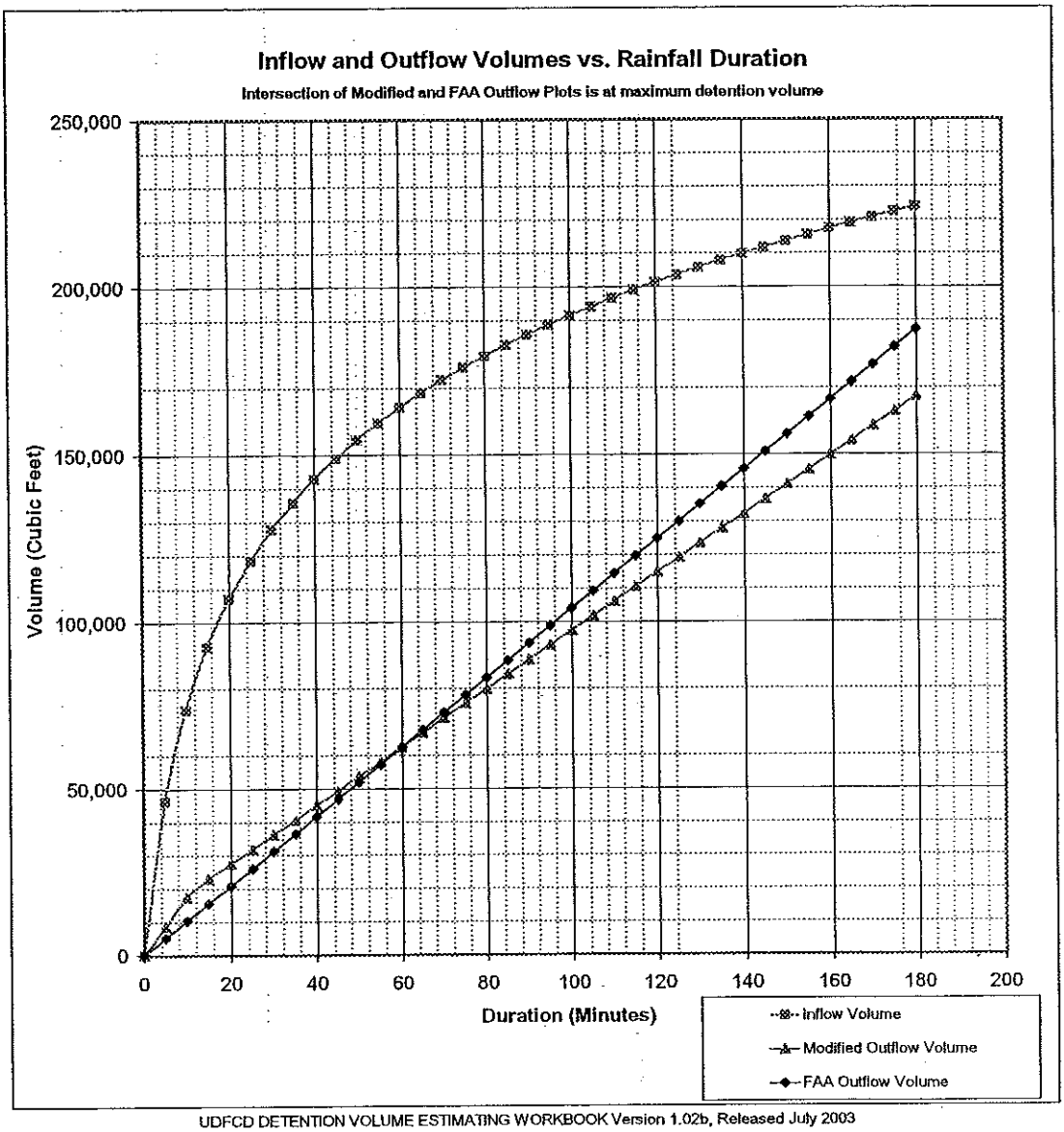

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 10 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	60 percent
Catchment Drainage Area	A =	29.26 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D)
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	14 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.83
Inflow Peak Runoff	Qp-in =	115.48 cfs
Allowable Peak Outflow Rate	Qp-out =	29.26 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.25

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.60	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	9.66	49,543	1.00	29.26	8,778	40,766
10	7.14	78,942	1.00	29.26	17,556	61,386
15	5.98	99,275	0.95	27.85	25,096	74,179
20	5.16	114,611	0.84	24.57	29,485	85,126
25	4.59	126,838	0.77	22.58	33,874	92,963
30	4.13	136,967	0.73	21.26	38,263	98,704
35	3.76	145,997	0.69	20.31	42,652	103,345
40	3.46	153,107	0.67	19.60	47,041	106,066
45	3.21	159,753	0.66	19.05	51,430	108,327
50	3.00	165,712	0.64	18.61	55,819	109,892
55	2.81	171,113	0.62	18.24	60,208	110,905
60	2.65	176,054	0.61	17.94	64,597	111,457
65	2.51	180,605	0.60	17.69	68,986	111,622
70	2.39	184,833	0.60	17.47	73,375	111,458
75	2.28	188,774	0.59	17.28	77,764	111,010
80	2.18	192,469	0.58	17.12	82,153	110,316
85	2.08	195,947	0.58	16.97	86,542	109,405
90	2.00	199,235	0.58	16.84	90,931	108,303
95	1.93	202,351	0.57	16.72	95,320	107,031
100	1.86	205,310	0.57	16.62	99,709	105,606
105	1.79	208,142	0.56	16.52	104,098	104,044
110	1.73	210,844	0.56	16.44	108,487	102,357
115	1.68	213,433	0.56	16.36	112,878	100,557
120	1.63	215,918	0.56	16.29	117,265	98,652
125	1.58	218,307	0.55	16.22	121,654	96,653
130	1.53	220,610	0.55	16.16	126,043	94,566
135	1.49	222,831	0.55	16.10	130,432	92,399
140	1.45	224,977	0.55	16.05	134,821	90,156
145	1.42	227,054	0.55	16.00	139,210	87,843
150	1.38	229,065	0.56	16.06	143,599	85,466
155	1.35	231,016	0.54	15.91	147,988	83,027
160	1.32	232,910	0.54	15.87	152,377	80,532
165	1.29	234,756	0.54	15.83	156,766	77,984
170	1.26	236,541	0.54	15.80	161,155	75,385
175	1.23	238,284	0.54	15.77	165,544	72,740
180	1.21	239,982	0.54	15.73	169,933	70,049

Stormwater Detention Volume (Cubic Feet) = 111,622
Stormwater Detention Volume (Acre Feet) = 2.5625

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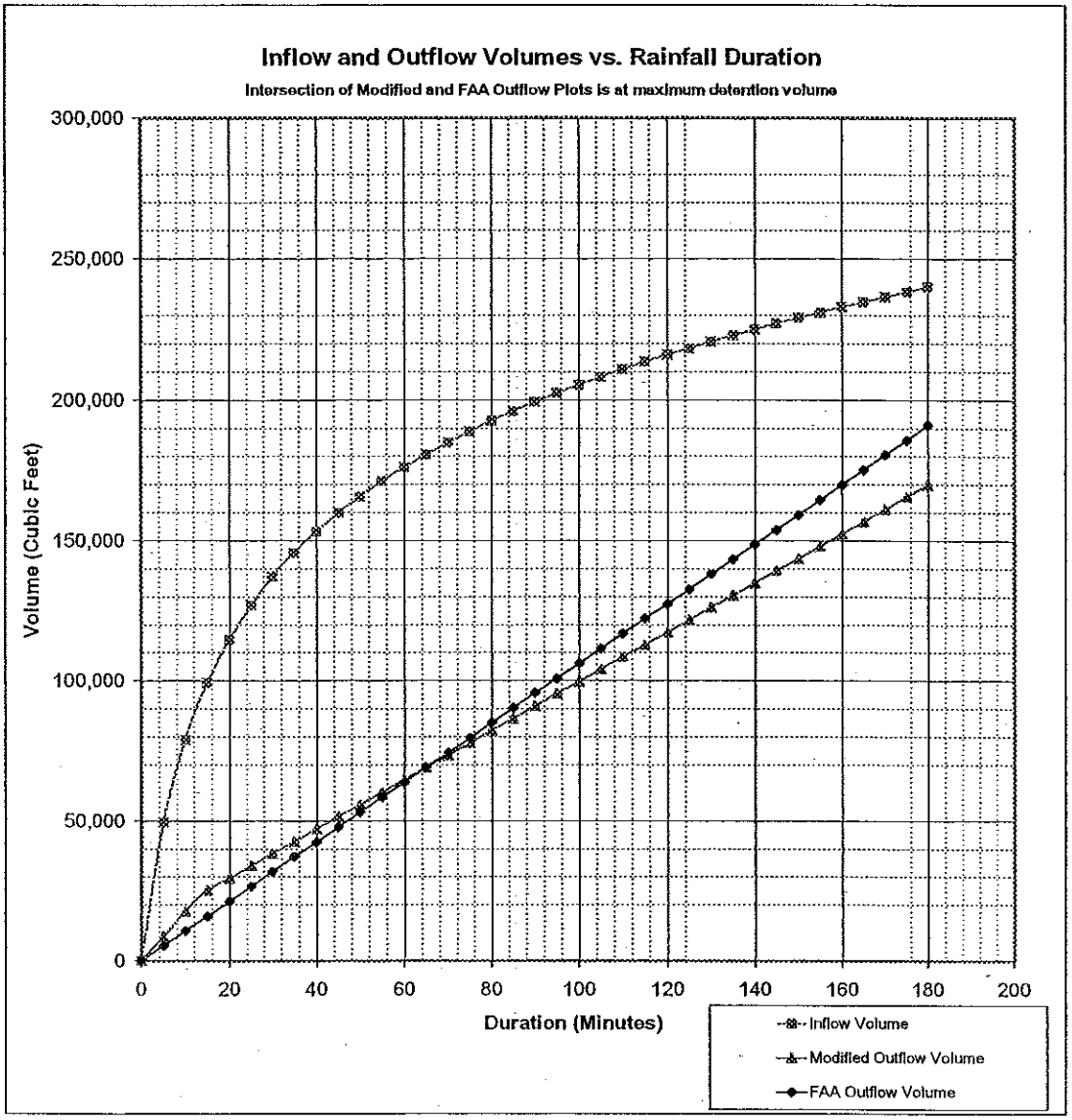

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 11 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	60	percent
Catchment Drainage Area	A =	47.00	acres
Predevelopment NRCS Soil Group	Type =	C	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	16	minutes
Allowable Unit Release Rate (See Table A)	q =	1.00	cfs/acre
One-hour Precipitation	P1 =	2.67	inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3			
Coefficient One	C1 =	28.50	
Coefficient Two	C2 =	10.00	
Coefficient Three	C3 =	0.79	

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.63	
Inflow Peak Runoff	Qp-in =	171.78	cfs
Allowable Peak Outflow Rate	Qp-out =	47.00	cfs
Ratio of Qp-out/Qp-in	Ratio =	0.27	

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	79,580	1.00	47.00	14,100	65,480
10	7.14	126,804	1.00	47.00	28,200	98,604
15	5.98	159,465	1.00	47.00	42,300	117,165
20	5.18	184,098	0.90	42.30	50,760	133,338
25	4.59	203,738	0.82	38.54	57,810	145,928
30	4.13	220,009	0.77	36.03	64,860	155,149
35	3.76	233,871	0.73	34.24	71,910	161,961
40	3.46	245,935	0.70	32.90	78,960	166,975
45	3.21	256,609	0.68	31.86	86,010	170,599
50	3.00	266,181	0.66	31.02	93,060	173,121
55	2.81	274,857	0.65	30.34	100,110	174,747
60	2.65	282,794	0.63	29.77	107,160	175,634
65	2.51	290,109	0.62	29.28	114,210	175,899
70	2.39	296,895	0.61	28.87	121,260	175,635
75	2.28	303,226	0.61	28.51	128,310	174,916
80	2.18	309,161	0.60	28.20	135,360	173,801
85	2.08	314,748	0.59	27.92	142,410	172,338
90	2.00	320,028	0.59	27.68	149,460	170,568
95	1.93	325,035	0.58	27.46	156,510	168,525
100	1.86	329,796	0.58	27.26	163,560	166,236
105	1.79	334,336	0.58	27.08	170,610	163,726
110	1.73	338,677	0.57	26.92	177,660	161,017
115	1.68	342,835	0.57	26.77	184,710	158,125
120	1.63	346,826	0.57	26.63	191,760	155,066
125	1.58	350,665	0.56	26.51	198,810	151,855
130	1.53	354,363	0.56	26.39	205,860	148,503
135	1.49	357,931	0.56	26.29	212,910	145,021
140	1.45	361,378	0.56	26.19	219,960	141,418
145	1.42	364,713	0.56	26.09	227,010	137,703
150	1.38	367,944	0.55	26.01	234,060	133,884
155	1.35	371,078	0.55	25.93	241,110	129,968
160	1.32	374,120	0.55	25.85	248,160	125,960
165	1.29	377,077	0.55	25.78	255,210	121,867
170	1.26	379,953	0.55	25.71	262,260	117,693
175	1.23	382,753	0.55	25.65	269,310	113,443
180	1.21	385,481	0.54	25.59	276,360	109,121

Stormwater Detention Volume (Cubic Feet) = 175,899
Stormwater Detention Volume (Acre Feet) = 4.0381

