Addendum to the 2005 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

CDOT Project Control No.: 12831

Prepared By:

CH2M HILL

9193 S. Jamaica Street

Englewood, Colorado 80112

June, 2012

Report Update Summary

This June, 2012 addendum to the Conceptual Drainage Design Report for the New Pueblo Freeway involves updates to the offsite basins and water quality capture volume.

The quantity and size of the offsite basins has been updated based on the City of Pueblo's storm drain system maps and an aerial topographic contour survey. The storm drain system maps provide the inlet locations and pipe sizes which collect and convey runoff away from the I-25 corridor. The updated offsite basins identify areas that will drain through or across the I-25 corridor. Some offsite basins will have to be routed through the Project's ponds while other offsite basins can drain across I-25 via an existing culvert or underground pipe system. The update to the offsite basins appears in the following sections of this report: Hydrology (Drainage Basin Description, Table 1 and Table 3), Hydraulic Analysis and Design (Drainage Design Concept and Table 5), and Appendix 2, 3 and 5.

The Project's water quality capture volume (WQCV) requirement has been increased by twenty percent to account for sedimentation. Updates to the WQCV appear in following sections of this report: Hydraulic Analysis and Design (Table 6 and 7) and Appendix 4.

Hydrology

Drainage Basin Description

Modify the last two sentences in the first paragraph to read, “Runonff that must be treated for quantity and quality before being released to these streams is generated from approximately 451 acres for the Existing Alignment Alternative or 485 acres for the Modified Alignment Alternative. An additional 422 acres of offsite area for the Existing Alignment Alternative drains through the project site or 426 acres for the Modified Alignment Alternative.”

Modify the first sentence of the fourth paragraph to read, “A total of 14 onsite basins and 27 offsite basins were identified; maps of these basins are provided in Figures 4 and 5. “

Modify Table 1 as follows.

TABLE 1
Basin Drainage

Basins	Receiving Water Body
Onsite Basin 1	Contributes to the existing Southgate Development system that outfalls to Lake Minnequa
Offsite Basins A-D	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 E-O	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 P-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
Onsite Basins 9-12	Directed east to Fountain Creek
Offsite basins V-Z	Directed east to Fountain Creek

Modify Table 3 as follows:

TABLE 3
Offsite Basin Hydrology

Basin	Existing Alignment Major Storm Discharge (cfs)	Modified Alignment Major Storm Discharge (cfs)
A	520	520
B	20	20
C	40	40
D	30	30
E	20	20
F	20	20
G	140	140
H	30	40
I	10	10
J	20	30
K	140	140
L	80	50
M	90	130
N	40	40
O	10	10
P	60	60
Q	40	40
R	40	40
S	20	20
T	40	30
U	10	10
V	30	30
W	40	40
X	20	30
Y	60	60
Z1	30	30
Z2	30	30

Hydraulic Analysis and Design

Drainage Design Concept

Drainage System

Replace entire "Drainage System" section from page 6 to 9 with the following:

The proposed drainage plan for both the Existing 1-25 Alignment Alternative and the Modified 1-25 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 A located at the southeast corner of the Pueblo Boulevard interchange;
- Basins B and C located at the northeast corner of the Pueblo Boulevard interchange;
- Basins E and F located west of I-25 between Joliet Avenue and Aqua Avenue;
- Basin G located at the southwest corner of the Indiana Avenue interchange;
- Basin H located west of I-25 between Canal Street and Central Avenue;
- Basin I located at the northwest corner of the Central Avenue on/off ramp;
- Basins J and K located west of I-25 between Mesa Avenue and West Summit Avenue;
- Basin L located east of I-25 and north of Mesa Avenue;
- Basins M, N and O located west of I-25 between West Summit Avenue and Abriendo Avenue;
- Basins P, Q, R, S and T located west of I-25 between the Arkansas River and Spring Street;
- Basin U located at the northeast corner of the existing Ilex Avenue interchange;
- Basins V, W and X located west of I-25 between West 9th Street and West 15th Street; and
- Basins Y, Z1 and Z2 located west of I-25 between West 20th Street and West 23rd 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, E and F are collected into reach A and conveyed to Pond 2.
- The outfall of Pond 2 travels through reach B where it is joined by runoff from drainage basin 3 and G before entering Pond 3.
- Drainage from drainage basin 4 comes together with the outfall of Pond 3 into reach C, contributing to Pond 4 which also received runoff from drainage basin H.
- Reach D conveys the outfall of Pond 4 and the runoff from drainage basins 5, I, K, Northern Avenue and Mesa Avenue to Pond 5, which also accepts flow from drainage basin L.
- 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 J is 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 and conveyed to Pond 7, which outfalls through reach H to the Arkansas River.