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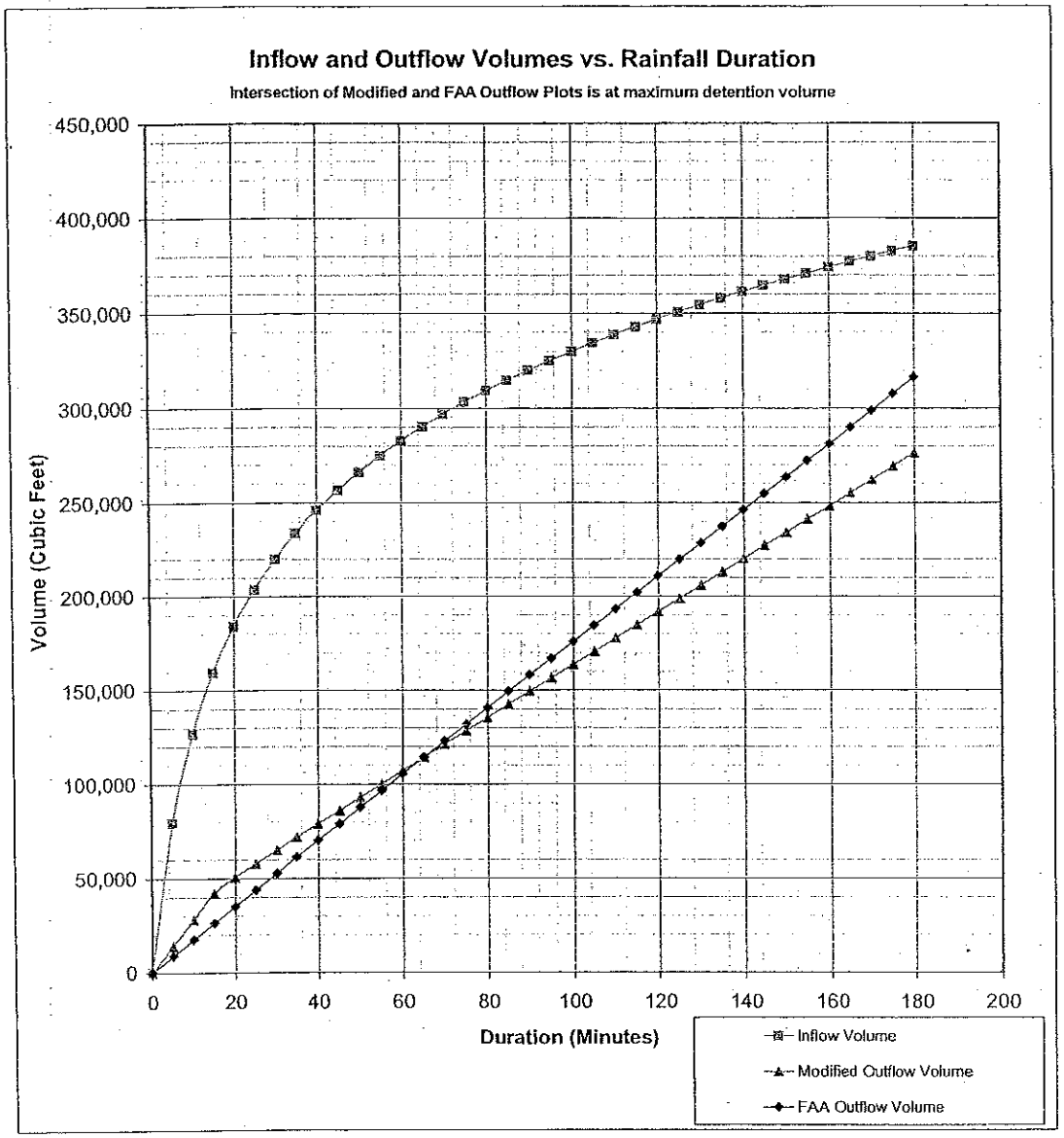

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Pond 12 Modified Alignment

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	90 percent
Catchment Drainage Area	A =	7.60 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	6 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.83
Inflow Peak Runoff	Qp-in =	52.97 cfs
Allowable Peak Outflow Rate	Qp-out =	7.60 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.14

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

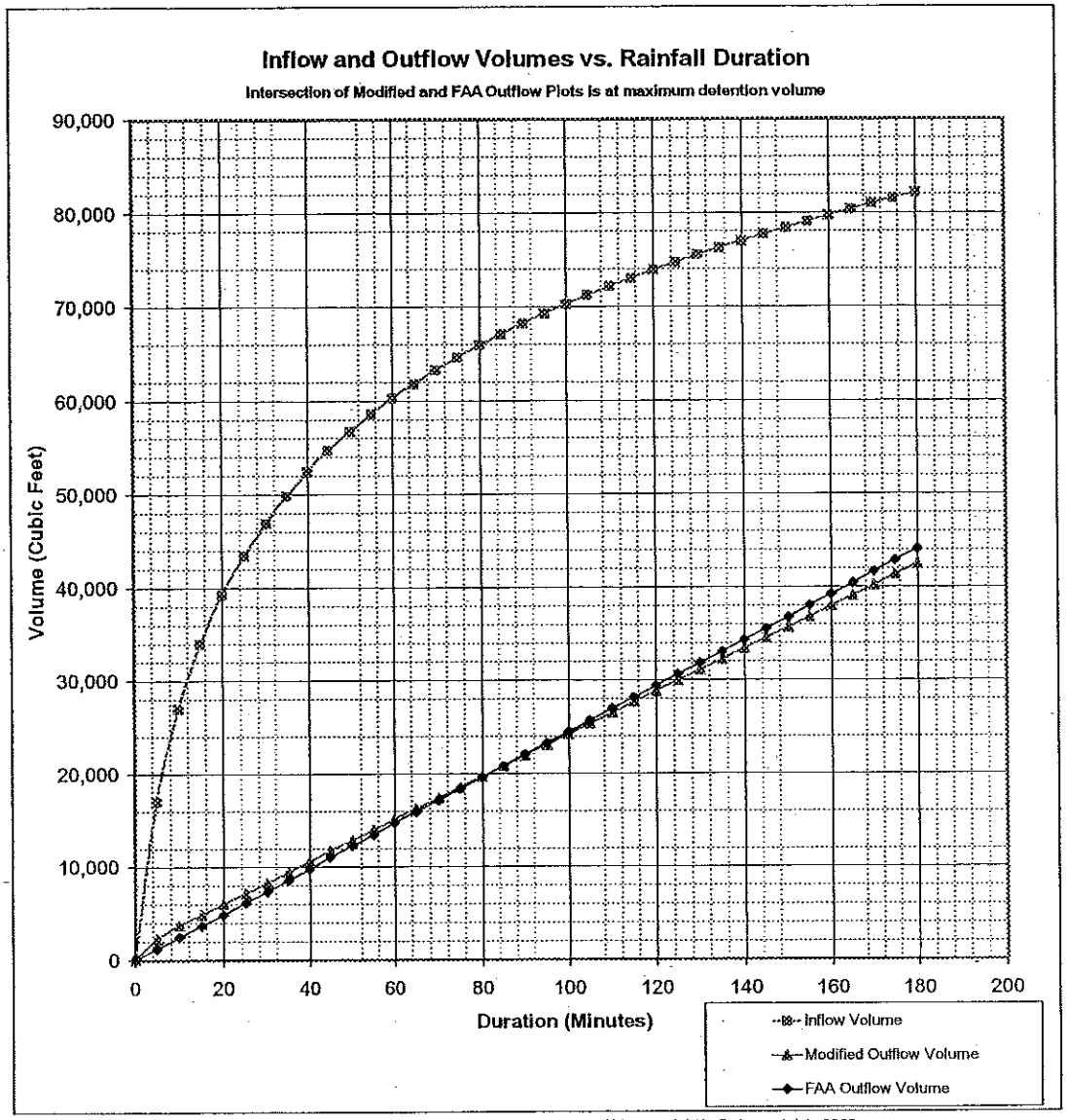
Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	16,963	1.00	7.60	2,280	14,673
10	7.14	27,014	0.81	6.19	3,712	23,302
15	5.98	33,972	0.71	5.39	4,852	29,120
20	5.16	39,220	0.66	4.99	5,992	33,228
25	4.59	43,404	0.63	4.75	7,132	36,272
30	4.13	46,879	0.60	4.60	8,272	38,606
35	3.76	49,823	0.59	4.48	9,412	40,411
40	3.46	52,393	0.58	4.40	10,552	41,841
45	3.21	54,667	0.57	4.33	11,692	42,975
50	3.00	56,706	0.56	4.26	12,832	43,874
55	2.81	58,554	0.56	4.23	13,972	44,583
60	2.65	60,245	0.55	4.20	15,112	45,133
65	2.51	61,804	0.55	4.17	16,252	45,552
70	2.39	63,249	0.54	4.14	17,392	45,858
75	2.28	64,598	0.54	4.12	18,532	46,066
80	2.18	65,862	0.54	4.10	19,672	46,191
85	2.09	67,053	0.54	4.08	20,812	46,241
90	2.00	68,178	0.53	4.07	21,952	46,226
95	1.93	69,244	0.53	4.05	23,092	46,152
100	1.86	70,258	0.53	4.04	24,232	46,027
105	1.79	71,226	0.53	4.03	25,372	45,854
110	1.73	72,150	0.53	4.02	26,512	45,639
115	1.68	73,036	0.53	4.01	27,652	45,384
120	1.63	73,886	0.53	4.00	28,792	45,095
125	1.58	74,704	0.53	3.99	29,932	44,772
130	1.53	75,492	0.52	3.98	31,072	44,420
135	1.49	76,252	0.52	3.98	32,212	44,040
140	1.45	76,987	0.52	3.97	33,352	43,635
145	1.42	77,697	0.52	3.96	34,492	43,205
150	1.38	78,385	0.52	3.96	35,632	42,754
155	1.35	79,053	0.52	3.95	36,772	42,281
160	1.32	79,701	0.52	3.95	37,912	41,789
165	1.29	80,331	0.52	3.94	39,052	41,279
170	1.26	80,944	0.52	3.94	40,192	40,752
175	1.23	81,540	0.52	3.94	41,332	40,208
180	1.21	82,121	0.52	3.93	42,472	39,650

Stormwater Detention Volume (Cubic Feet) = 46,241
Stormwater Detention Volume (Acre Feet) = 1.0618

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003



UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

Time of Concentration and Peak Discharge Calculations
Offsite Basins

Purpose: Time of Concentration for Offsite Basins

Offsite Basins

Basin	Total tc min	Regional tc min
Q	16	18
R	20	20
S	14	18
T	21	18
U	12	14
W	13	15
X	18	13
Y	25	15
Z	23	19

Calculation Methods:

Total tc The sum of overland travel time, channel travel time, and flow travel time.

Regional tc Using the equation:tc=L/180+10, where L is the total travel length.

Data Presentation:

The total tc and regional tc are calculated from unrounded values, with the result rounded.

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin Q

I. Catchment Hydrologic Data

Catchment ID =		
Area =	17.25	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

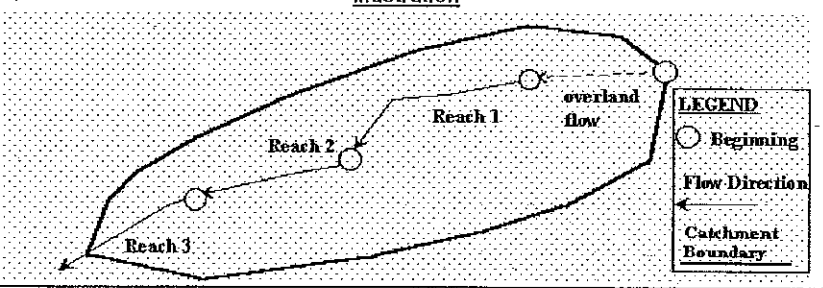
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.75	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.66	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0200	186	0.66		0.36	8.69
1	0.0186	1,089		20.00	2.73	6.65
2						
3						
4						
5						
Sum		1,275				

Computed Tc = 15.34
Regional Tc = 17.08

IV.

Peak Runoff Prediction using Computed Tc			Peak Runoff Prediction using Regional Tc		
Rainfall Intensity at Tc, I =	6.00	inch/hr	Rainfall Intensity at Tc, I =	5.69	inch/hr
Peak Flowrate, Qp =	77.67	cfs	Peak Flowrate, Qp =	73.73	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin R

I. Catchment Hydrologic Data

Catchment ID =		
Area =	59.83	Acres
Percent Imperviousness =	93.60	%
NRCS Soil Type =	B	A, B, C, or D

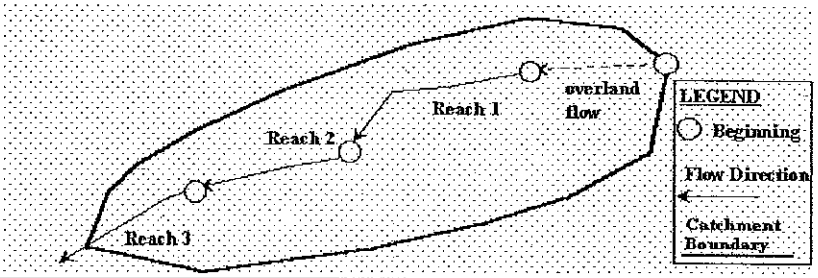
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.86	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.78	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland			0.78		0.00	0.00
1	0.0050	1,667		20.00	1.41	19.65
2						
3						
4						
5						
Sum		1,667				

Computed Tc = 19.65
Regional Tc = 19.26

IV.

Peak Runoff Prediction using Computed Tc		Peak Runoff Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	5.30 inch/hr	Rainfall Intensity at Tc, I =	5.36 inch/hr
Peak Flowrate, Qp =	272.05 cfs	Peak Flowrate, Qp =	274.86 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin S

I. Catchment Hydrologic Data

Catchment ID =		
Area =	58.01	Acres
Percent Imperviousness =	87.30	%
NRCS Soil Type =	B	A, B, C, or D

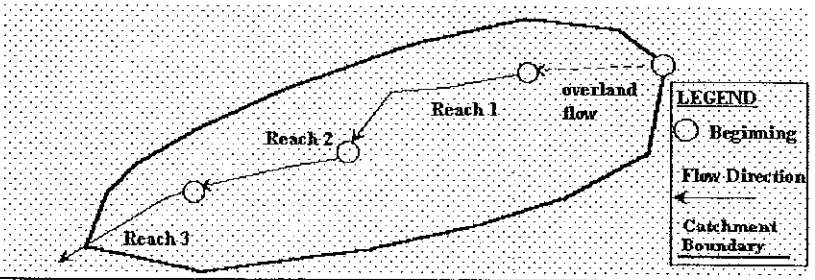
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.78	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.69	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland			0.69		0.00	0.00
1	0.0069	1,328		20.00	1.66	13.32
2						
3						
4						
5						
Sum		1,328			Computed Tc =	13.32
					Regional Tc =	17.38

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	6.40 inch/hr	Rainfall Intensity at Tc, I =	5.64 inch/hr
Peak Flowrate, Qp =	288.50 cfs	Peak Flowrate, Qp =	254.35 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin T

I. Catchment Hydrologic Data

Catchment ID =		
Area =	12.00	Acres
Percent Imperviousness =	82.40	%
NRCS Soil Type =	B	A, B, C, or D

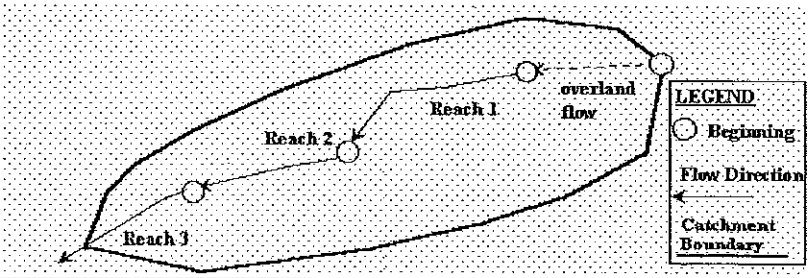
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.72	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.62	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0130	251	0.62		0.33	12.51
1	0.0169	1,171		20.00	2.60	7.51
2						
3						
4						
5						
Sum		1,422				

Computed Tc = 20.02
Regional Tc = 17.90

IV.

Peak Runoff Prediction using Computed Tc			Peak Runoff Prediction using Regional Tc		
Rainfall Intensity at Tc, I =	5.25	inch/hr	Rainfall Intensity at Tc, I =	5.56	inch/hr
Peak Flowrate, Qp =	45.59	cfs	Peak Flowrate, Qp =	48.28	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin U

I. Catchment Hydrologic Data

Catchment ID =		
Area =	4.85	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

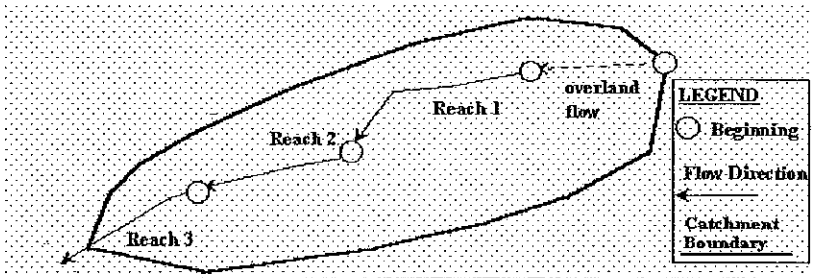
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.88	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.81	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0131	300	0.81		0.59	8.40
1	0.0098	370		20.00	1.98	3.11
2						
3						
4						
5						
Sum		670				

Computed Tc = 11.52
Regional Tc = 13.72

IV.

Peak Runoff Prediction using Computed Tc		Peak Runoff Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	6.82 inch/hr	Rainfall Intensity at Tc, I =	6.32 inch/hr
Peak Flowrate, Qp =	29.03 cfs	Peak Flowrate, Qp =	26.89 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin X

I. Catchment Hydrologic Data

Catchment ID =		
Area =	2.56	Acres
Percent Imperviousness =	52.70	%
NRCS Soil Type =	C	A, B, C, or D

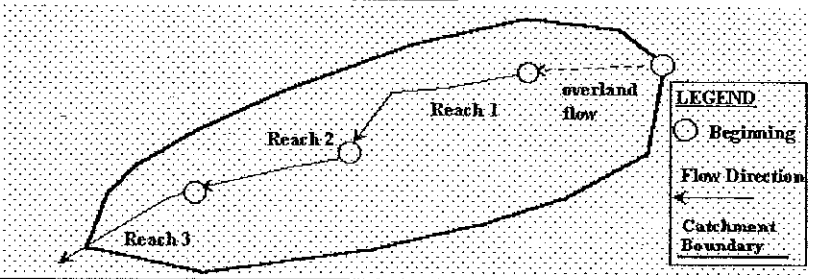
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.61	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.41	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0095	142	0.41		0.16	15.04
1	0.0213	389		20.00	2.92	2.22
2						
3						
4						
5						
Sum		531				

Computed Tc = 17.27
Regional Tc = 12.95

IV.

Peak Runoff Prediction using Computed Tc			Peak Runoff Prediction using Regional Tc		
Rainfall Intensity at Tc, I =	5.66	inch/hr	Rainfall Intensity at Tc, I =	6.48	inch/hr
Peak Flowrate, Qp =	8.84	cfs	Peak Flowrate, Qp =	10.12	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin Y

I. Catchment Hydrologic Data

Catchment ID =		
Area =	7.22	Acres
Percent Imperviousness =	69.80	%
NRCS Soil Type =	C	A, B, C, or D

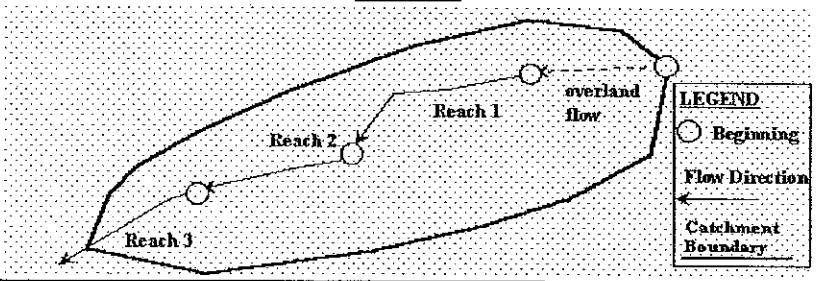
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.68	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.53	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff C-5	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft			fps	minutes
	input	input	output	input	output	output
Overland	0.0078	300	0.53		0.26	19.37
1	0.0067	516		20.00	1.64	5.25
2						
3						
4						
5						
Sum		816			Computed Tc =	24.63
					Regional Tc =	14.53

IV.

Peak Runoff Prediction using Computed Tc		ediction using Regional Tc	
Rainfall Intensity at Tc, I =	4.69 inch/hr	Rainfall Intensity at Tc, I =	6.15 inch/hr
Peak Flowrate, Qp =	22.93 cfs	Peak Flowrate, Qp =	30.06 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Basin Z

I. Catchment Hydrologic Data

Catchment ID =		
Area =	4.17	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	C	A, B, C, or D

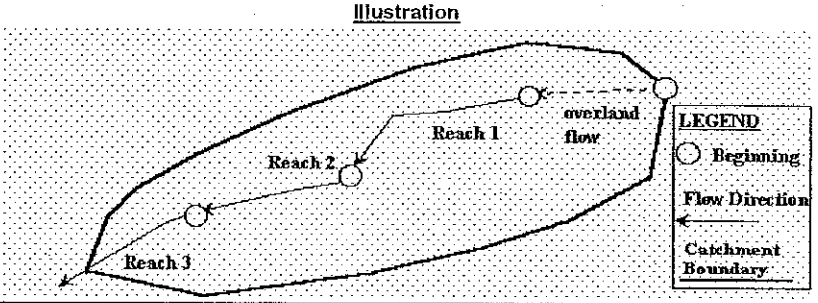
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	2.67	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.79	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.68	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S	Length L	5-yr Runoff Coeff	NRCS Convey-ance	Flow Velocity V	Flow Time Tf
	ft/ft	ft	C-5		fps	minutes
	input	input	output	input	output	output
Overland	0.0084	300	0.68		0.36	13.85
1	0.0112	1,142		20.00	2.12	8.99
2						
3						
4						
5						
Sum		1,442			Computed Tc =	22.84
					Regional Tc =	18.01

IV.

Peak Runoff Prediction using Computed Tc		Prediction using Regional Tc	
Rainfall Intensity at Tc, I =	4.89 inch/hr	Rainfall Intensity at Tc, I =	5.54 inch/hr
Peak Flowrate, Qp =	16.02 cfs	Peak Flowrate, Qp =	18.16 cfs

Peak Discharge and Detention Volume Calculations For Local Streets That Contribute to the System

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Northern Ave (E)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	80 percent
Catchment Drainage Area	A =	3.07 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.70
Inflow Peak Runoff	Qp-in =	12.25 cfs
Allowable Peak Outflow Rate	Qp-out =	2.61 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.14

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	5.56	5,776	1.00	2.61	784	4,993
10	7.14	9,203	0.79	1.98	1,174	8,029
15	5.98	11,573	0.67	1.74	1,565	10,008
20	5.16	13,361	0.61	1.63	1,957	11,404
25	4.59	14,787	0.59	1.57	2,349	12,438
30	4.13	15,968	0.56	1.52	2,740	13,228
35	3.76	16,974	0.57	1.49	3,131	13,842
40	3.46	17,840	0.56	1.47	3,523	14,318
45	3.21	18,624	0.56	1.46	3,914	14,710
50	3.00	19,319	0.55	1.44	4,306	15,013
55	2.81	19,948	0.55	1.42	4,697	15,251
60	2.65	20,524	0.54	1.41	5,089	15,436
65	2.51	21,056	0.54	1.41	5,480	15,575
70	2.39	21,548	0.54	1.40	5,871	15,676
75	2.28	22,007	0.53	1.39	6,263	15,744
80	2.18	22,438	0.53	1.39	6,654	15,784
85	2.08	22,843	0.53	1.38	7,046	15,796
90	2.00	23,227	0.53	1.38	7,437	15,790
95	1.93	23,590	0.53	1.37	7,829	15,761
100	1.86	23,936	0.53	1.37	8,220	15,716
105	1.79	24,265	0.52	1.37	8,611	15,654
110	1.73	24,580	0.52	1.36	9,003	15,577
115	1.68	24,882	0.52	1.36	9,394	15,488
120	1.63	25,172	0.52	1.35	9,786	15,386
125	1.58	25,450	0.52	1.35	10,177	15,273
130	1.53	25,719	0.52	1.35	10,568	15,150
135	1.49	25,977	0.52	1.35	10,960	15,018
140	1.45	26,228	0.52	1.35	11,351	14,876
145	1.42	26,470	0.52	1.35	11,743	14,727
150	1.38	26,704	0.52	1.35	12,134	14,570
155	1.35	26,932	0.52	1.35	12,526	14,406
160	1.32	27,152	0.52	1.35	12,917	14,235
165	1.29	27,367	0.52	1.34	13,308	14,059
170	1.26	27,576	0.51	1.34	13,700	13,876
175	1.23	27,779	0.51	1.34	14,091	13,688
180	1.21	27,977	0.51	1.34	14,483	13,494

Stormwater Detention Volume (Cubic Feet) = 15,798
Stormwater Detention Volume (Acre Feet) = 0.3627

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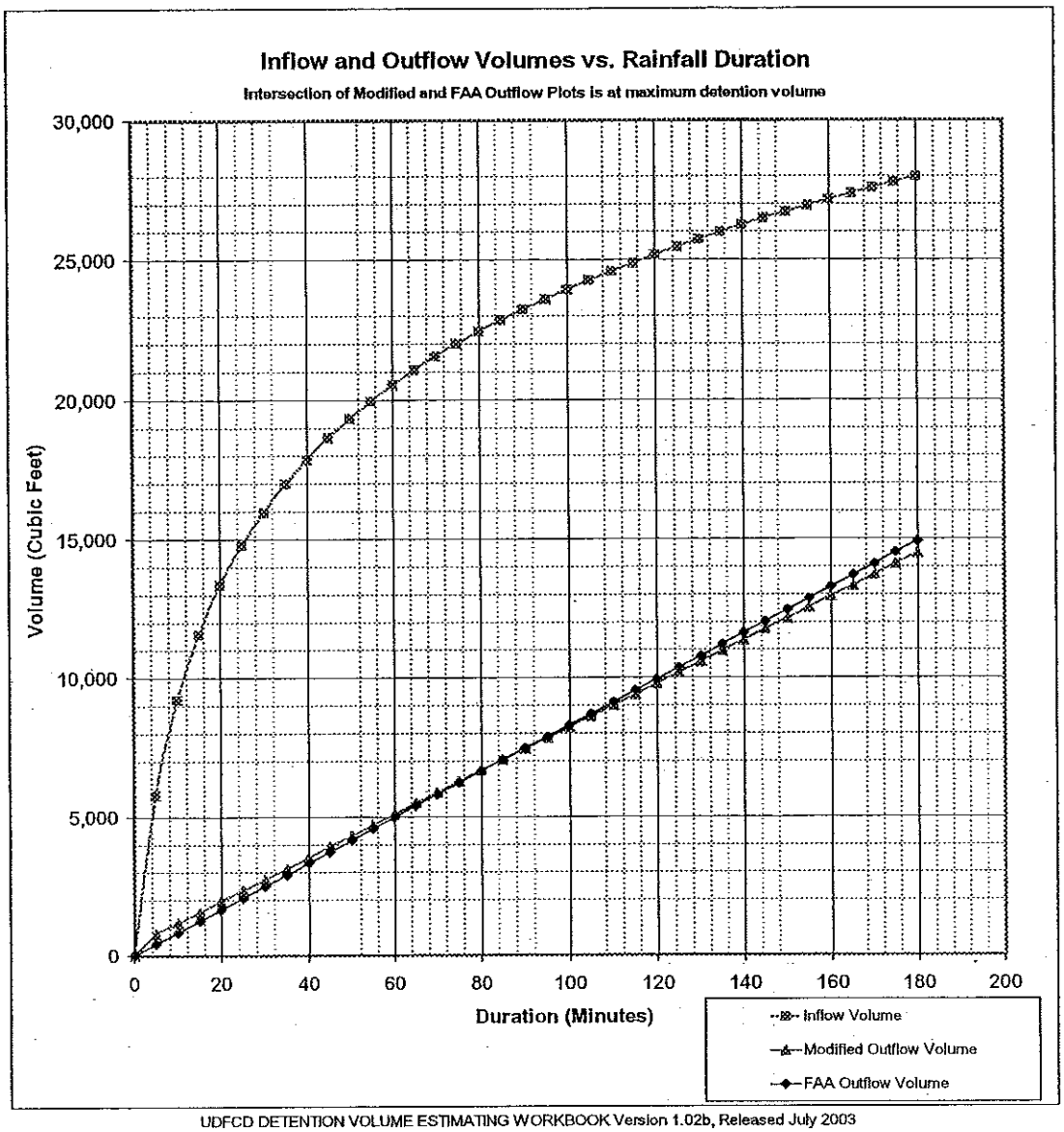

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Northern Ave (W)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	100	percent
Catchment Drainage Area	A =	5.21	acres
Predevelopment NRCS Soil Group	Type =	B	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5	minutes
Allowable Unit Release Rate (See Table A)	q =	0.85	cfs/acre
One-hour Precipitation	P1 =	2.67	inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3			
Coefficient One	C1 =	28.50	
Coefficient Two	C2 =	10.00	
Coefficient Three	C3 =	0.79	

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.96	
Inflow Peak Runoff	Qp-in =	44.61	cfs
Allowable Peak Outflow Rate	Qp-out =	4.43	cfs
Ratio of Qp-out/Qp-in	Ratio =	0.10	

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.24	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	13,442	1.00	4.43	1,329	12,114
10	7.14	21,419	0.75	3.32	1,993	19,426
15	5.98	26,936	0.67	2.95	2,657	24,279
20	5.16	31,007	0.63	2.77	3,321	27,776
25	4.59	34,415	0.60	2.66	3,986	30,429
30	4.13	37,163	0.58	2.58	4,650	32,513
35	3.76	39,504	0.57	2.53	5,314	34,190
40	3.46	41,542	0.56	2.49	5,978	35,564
45	3.21	43,345	0.56	2.46	6,643	36,703
50	3.00	44,962	0.55	2.44	7,307	37,655
55	2.81	46,426	0.55	2.42	7,971	38,456
60	2.65	47,765	0.54	2.40	8,636	39,133
65	2.51	49,004	0.54	2.38	9,300	39,704
70	2.39	50,150	0.54	2.37	9,964	40,186
75	2.28	51,220	0.53	2.36	10,628	40,591
80	2.18	52,222	0.53	2.35	11,293	40,929
85	2.08	53,166	0.53	2.34	11,957	41,209
90	2.00	54,058	0.53	2.34	12,621	41,437
95	1.93	54,904	0.53	2.33	13,286	41,618
100	1.86	55,708	0.53	2.32	13,950	41,758
105	1.79	56,476	0.52	2.32	14,614	41,861
110	1.73	57,208	0.52	2.31	15,278	41,930
115	1.68	57,910	0.52	2.31	15,943	41,968
120	1.63	58,584	0.52	2.31	16,607	41,978
125	1.58	59,233	0.52	2.30	17,271	41,962
130	1.53	59,857	0.52	2.30	17,935	41,922
135	1.49	60,460	0.52	2.30	18,600	41,860
140	1.45	61,042	0.52	2.29	19,264	41,779
145	1.42	61,606	0.52	2.29	19,928	41,678
150	1.38	62,152	0.52	2.29	20,593	41,559
155	1.35	62,681	0.52	2.29	21,257	41,424
160	1.32	63,195	0.52	2.28	21,921	41,274
165	1.29	63,694	0.52	2.28	22,585	41,109
170	1.26	64,180	0.51	2.28	23,250	40,930
175	1.23	64,653	0.51	2.28	23,914	40,739
180	1.21	65,114	0.51	2.28	24,578	40,536

Stormwater Detention Volume (Cubic Feet) = 41,978
Stormwater Detention Volume (Acre Feet) = 0.9637

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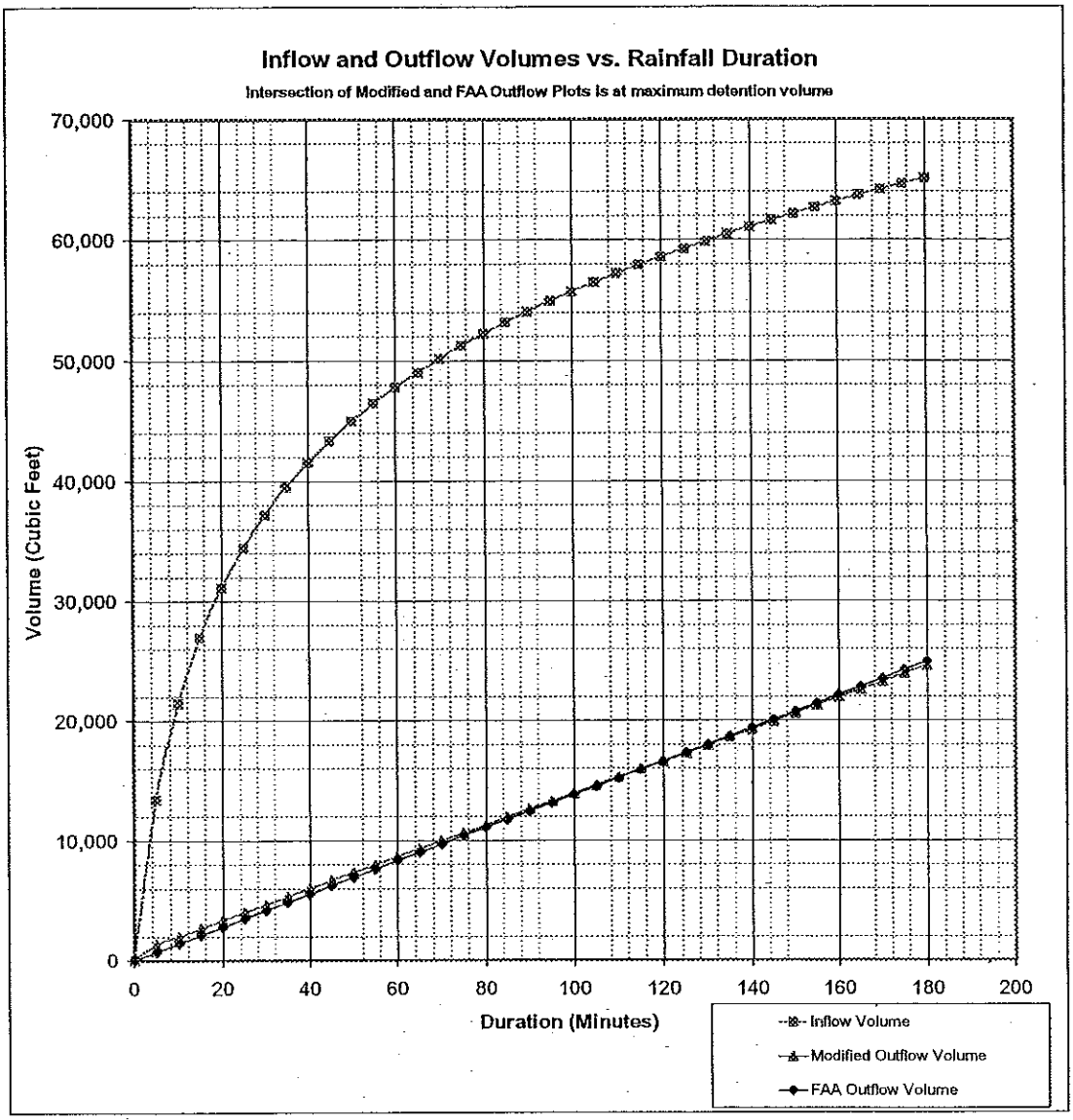

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: 1st St (E)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	100 percent
Catchment Drainage Area	A =	0.56 acres
Predevelopment NRCS Soil Group	Type =	D (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.96
Inflow Peak Runoff	Qp-in =	4.99 cfs
Allowable Peak Outflow Rate	Qp-out =	0.56 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.12

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	1,488	1.00	0.56	174	1,322
10	7.14	2,364	0.75	0.44	261	2,123
15	5.96	2,999	0.67	0.39	348	2,651
20	5.18	3,462	0.63	0.36	435	3,027
25	4.59	3,831	0.60	0.35	522	3,309
30	4.14	4,137	0.58	0.34	609	3,528
35	3.76	4,395	0.57	0.33	696	3,702
40	3.46	4,625	0.56	0.33	783	3,842
45	3.21	4,825	0.56	0.32	870	3,954
50	3.00	5,005	0.55	0.32	957	4,048
55	2.81	5,169	0.55	0.32	1,044	4,125
60	2.65	5,318	0.54	0.31	1,131	4,187
65	2.51	5,456	0.54	0.31	1,218	4,237
70	2.39	5,583	0.54	0.31	1,305	4,278
75	2.28	5,702	0.53	0.31	1,392	4,310
80	2.18	5,814	0.53	0.31	1,479	4,335
85	2.08	5,919	0.53	0.31	1,566	4,353
90	2.00	6,018	0.53	0.31	1,653	4,365
95	1.93	6,112	0.53	0.31	1,740	4,372
100	1.86	6,202	0.53	0.30	1,827	4,375
105	1.79	6,287	0.52	0.30	1,914	4,373
110	1.73	6,369	0.52	0.30	2,001	4,368
115	1.68	6,447	0.52	0.30	2,088	4,359
120	1.63	6,522	0.52	0.30	2,175	4,347
125	1.58	6,594	0.52	0.30	2,262	4,332
130	1.53	6,664	0.52	0.30	2,349	4,315
135	1.49	6,731	0.52	0.30	2,436	4,295
140	1.45	6,796	0.52	0.30	2,523	4,273
145	1.42	6,858	0.52	0.30	2,610	4,248
150	1.38	6,919	0.52	0.30	2,697	4,222
155	1.35	6,978	0.52	0.30	2,784	4,194
160	1.32	7,035	0.52	0.30	2,871	4,164
165	1.29	7,091	0.52	0.30	2,958	4,133
170	1.26	7,146	0.51	0.30	3,045	4,100
175	1.23	7,197	0.51	0.30	3,132	4,065
180	1.21	7,248	0.51	0.30	3,219	4,030

Stormwater Detention Volume (Cubic Feet) = 4,375
Stormwater Detention Volume (Acre Feet) = 0.1004

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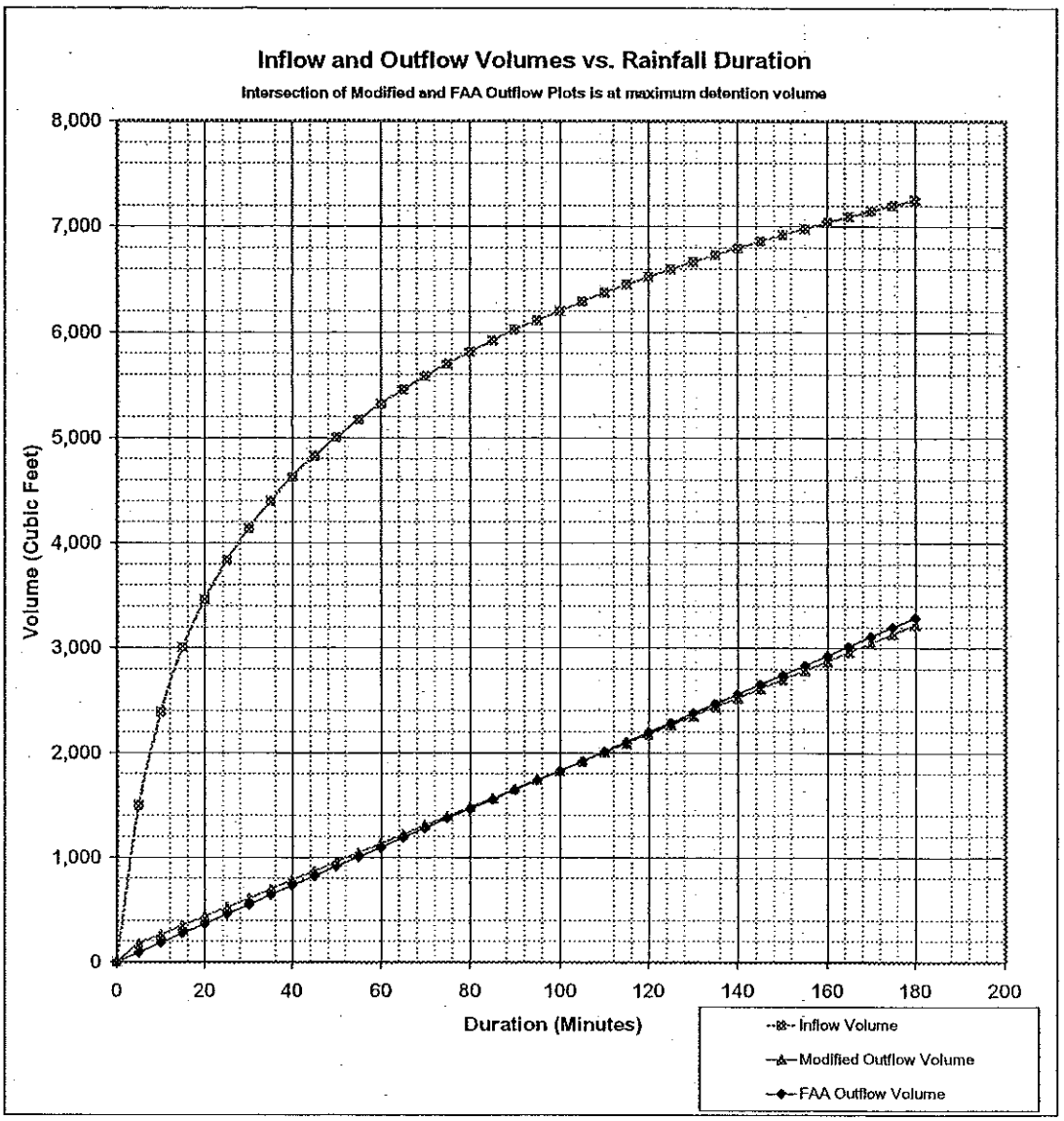

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: 1st St (W)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	100 percent
Catchment Drainage Area	A =	0.75 acres
Predevelopment NRCS Soil Group	Type =	D A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.96
Inflow Peak Runoff	Qp-in =	5.45 cfs
Allowable Peak Outflow Rate	Qp-out =	0.75 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.12

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	1,935	1.00	0.75	225	1,710
10	7.14	3,083	0.79	0.56	336	2,746
15	5.96	3,878	0.67	0.50	450	3,428
20	5.18	4,477	0.63	0.47	563	3,914
25	4.59	4,954	0.60	0.45	675	4,279
30	4.13	5,350	0.58	0.44	788	4,562
35	3.76	5,687	0.57	0.43	900	4,787
40	3.46	5,980	0.56	0.42	1,013	4,966
45	3.21	6,240	0.56	0.42	1,125	5,116
50	3.00	6,472	0.55	0.41	1,238	5,235
55	2.81	6,683	0.55	0.41	1,350	5,333
60	2.65	6,876	0.54	0.41	1,463	5,414
65	2.51	7,054	0.54	0.40	1,575	5,479
70	2.39	7,219	0.54	0.40	1,688	5,532
75	2.28	7,373	0.53	0.40	1,800	5,573
80	2.18	7,518	0.53	0.40	1,913	5,605
85	2.09	7,653	0.53	0.40	2,025	5,628
90	2.00	7,782	0.53	0.40	2,138	5,644
95	1.93	7,904	0.53	0.39	2,250	5,654
100	1.86	8,019	0.53	0.39	2,363	5,657
105	1.79	8,130	0.52	0.39	2,475	5,655
110	1.73	8,235	0.52	0.39	2,588	5,648
115	1.68	8,336	0.52	0.39	2,700	5,636
120	1.63	8,433	0.52	0.39	2,813	5,621
125	1.58	8,527	0.52	0.39	2,925	5,602
130	1.53	8,617	0.52	0.39	3,038	5,579
135	1.49	8,703	0.52	0.39	3,150	5,553
140	1.45	8,787	0.52	0.39	3,263	5,525
145	1.42	8,868	0.52	0.39	3,375	5,493
150	1.38	8,947	0.52	0.39	3,488	5,459
155	1.35	9,023	0.52	0.39	3,600	5,423
160	1.32	9,097	0.52	0.39	3,713	5,385
165	1.29	9,169	0.52	0.39	3,825	5,344
170	1.26	9,239	0.51	0.39	3,938	5,301
175	1.23	9,307	0.51	0.39	4,050	5,257
180	1.21	9,373	0.51	0.39	4,163	5,211

Stormwater Detention Volume (Cubic Feet) = 5,557
Stormwater Detention Volume (Acre Feet) = 0.1299

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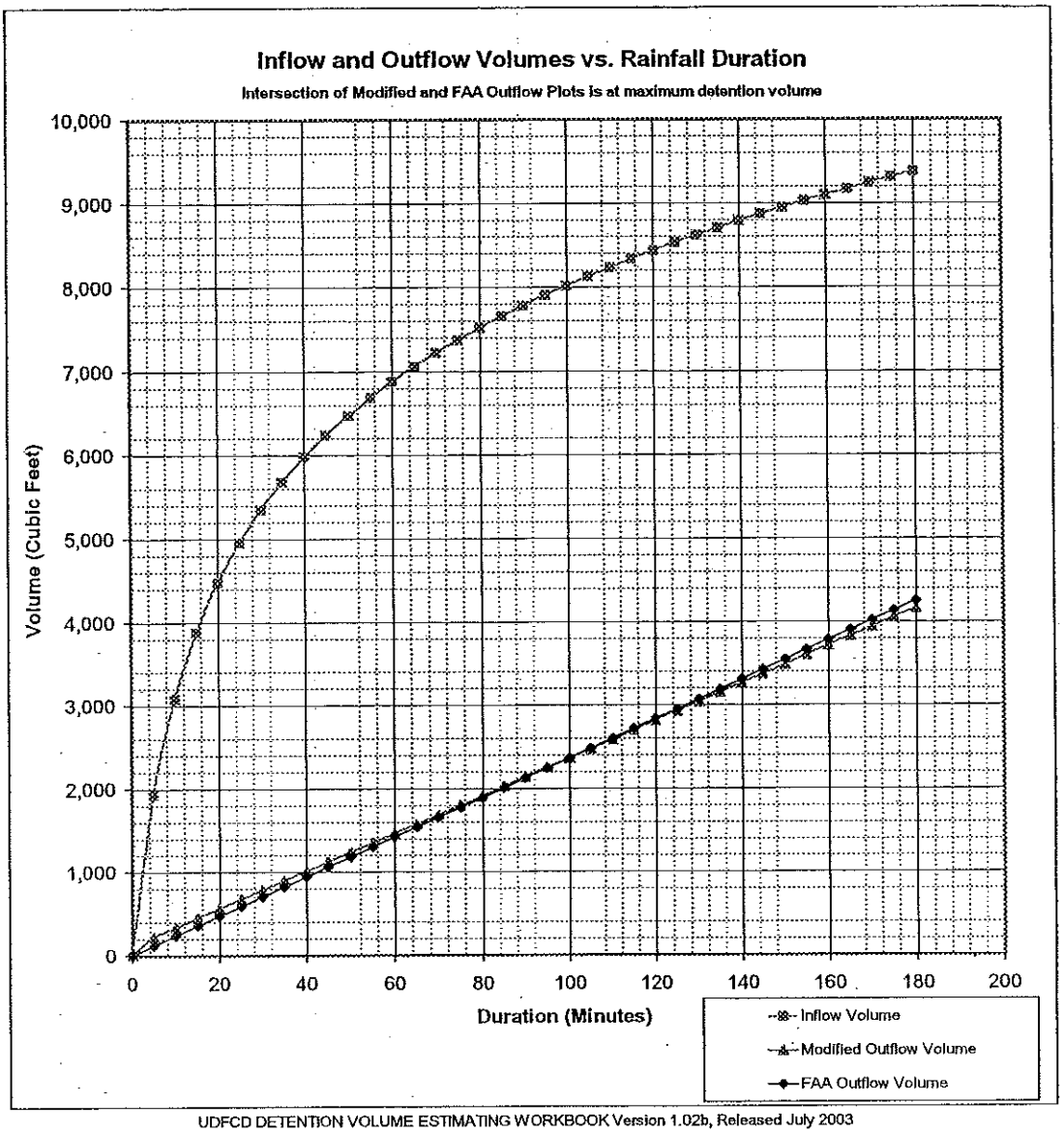

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: 8th St (E)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	46 percent
Catchment Drainage Area	A =	2.62 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.59
Inflow Peak Runoff	Qp-in =	13.65 cfs
Allowable Peak Outflow Rate	Qp-out =	2.62 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.19

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

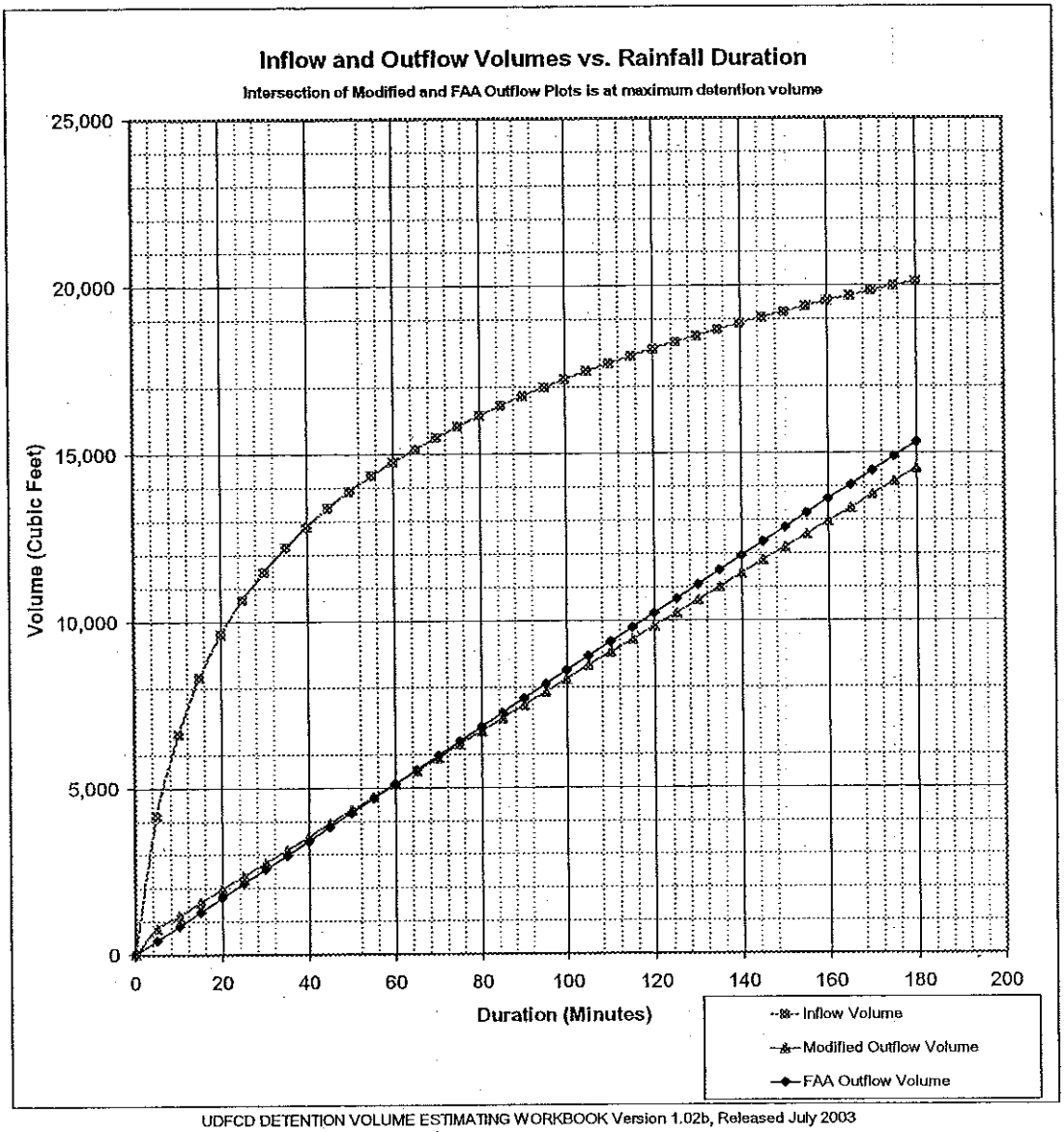
Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	4,164	1.00	2.62	786	3,368
10	7.14	6,629	0.75	1.97	1,179	5,441
15	5.98	8,329	0.67	1.75	1,572	6,793
20	5.16	9,611	0.63	1.64	1,965	7,646
25	4.59	10,636	0.60	1.57	2,358	8,278
30	4.13	11,459	0.58	1.53	2,751	8,735
35	3.76	12,209	0.57	1.50	3,144	9,065
40	3.46	12,899	0.56	1.47	3,537	9,362
45	3.21	13,546	0.56	1.46	3,930	9,616
50	3.00	14,156	0.55	1.44	4,323	9,833
55	2.81	14,749	0.55	1.43	4,716	10,033
60	2.65	15,263	0.54	1.42	5,109	10,154
65	2.51	15,745	0.54	1.41	5,502	10,243
70	2.39	16,199	0.54	1.40	5,895	10,304
75	2.28	16,630	0.53	1.40	6,288	10,342
80	2.18	17,040	0.53	1.39	6,681	10,359
85	2.08	17,432	0.53	1.39	7,074	10,358
90	2.00	17,807	0.53	1.38	7,467	10,340
95	1.93	18,169	0.53	1.38	7,860	10,309
100	1.86	17,217	0.53	1.38	8,253	8,964
105	1.79	17,454	0.52	1.37	8,646	8,808
110	1.73	17,681	0.52	1.37	9,039	8,642
115	1.68	17,898	0.52	1.37	9,432	8,466
120	1.63	18,106	0.52	1.36	9,825	8,281
125	1.58	18,307	0.52	1.36	10,218	8,089
130	1.53	18,500	0.52	1.36	10,611	7,889
135	1.49	18,686	0.52	1.36	11,004	7,682
140	1.45	18,866	0.52	1.36	11,397	7,469
145	1.42	19,040	0.52	1.36	11,790	7,250
150	1.38	19,209	0.52	1.36	12,183	7,026
155	1.35	19,372	0.52	1.35	12,576	6,796
160	1.32	19,531	0.52	1.35	12,969	6,562
165	1.29	19,685	0.52	1.35	13,362	6,323
170	1.26	19,836	0.51	1.35	13,755	6,081
175	1.23	19,982	0.51	1.35	14,148	5,834
180	1.21	20,124	0.51	1.35	14,541	5,583

Stormwater Detention Volume (Cubic Feet) = 9,654
Stormwater Detention Volume (Acre Feet) = 0.2216



UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: 8th St (W)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	100 percent
Catchment Drainage Area	A =	0.74 acres
Predevelopment NRCS Soil Group	Type =	D (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.96
Inflow Peak Runoff	Qp-in =	5.36 cfs
Allowable Peak Outflow Rate	Qp-out =	0.74 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.12

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	1,993	1.00	0.74	222	1,667
10	7.14	3,042	0.75	0.56	333	2,709
15	5.98	3,828	0.67	0.49	444	3,382
20	5.16	4,417	0.63	0.46	556	3,862
25	4.59	4,866	0.60	0.44	666	4,222
30	4.13	5,278	0.58	0.43	777	4,501
35	3.76	5,611	0.57	0.42	888	4,723
40	3.46	5,900	0.56	0.42	999	4,901
45	3.21	6,157	0.56	0.41	1,110	5,047
50	3.00	6,386	0.55	0.41	1,221	5,165
55	2.83	6,594	0.55	0.40	1,332	5,262
60	2.65	6,785	0.54	0.40	1,443	5,342
65	2.51	6,960	0.54	0.40	1,554	5,406
70	2.39	7,123	0.54	0.40	1,665	5,458
75	2.28	7,275	0.53	0.39	1,776	5,499
80	2.18	7,417	0.53	0.39	1,887	5,530
85	2.09	7,551	0.53	0.39	1,998	5,553
90	2.00	7,676	0.53	0.39	2,109	5,568
95	1.93	7,798	0.53	0.39	2,220	5,578
100	1.86	7,912	0.53	0.39	2,331	5,581
105	1.79	8,021	0.52	0.39	2,442	5,579
110	1.73	8,125	0.52	0.39	2,553	5,572
115	1.68	8,225	0.52	0.39	2,664	5,561
120	1.63	8,321	0.52	0.39	2,775	5,546
125	1.58	8,414	0.52	0.39	2,886	5,527
130	1.53	8,502	0.52	0.39	2,997	5,505
135	1.49	8,587	0.52	0.38	3,106	5,479
140	1.45	8,670	0.52	0.38	3,219	5,451
145	1.42	8,750	0.52	0.38	3,330	5,420
150	1.38	8,828	0.52	0.38	3,441	5,387
155	1.35	8,903	0.52	0.38	3,552	5,351
160	1.32	8,976	0.52	0.38	3,663	5,313
165	1.29	9,047	0.52	0.38	3,774	5,273
170	1.26	9,116	0.51	0.38	3,885	5,231
175	1.23	9,183	0.51	0.38	3,996	5,187
180	1.21	9,248	0.51	0.38	4,107	5,141

Stormwater Detention Volume (Cubic Feet) = 5,581
Stormwater Detention Volume (Acre Feet) = 0.1281

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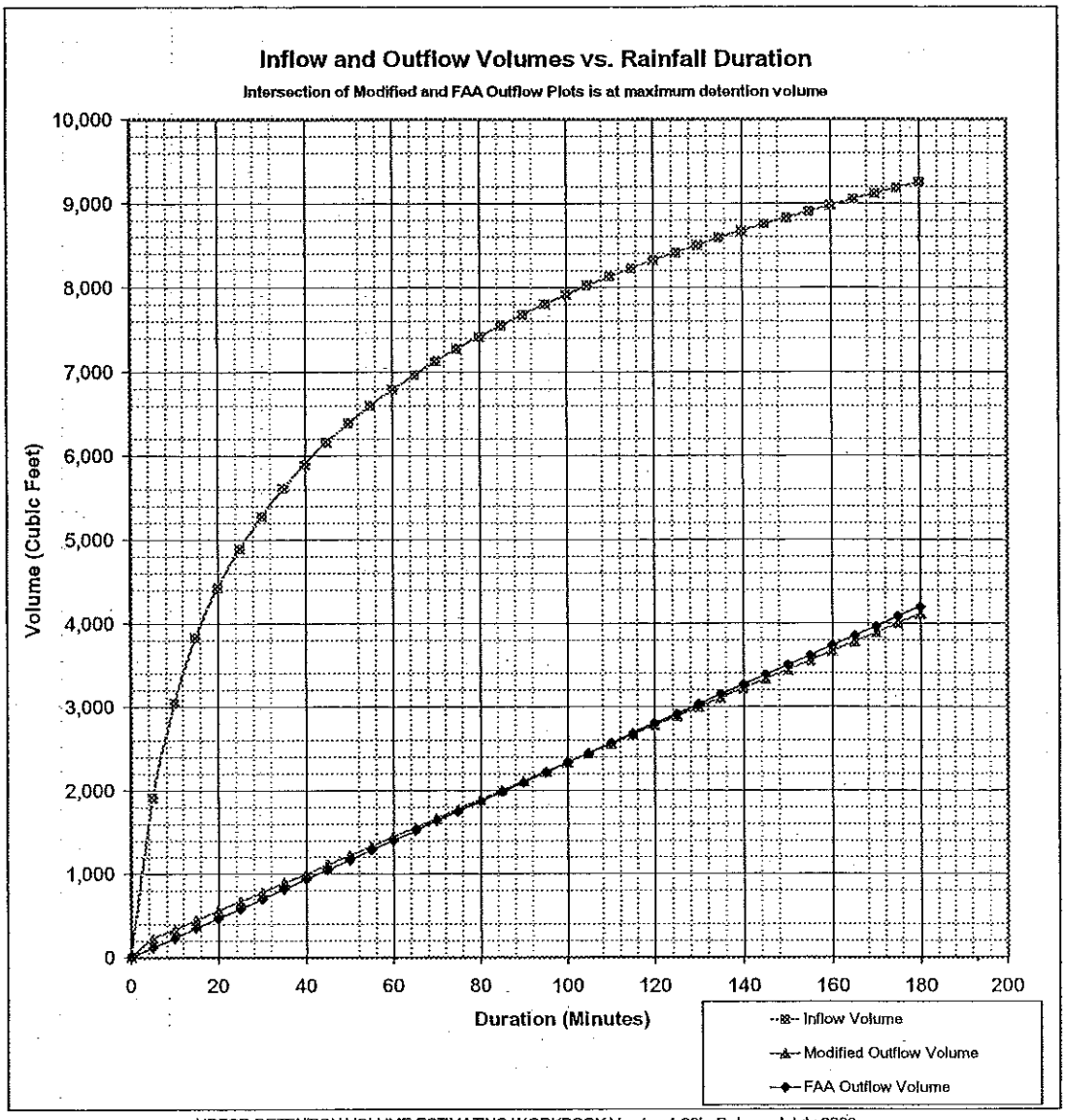

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: 13th St

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	100 percent
Catchment Drainage Area	A =	0.56 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.96
Inflow Peak Runoff	Qp-in =	4.82 cfs
Allowable Peak Outflow Rate	Qp-out =	0.56 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.12

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity Inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	6.96	1,445	1.00	0.56	168	1,277
10	7.14	2,302	0.75	0.42	252	2,050
15	5.98	2,889	0.67	0.37	336	2,553
20	5.16	3,342	0.63	0.35	420	2,922
25	4.59	3,698	0.60	0.34	504	3,195
30	4.13	3,994	0.58	0.33	588	3,406
35	3.78	4,246	0.57	0.32	672	3,574
40	3.46	4,465	0.56	0.32	756	3,708
45	3.21	4,659	0.56	0.31	840	3,819
50	3.00	4,833	0.55	0.31	924	3,909
55	2.81	4,990	0.55	0.31	1,008	3,982
60	2.65	5,134	0.54	0.30	1,092	4,042
65	2.51	5,267	0.54	0.30	1,176	4,091
70	2.39	5,390	0.54	0.30	1,260	4,130
75	2.28	5,505	0.53	0.30	1,344	4,161
80	2.18	5,613	0.53	0.30	1,428	4,185
85	2.08	5,715	0.53	0.30	1,512	4,203
90	2.00	5,810	0.53	0.30	1,596	4,214
95	1.93	5,901	0.53	0.29	1,680	4,221
100	1.86	5,988	0.53	0.29	1,764	4,224
105	1.79	6,070	0.52	0.29	1,848	4,222
110	1.74	6,149	0.52	0.29	1,932	4,217
115	1.68	6,225	0.52	0.29	2,016	4,209
120	1.63	6,297	0.52	0.29	2,100	4,197
125	1.58	6,367	0.52	0.29	2,184	4,183
130	1.53	6,434	0.52	0.29	2,268	4,166
135	1.49	6,499	0.52	0.29	2,352	4,147
140	1.45	6,561	0.52	0.29	2,436	4,125
145	1.42	6,622	0.52	0.29	2,520	4,102
150	1.38	6,680	0.52	0.29	2,604	4,076
155	1.35	6,737	0.52	0.29	2,688	4,049
160	1.32	6,793	0.52	0.29	2,772	4,021
165	1.29	6,846	0.52	0.29	2,856	3,990
170	1.26	6,898	0.51	0.29	2,940	3,958
175	1.23	6,949	0.51	0.29	3,024	3,925
180	1.21	6,999	0.51	0.29	3,108	3,891

Stormwater Detention Volume (Cubic Feet) = 4,224
Stormwater Detention Volume (Acre Feet) = 0.0970

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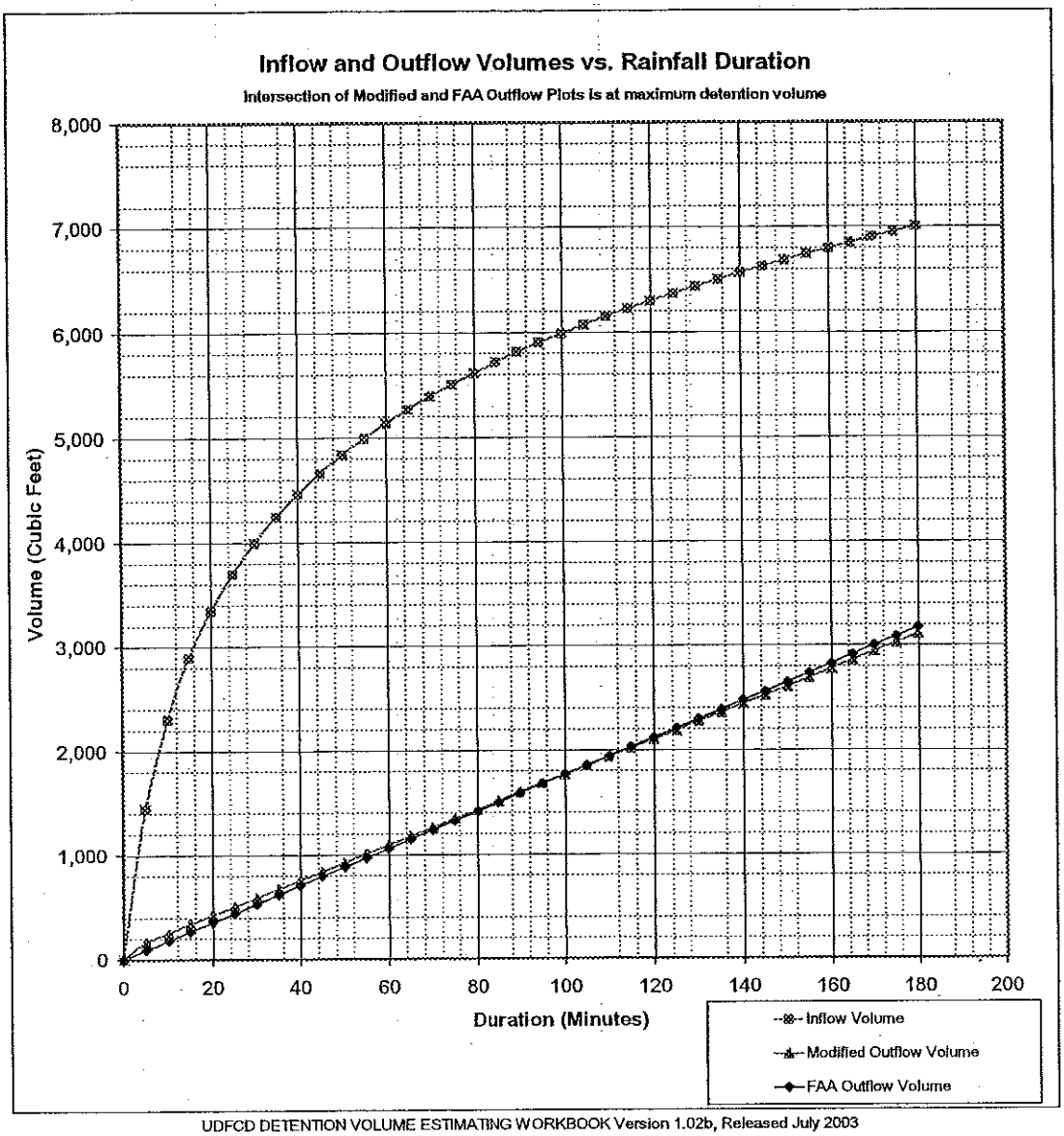

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DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Mesa Ave (E)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	100 percent
Catchment Drainage Area	A =	0.66 acres
Predevelopment NRCS Soil Group	Type =	B (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	0.85 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.96
Inflow Peak Runoff	Qp-in =	5.68 cfs
Allowable Peak Outflow Rate	Qp-out =	0.56 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.10

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	1,704	1.00	0.56	168	1,536
10	7.14	2,713	0.79	0.42	252	2,461
15	6.06	3,412	0.67	0.37	337	3,076
20	5.36	3,939	0.63	0.35	421	3,519
25	4.59	4,360	0.60	0.34	505	3,855
30	4.13	4,709	0.58	0.33	589	4,119
35	3.76	5,004	0.57	0.32	673	4,331
40	3.46	5,263	0.56	0.32	757	4,505
45	3.21	5,491	0.56	0.31	842	4,649
50	3.00	5,696	0.55	0.31	926	4,770
55	2.81	5,881	0.55	0.31	1,010	4,872
60	2.65	6,051	0.54	0.30	1,094	4,957
65	2.51	6,208	0.54	0.30	1,178	5,030
70	2.39	6,362	0.54	0.30	1,262	5,091
75	2.28	6,488	0.53	0.30	1,346	5,142
80	2.18	6,616	0.53	0.30	1,431	5,185
85	2.09	6,736	0.53	0.30	1,515	5,220
90	2.00	6,848	0.53	0.30	1,599	5,249
95	1.93	6,955	0.53	0.30	1,683	5,272
100	1.86	7,057	0.53	0.29	1,767	5,290
105	1.79	7,154	0.52	0.29	1,851	5,303
110	1.73	7,247	0.52	0.29	1,935	5,312
115	1.68	7,336	0.52	0.29	2,020	5,316
120	1.63	7,421	0.52	0.29	2,104	5,316
125	1.58	7,504	0.52	0.29	2,188	5,316
130	1.53	7,583	0.52	0.29	2,272	5,311
135	1.49	7,659	0.52	0.29	2,356	5,303
140	1.45	7,731	0.52	0.29	2,440	5,292
145	1.42	7,804	0.52	0.29	2,525	5,280
150	1.38	7,872	0.52	0.29	2,609	5,265
155	1.35	7,940	0.52	0.29	2,693	5,248
160	1.32	8,005	0.52	0.29	2,777	5,229
165	1.29	8,069	0.52	0.29	2,861	5,208
170	1.26	8,130	0.51	0.29	2,945	5,185
175	1.23	8,190	0.51	0.29	3,029	5,161
180	1.21	8,248	0.51	0.29	3,114	5,135

Stormwater Detention Volume (Cubic Feet) = 5,318
Stormwater Detention Volume (Acre Feet) = 0.1221

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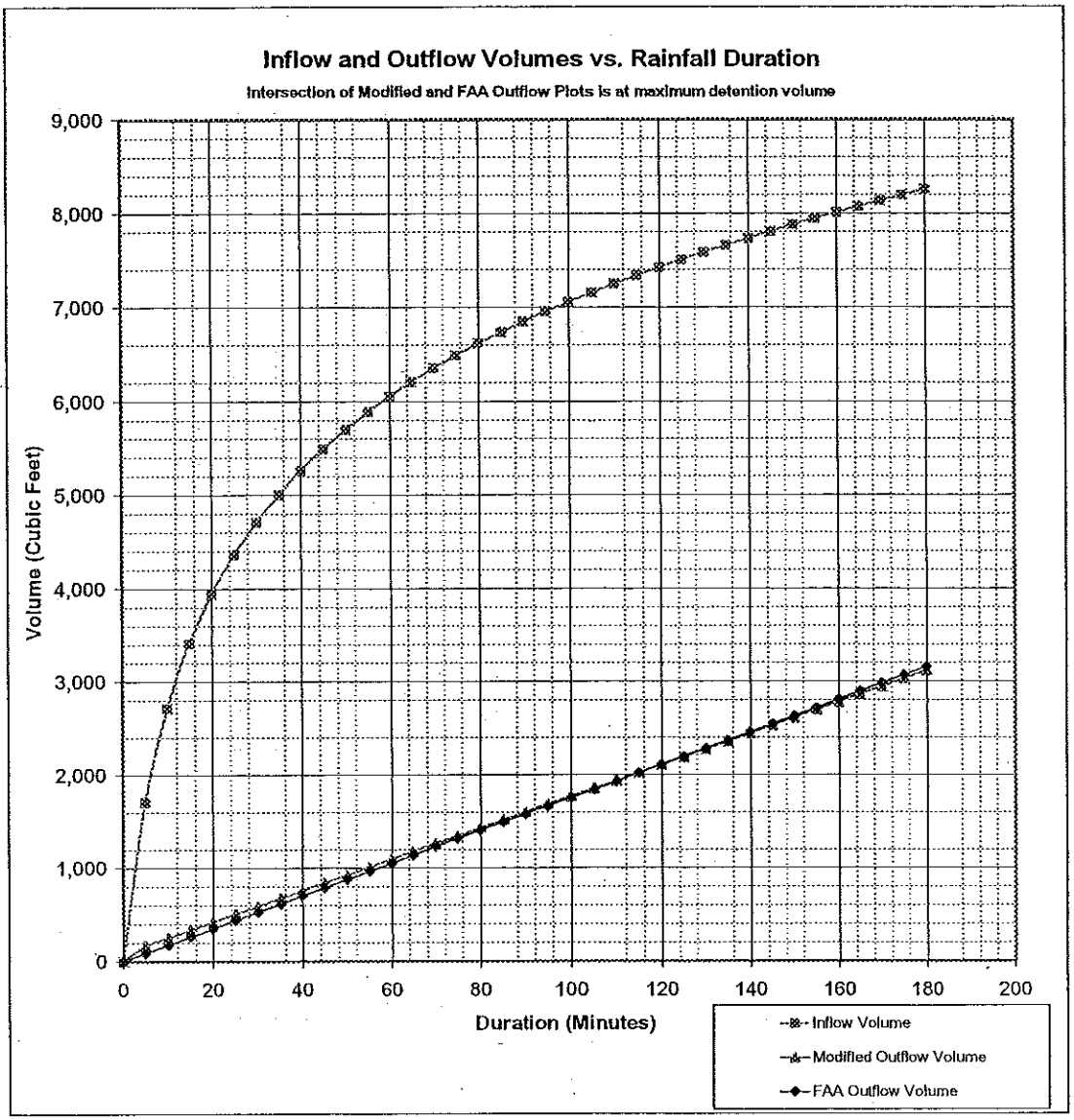


UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Mesa Ave (W)

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	100	percent
Catchment Drainage Area	A =	0.32	acres
Predevelopment NRCS Soil Group	Type =	B	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5	minutes
Allowable Unit Release Rate (See Table A)	q =	0.85	cfs/acre
One-hour Precipitation	P1 =	2.67	inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3			
Coefficient One	C1 =	26.50	
Coefficient Two	C2 =	10.00	
Coefficient Three	C3 =	0.79	

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.96	
Inflow Peak Runoff	Qp-in =	2.75	cfs
Allowable Peak Outflow Rate	Qp-out =	0.27	cfs
Ratio of Qp-out/Qp-in	Ratio =	0.10	

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

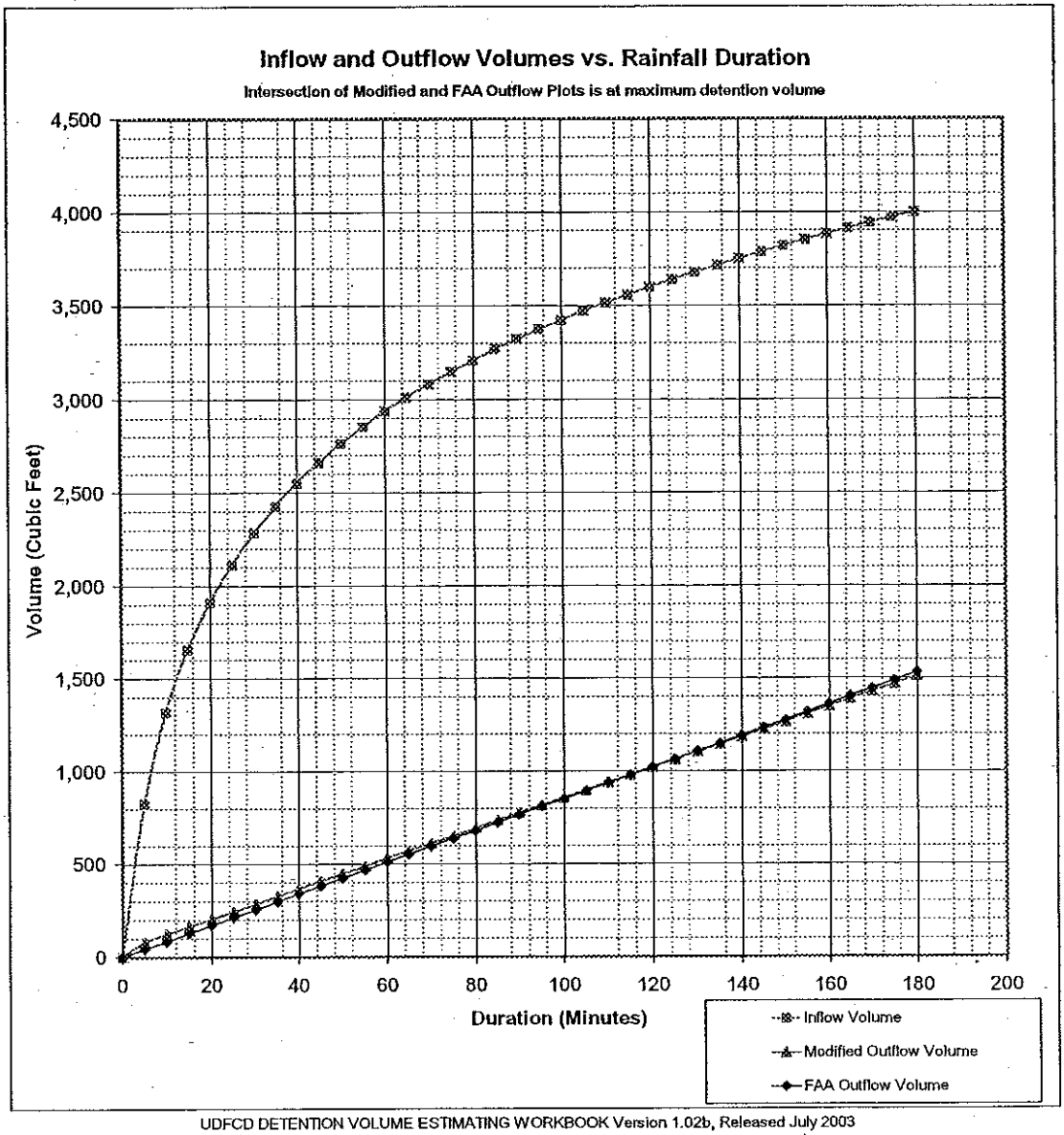
Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	4.66	826	1.00	0.27	82	744
10	7.14	1,316	0.75	0.20	122	1,193
15	5.98	1,654	0.67	0.18	163	1,491
20	5.18	1,910	0.63	0.17	204	1,706
25	4.59	2,114	0.60	0.16	245	1,869
30	4.14	2,287	0.58	0.16	286	1,997
35	3.78	2,426	0.57	0.16	326	2,100
40	3.46	2,552	0.56	0.15	367	2,184
45	3.21	2,662	0.56	0.15	408	2,254
50	3.00	2,762	0.55	0.15	449	2,313
55	2.81	2,852	0.55	0.15	490	2,362
60	2.65	2,934	0.54	0.15	530	2,404
65	2.51	3,010	0.54	0.15	571	2,439
70	2.39	3,080	0.54	0.15	612	2,468
75	2.28	3,146	0.53	0.15	653	2,493
80	2.18	3,208	0.53	0.14	694	2,514
85	2.09	3,265	0.53	0.14	734	2,531
90	2.00	3,320	0.53	0.14	775	2,545
95	1.93	3,372	0.53	0.14	816	2,556
100	1.86	3,422	0.53	0.14	857	2,565
105	1.79	3,469	0.52	0.14	898	2,571
110	1.73	3,514	0.52	0.14	938	2,576
115	1.68	3,557	0.52	0.14	979	2,578
120	1.63	3,598	0.52	0.14	1,020	2,578
125	1.58	3,638	0.52	0.14	1,061	2,577
130	1.53	3,676	0.52	0.14	1,102	2,575
135	1.49	3,713	0.52	0.14	1,142	2,571
140	1.45	3,748	0.52	0.14	1,183	2,566
145	1.42	3,784	0.52	0.14	1,224	2,560
150	1.38	3,817	0.52	0.14	1,265	2,553
155	1.35	3,850	0.52	0.14	1,306	2,544
160	1.32	3,881	0.52	0.14	1,346	2,535
165	1.29	3,912	0.52	0.14	1,387	2,525
170	1.26	3,942	0.51	0.14	1,428	2,514
175	1.23	3,971	0.51	0.14	1,469	2,502
180	1.21	3,999	0.51	0.14	1,510	2,490

Stormwater Detention Volume (Cubic Feet) = 2,578
Stormwater Detention Volume (Acre Feet) = 0.0592

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003



UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

DETENTION VOLUME BY MODIFIED FAA METHOD

(See USDCM Volume I Runoff Chapter for description of method)

Project: New Pueblo Freeway
Basin ID: Frontage Road near 29th Street

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing methods)
(Note: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

The user must fill in all of the blue cells for these sheets to function.

Design Information (Input):

Catchment Drainage Imperviousness	I_a =	70 percent
Catchment Drainage Area	A =	13.92 acres
Predevelopment NRCS Soil Group	Type =	C (A, B, C, or D
Return Period for Detention Control	T =	100 years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5 minutes
Allowable Unit Release Rate (See Table A)	q =	1.00 cfs/acre
One-hour Precipitation	P1 =	2.67 inches
Design Rainfall IDF Formula I = C1* P1/(C2+Tc)^C3		
Coefficient One	C1 =	28.50
Coefficient Two	C2 =	10.00
Coefficient Three	C3 =	0.79

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.88
Inflow Peak Runoff	Qp-in =	81.44 cfs
Allowable Peak Outflow Rate	Qp-out =	13.92 cfs
Ratio of Qp-out/Qp-in	Ratio =	0.18

Table A Recommended Unit Flow Release Rate in cfs/acre of tributary catchment within UDFCD boundaries.

Design Frequency	NRCS (SCS) Hydrologic Soil Group		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
50-year	0.33	0.56	0.68
100-year	0.50	0.85	1.00

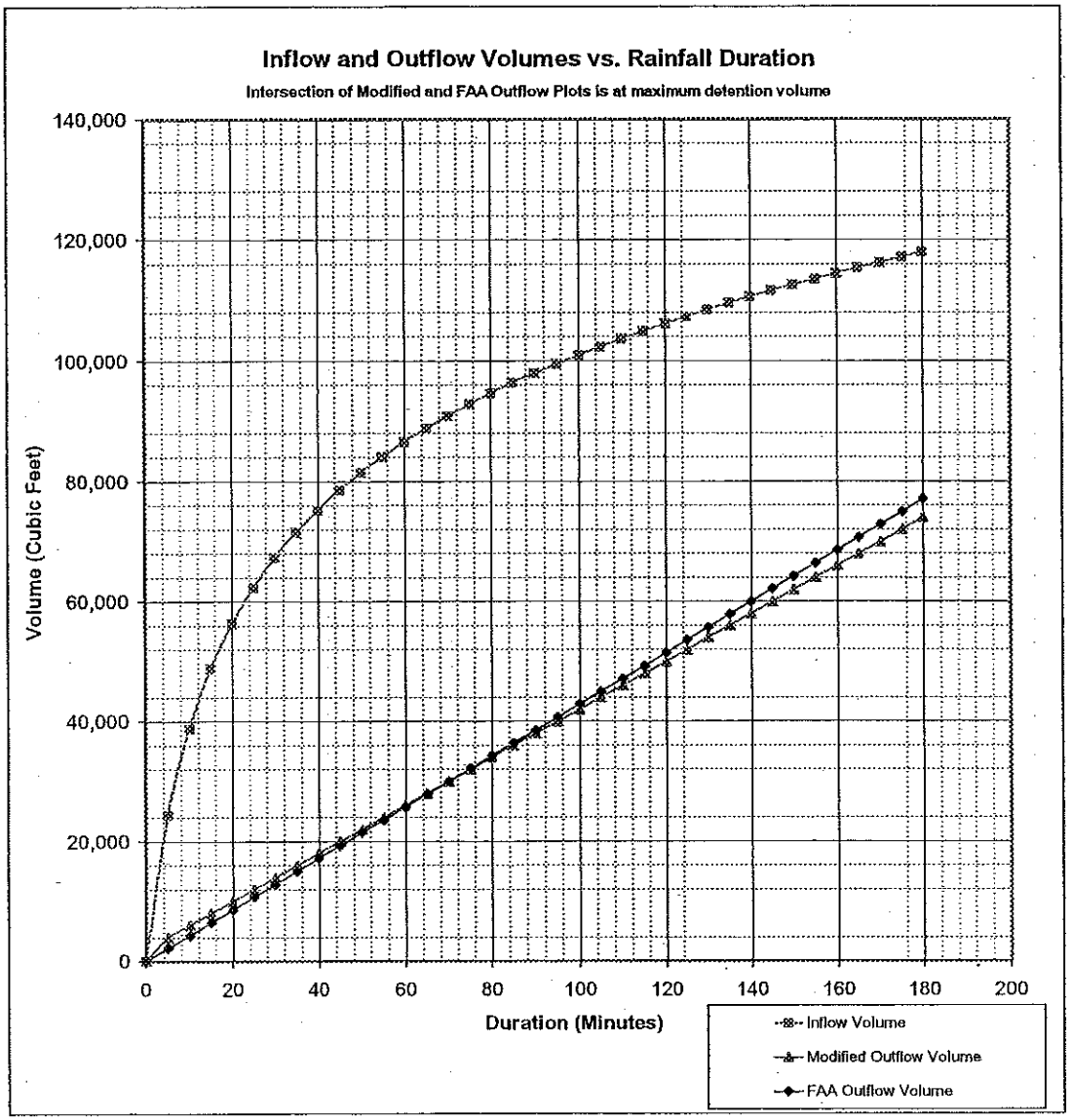
Determination of Detention Volume Using Modified FAA Method

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches/hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)
0	0.00	0	0.00	0.00	0	0
5	8.96	24,343	1.00	13.92	3,896	20,447
10	7.14	38,789	0.79	9.89	5,994	32,795
15	5.96	48,760	0.67	8.68	7,992	40,768
20	5.18	56,315	0.63	8.33	9,990	46,325
25	4.59	62,323	0.60	7.99	11,988	50,335
30	4.13	67,300	0.58	7.77	13,986	53,314
35	3.78	71,540	0.57	7.61	15,984	55,556
40	3.48	75,231	0.56	7.48	17,982	57,249
45	3.21	78,406	0.56	7.40	19,980	58,516
50	3.00	81,424	0.55	7.33	21,978	59,446
55	2.81	84,076	0.55	7.27	23,976	60,102
60	2.65	86,506	0.54	7.22	25,974	60,532
65	2.51	88,743	0.54	7.17	27,972	60,771
70	2.39	90,819	0.54	7.14	29,970	60,849
75	2.28	92,756	0.53	7.10	31,968	60,788
80	2.18	94,571	0.53	7.08	33,966	60,605
85	2.08	96,280	0.53	7.05	35,964	60,316
90	2.00	97,896	0.53	7.02	37,962	59,934
95	1.93	99,427	0.53	7.01	39,960	59,467
100	1.86	100,884	0.53	6.99	41,958	58,926
105	1.79	102,272	0.52	6.96	43,956	58,316
110	1.73	103,600	0.52	6.95	45,954	57,646
115	1.68	104,872	0.52	6.93	47,952	56,920
120	1.63	106,093	0.52	6.94	49,950	56,143
125	1.58	107,267	0.52	6.93	51,948	55,319
130	1.53	108,398	0.52	6.92	53,946	54,452
135	1.49	109,490	0.52	6.91	55,944	53,546
140	1.45	110,544	0.52	6.90	57,942	52,602
145	1.42	111,565	0.52	6.89	59,940	51,625
150	1.38	112,553	0.52	6.88	61,938	50,615
155	1.35	113,512	0.52	6.87	63,936	49,576
160	1.32	114,442	0.52	6.87	65,934	48,508
165	1.29	115,346	0.52	6.86	67,932	47,414
170	1.26	116,226	0.51	6.86	69,930	46,296
175	1.23	117,083	0.51	6.85	71,928	45,155
180	1.21	117,917	0.51	6.85	73,926	43,991

Stormwater Detention Volume (Cubic Feet) = 60,849
Stormwater Detention Volume (Acre Feet) = 1.3969

UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003



UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 1.02b, Released July 2003

Appendix 4: Pond Hydraulics

Purpose: To calculate the pond volume required to accommodate detention and WQCV.

Existing Alignment

	Onsite System Hydrology											*Local Streets*		*Total*
Basin	Percent Imperviousness	Soil Type	Runoff Coefficient C (100 yr)	Time of Concentration tc (min)	Area (ac)	DON'T SHOW Area (ac)	Rainfall Depth (100yr)	Inflow Qp100 (cfs)	Outlet Qp100 (cfs)	V100 (Ac-ft)	WQCV (ac-ft)	V100 (Ac-ft)	WQCV (ac-ft)	Detention and WQCV (ac-ft)
1	36	B	0.48	58	107	106.87	2.67	150	20	14	1.6	NA	NA	15
2	65	B	0.59	15	24	23.92	2.67	90	30	3	0.6	NA	NA	3
3	72	B	0.64	12	22	21.01	2.67	100	20	3	0.6	NA	NA	3
4	41	B	0.50	18	34	33.72	2.67	100	30	3	0.6	NA	NA	3
5	41	B	0.50	20	32	31.71	2.67	90	30	2	0.5	2	0.4	5
6a (Abr)	55	B	0.54	13	25	24.55	2.67	90	30	2	0.5	NA	NA	3
6b (east)	61	B	0.56	9	12	11.83	2.67	60	20	1	0.3	NA	NA	2
7	70	B	0.62	10	13	12.22	2.67	60	20	2	0.3	NA	NA	2
8	41	B	0.50	5	36	35.90	2.67	170	40	3	0.6	NA	NA	4
8a	41	B	0.50	12	31	31.00	2.67	110	30	3	0.5	1	0.1	3
9	44	D	0.59	12	30	29.14	2.67	120	30	3	0.5	1	0.1	4
10	61	C	0.63	14	30	29.26	2.67	120	30	3	0.6	1	0.1	4
11	61	C	0.63	17	47	47.00	2.67	170	50	5	1.0	NA	NA	5
12	90	C	0.83	7	8	7.60	2.67	60	10	2	0.3	2	0.4	4

Sources:

Percent Imperviousness	Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type	Natural Resources Conservation Service
Runoff Coefficient	Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.

Data Presentation:
Values shown for time of concentration, area, volume, and flowrate are rounded. The total volume was calculated from the unrounded values, with the result rounded.

Purpose: To calculate the quantity of water quality capture volume required.

Local Streets WQCV: Existing Alignment

Location See Figure 6	Soil Type	Percent Impervious	Area (ac)	WQCV (ft^3)	WQCV (ac-ft)
NFR	C	70	14	0.3	0.4
Dillon	C	100	8	0.5	0.3
Hwy 50B	C	61	16	0.3	0.4
Northern (W)	B	100	6	0.5	0.3
Northern (E)	B	80	4	0.4	0.1
Mesa (E)	B	100	1	0.5	0.1
Mesa (W)	B	100	1	0.5	0.1
1st (W)	D	100	1	0.5	0.1
1st (E)	D	100	1	0.5	0.1
4th (W)	D	100	1	0.5	0.1
4th (E)	D	100	1	0.5	0.1
8th (W)	D	100	1	0.5	0.1
8th (E)	C	46	3	0.2	0.1
13th	C	100	1	0.5	0.1
Pueblo Blvd	B	61	6	0.3	0.2

W= West of I-25
E=East of I-25

Sources:
Percent Impervious Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type Natural Resources Conservation Service

Data Presentation:
Values shown for percent impervious and area are rounded.
The WQCV was calculated from unrounded values, with the result rounded.

Purpose: To calculate the pond volume required to accommidate detention and WQCV.

Modified Alignment

	Onsite System Hydrology										*Local Streets*		*Total*
Basin	Percent Imperviousness	Soil Type	Runoff Coefficient C (100 yr)	Time of Concentration tc (min)	Area (ac)	Rainfall Depth (100yr)	Inflow Qp100 (cfs)	Outlet Qp100 (cfs)	V100 (Ac-ft)	WQCV (ac-ft)	V100 (Ac-ft)	WQCV (ac-ft)	Detention and WQCV (ac-ft)
1	50	B	0.52	56	107	2.67	150	20	14	1.9	NA	NA	16
2	61	B	0.56	18	23	2.67	80	20	2	0.5	NA	NA	3
3	41	B	0.5	14	16	2.67	50	20	2	0.3	NA	NA	2
4	61	B	0.56	18	52	2.67	170	50	5	1.1	NA	NA	6
5	41	A	0.41	11	17	2.67	40	10	2	0.3	NA	NA	2
6a&b	54	B	0.54	16	66	2.67	210	60	5	1.2	NA	NA	7
7	50	B	0.52	12	41	2.67	150	40	3	0.7	NA	NA	4
8	41	B	0.5	10	17	2.67	60	20	2	0.3	NA	NA	2
8a	41	B	0.5	12	31	2.67	110	30	3	0.5	1	0.1	3
9	44	D	0.59	12	30	2.67	120	30	3	0.5	1	0.1	4
10	61	C	0.63	14	30	2.67	120	30	3	0.6	1	0.1	4
11	61	C	0.63	17	47	2.67	180	50	5	1.0	NA	NA	5
12	90	C	0.83	7	8	2.67	60	10	2	0.3	2	0.4	4

Sources:
Percent Imperviousness Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type Natural Resources Conservation Service
Runoff Coefficient Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.

Data Presentation:
Values shown for time of concentration, area, volume, and flowrate are rounded. The total volume was calculated from the unrounded values, with the result rounded.

Purpose: To calculate the quantity of water quality capture volume required.

Local Streets WQCV: Modified Alignment

Location See Figure 7	Soil Type	Percent Impervious	Area (ac)	WQCV (ft^3)	WQCV (ac-ft)
NFR	C	70	14	0.3	0.4
Dillon	C	100	8	0.5	0.3
Hwy 50B	C	61	16	0.3	0.4
Northern (W)	B	100	2	0.5	0.1
Northern (E)	B	80	3	0.4	0.1
Mesa (W)	B	100	1	0.5	0.1
Mesa (E)	B	100	2	0.5	0.1
1st (W)	D	100	1	0.5	0.1
1st (E)	D	100	1	0.5	0.1
4th (W)	D	100	1	0.5	0.1
4th (E)	D	100	1	0.5	0.1
8th (W)	D	100	1	0.5	0.1
8th (E)	C	46	3	0.2	0.1
13th	C	100	1	0.5	0.1
Indiana (E)	B	100	1	0.5	0.1
Pueblo Blvd	B	61	6	0.3	0.2

W= West of I-25
E=East of I-25

Sources:
Percent Impervious Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type Natural Resources Conservation Service

Data Presentation:
Values shown for percent impervious and area are rounded.
The WQCV was calculated from unrounded values, with the result rounded.

Appendix 5: Conveyance Hydraulics

Purpose: To judge feasibility of conveyance system.

Existing Alignment Alternative

	Onsite Basin		Onsite Detention Ponds		Local Streets		Offsite Basins					
Reach ID	ID	Peak Discharge 100-yr (cfs)	ID	Release Rate 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	Design Discharge* 100-yr (cfs)	slope (flattest)	Full flow diameter (computed from Flowmaster)	Selected Pipe Size
A	2	90	none		none		none		90	0.5%	45	48
B	3	100	pond 2	30	none		Q	80	190	3.7%	41	42
C	4	100	ponds 2 and 3	40	none		Q	80	210	0.8%	57	60
D	5	90	ponds 2, 3, and 4	70	none		Q+R	350	500	1.4%	72	72
E	6a	90	none		none		S	260	350	1.4%	62	66
F	6b	60	ponds 2, 3, 4, and 5	100	Northern and Mesa	60	Q, R, T	400	620	0.5%	94	96
G			ponds 2, 3, 4, 5, 6A, and 6B	130	Northern and Mesa	80	Q, R, T, S	660	850	0.5%	106	108
H	7	80	none		none		none		80	0.6%	37	42
AA	8	230	none		none		none		230	0.6%	62	66
BB	8a	110	none		1st	20	none		120	1.3%	42	42
CC	9	120	none		none		W	60	180	0.5%	59	60
DD	10	120	none		none		Y + Z	50	170	0.5%	56	60
EE	11	180	none		none		none		180	0.6%	57	60
FF	12	140	none		none		none		140	0.8%	49	54
Det 7 outfall				20					20	0.5%	20	21
Det 8a outfall				30					30	0.5%	29	30
Det 8 outfall				40					40	0.5%	31	33
Det 9 outfall				30					30	0.5%	30	30
Det 10 outfall				30					30	0.5%	30	30
Det 11 outfall				40					40	0.5%	31	33
Det 12 outfall				10					10	0.5%	18	18
Det 11 & 12 outfalls				50					50	0.5%	33	33

* Design Discharge = $Q_{onsite\ basin} + Q_{detention\ release} + Q_{local\ streets} + Q_{offsite}$

Data Presentation:
Values shown for contributing discharges are rounded. Where multiple values were summed to find a flow, the unrounded values were summed with the result being rounded.

Purpose: To judge feasibility of conveyance system.

Modified Alignment Alternative

	Onsite Basin		Onsite Detention Ponds		Local Streets		Offsite Basins					
Reach ID	ID	Peak Discharge 100-yr (cfs)	ID	Release Rate 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	Design Discharge* 100-yr (cfs)	slope (flattest)	Full flow diameter (computed from Flowmaster)	Selected Pipe Size
A	2	80	none		none		none		80	0.5%	42	42
B	3	50	pond 2	20	none		Q	80	150	0.6%	53	54
C	4	170	ponds 2 and 3	40	none		Q	80	270	2.0%	53	54
D			ponds 2, 3, 4b	80	none		Q + R	350	430	2.0%	64	66
E	5	40	none		none		S	260	290	2.0%	56	60
F	6	210	ponds 2, 3, 4, and 5	90	none		Q, R, T	400	690	1.5%	80	84
G			ponds 2, 3, 4, 5, and 6b	150	none		Q, R, S, T	660	800	1.5%	85	90
H	7	150	none		none		none		150	1.3%	45	48
AA	8	60	none		none		none		60	1.3%	33	33
BB	8a	110	none		1st	20	none		120	1.3%	42	42
CC	9	120	none		none		W	60	180	0.5%	59	60
DD	10	120	none		none		Y+Z	50	170	0.6%	56	60
EE	11	180	none		none		none		180	0.6%	57	60
FF	12	140	none		none		none		140	0.8%	49	54
Det 7 outfall				40					40	0.5%	32	33
Det 8a outfall				30					30	0.5%	29	30
Det 8 outfall				20					20	0.5%	23	24
Det 9 outfall				30					30	0.5%	30	30
Det 10 outfall				30					30	0.5%	30	30
Det 11 outfall				40					40	0.5%	31	33
Det 12 outfall				10					10	0.5%	18	18
Det 11 & 12 outfalls				50					50	0.5%	33	33

* Design Discharge = $Q_{onsite\ basin} + Q_{detention\ release} + Q_{local\ streets} + Q_{offsite}$

Data Presentation:
Values shown for contributing discharges are rounded. The design discharge was calculated from the unrounded values, with the result rounded.

Bessemer Ditch

CURRENT DATE: 04-25-2005
CURRENT TIME: 09:41:55

FILE DATE: 04-25-2005
FILE NAME: B_D_CURR

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	4766.25	4764.90	214.75	1 RCB	15.00	8.00	.013	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: B_D_CURR DATE: 04-25-2005

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4768.17	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4769.27	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4770.21	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4771.01	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4771.75	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4772.45	600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4773.12	700.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4773.44	750.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4774.41	900.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
4775.06	1000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B_D_CURR DATE: 04-25-2005

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
0.00	0.000	0.00	0.00	0.00
4768.17	0.000	100.00	0.00	0.00
4769.27	0.000	200.00	0.00	0.00
4770.21	0.000	300.00	0.00	0.00
4771.01	0.000	400.00	0.00	0.00
4771.75	0.000	500.00	0.00	0.00
4772.45	0.000	600.00	0.00	0.00
4773.12	0.000	700.00	0.00	0.00
4773.44	0.000	750.00	0.00	0.00
4774.41	0.000	900.00	0.00	0.00
4775.06	0.000	1000.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT TIME: 09:41:55 FILE NAME: B_D_CURR

PERFORMANCE CURVE FOR CULVERT 1 - 1(15.00 (ft) BY 8.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	4766.25	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
100.00	4768.17	1.92	1.92	1-S2n	0.86	1.12	0.87	0.93	7.67	7.79
200.00	4769.27	3.02	3.02	1-S2n	1.31	1.77	1.27	1.38	10.49	9.80
300.00	4770.21	3.96	3.96	1-S2n	1.73	2.32	1.78	1.74	11.23	11.14
400.00	4771.01	4.76	4.76	1-S2n	2.09	2.81	2.17	2.04	12.28	12.18
500.00	4771.76	5.51	5.51	1-S2n	2.44	3.26	2.54	2.31	13.11	13.02
600.00	4772.45	6.20	6.20	1-S2n	2.75	3.68	2.88	2.55	13.87	13.75
700.00	4773.12	6.87	6.87	1-S2n	3.05	4.08	3.23	2.77	14.43	14.38
750.00	4773.44	7.19	7.19	1-S2n	3.21	4.28	3.40	2.88	14.73	14.67
900.00	4774.41	8.16	8.16	5-S2n	3.63	4.83	3.87	3.17	15.51	15.46
1000.00	4775.06	8.81	8.81	5-S2n	3.91	5.18	4.18	3.35	15.95	15.93

El. inlet face invert 4766.25 ft El. outlet invert 4764.90 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	4766.25 ft
OUTLET STATION	214.75 ft
OUTLET ELEVATION	4764.90 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0063
CULVERT LENGTH ALONG SLOPE	214.75 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	15.00 ft
BARREL RISE	8.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.013
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

CURRENT DATE: 04-25-2005 FILE DATE: 04-25-2005
CURRENT TIME: 09:41:55 FILE NAME: B_D_CURR

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	12.00 ft
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (ft/ft)	0.006
MANNING'S n (.01-0.1)	0.013
CHANNEL INVERT ELEVATION	4764.90 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	4764.90 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

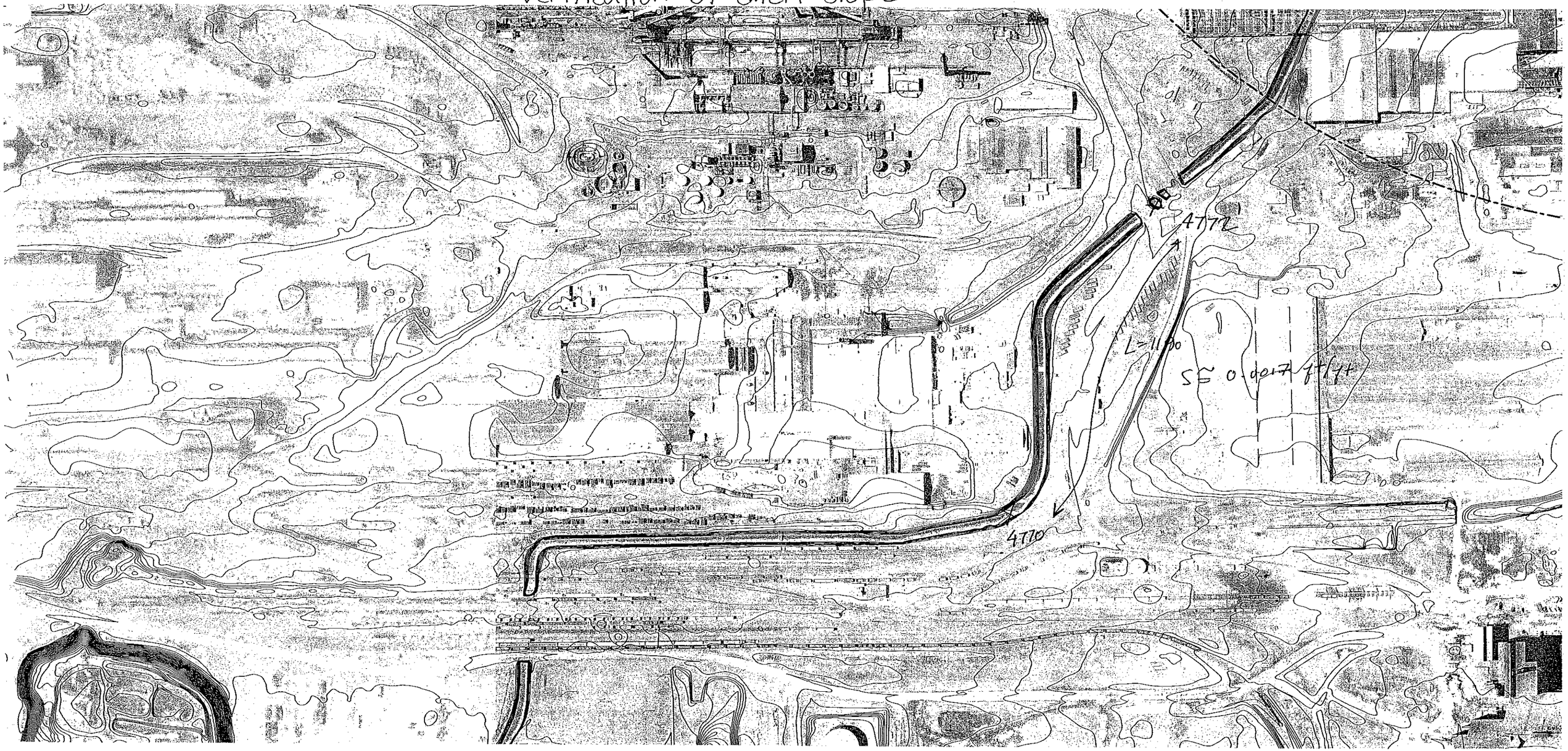
FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	4764.90	0.000	0.00	0.00	0.00
100.00	4765.83	1.425	0.93	7.79	0.36
200.00	4766.28	1.469	1.38	9.80	0.54
300.00	4766.64	1.489	1.74	11.14	0.68
400.00	4766.94	1.502	2.04	12.18	0.80
500.00	4767.21	1.510	2.31	13.02	0.91
600.00	4767.45	1.516	2.55	13.75	1.00
700.00	4767.67	1.521	2.77	14.38	1.09
750.00	4767.78	1.524	2.88	14.67	1.13
900.00	4768.07	1.529	3.17	15.46	1.25
1000.00	4768.25	1.532	3.35	15.93	1.32

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	20.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	4776.25 ft

0

Verification of ditch slope



1" = 300'

4/29/05