Modified 1-25 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, E and F are collected into reach A and conveyed to Pond 2.
- The outfall of Pond 2 and runoff from basin G travel through reach B to the Pond 3 outfall.
- Runoff from basin 3 is collected and detained in Pond 3 before being released to combine with reach B and flow into reach C.
- Flows from drainage basin 4 are collected in reach C and conveyed to Ponds 4a and 4b which also receive runoff from basins H and I.
- Reach D conveys the outfall of Pond 4b and the runoff from drainage basins 6, K, L, Northern Avenue and Mesa Avenue to the dual pond system of Pond 6a and 6b.
- Runoff from basins 5 and J are collected in reach E and conveyed to Pond 5 before being released through reach F to the dual pond system of 6a and 6b.
- Pond 6b outlets into reach G which discharges to the Arkansas River.

Finally, as in the Existing I-25 Alignment Alternative, drainage basin 7 will likely be collected and conveyed to Pond 7, which outfalls through reach H 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 V via reach CC and outlets to Fountain Creek.

- Drainage basin 10 flows through reach DD to Pond 10, where runoff from 13th Street and drainage basin X contribute to the pond. Pond 10 then releases to Fountain Creek.
- Offsite flow from basins Y and Z1 drain to existing culverts at West 20th and 21st Street, respectively, that cross under I-25 that discharge to the east.
- Discharge from drainage basin 11 is conveyed via reach EE to Pond 11, which also accepts runoff from basin Z2.
- 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 predevelopment rates, this design assumes release at the more conservative historic rates. When the project progresses further in the design phase, analysis of the allowable predevelopment release rates may result in smaller pond sizes. Complete pond hydraulic calculations are included in Appendix 4.

Modify Table 5 as follows:

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	E and F		E and F	
3	G			
4	H		G, H and I	
5	I, K and L	Northern and Mesa	J	
6a	J		K and L	
6b				
7			T and U	
8				
8a		1st Street		1st Street
9		8th Street		8th Street
10		13th Street		13th Street
11	Z2		Z2	
12		Frontage Road		Frontage Road

Modify Table 6 as follows (values have increased due to incorporation of 20% additional WQCV for sedimentation):

TABLE 6
Conceptual WQCVs

Area Served	Existing Alignment WQCV Storage Volume (ac-ft)	Modified Alignment WQCV Storage Volume (ac-ft)
Basin 1	1.9	2.3
Basin 2	0.7	0.6
Basin 3	0.7	0.3
Basin 4	0.7	1.3
Basin 5	0.6	0.4
Basin 6a	0.6	1.5
Basin 6b	0.3	N/A
Basin 7	0.4	0.9
Basin 8	0.7	0.4
Basin 8a	0.6	0.6
Basin 9	0.6	0.6
Basin 10	0.8	0.8
Basin 11	1.2	1.2
Basin 12	0.4	0.4
Frontage Road	0.4	0.4
Dillon Avenue	0.4	0.4
US HWY 50	0.4	0.4
Northern Avenue	0.5	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	N/A	0.1
Pueblo Blvd	0.2	0.2

Modify Table 7 as follows (highlighted values have increased by 1 acre-foot due to incorporation of 20% additional WQCV for sedimentation):

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	16	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	N/A	N/A
7	2	20	4	40
8	4	40	2	20
8a	4	30	4	30
9	4	30	4	30
10	4	30	4	30
11	6	50	6	50
12	4	10	4	10
WQ1	1	*	1	*
WQ2	1	*	1	*
WQ3	1	*	1	*

Notes:
Pond 1's release rate reflects the historic release rate per the Southgate Development Drainage Report, which is less than the allowed pre-development release rate.

* WQCV shall be released in 40 hours.

Appendix 2: Hydrology Parameters

Basin Characteristics

Modify Offsite Basins characteristics as follows:

Offsite Basins

Basin	Land Use	Percent Imp.	Soil Type	Runoff Coefficient "C" (100 yr)	Existing Alignment Area (Ac)	Modified Alignment Area (Ac)
A	100% commercial	95	B	0.88	195	195
B	90% open, 10% roadway	10	B	0.40	5	5
C	80% open, 20% roadway	20	B	0.44	14	14
D	90% open, 10% roadway	10	B	0.40	10	10
E	100% residential	85	B	0.75	3	3
F	100% residential	85	B	0.75	3	3
G	100% residential	85	B	0.75	35	35
H	100% commercial	95	B	0.88	4	6
I	90% open, 10% roadway	10	B	0.40	2	1
J	100% residential	85	B	0.75	3	5
K	23% comm, 77% residential	87.3	B	0.78	32	32
L	14% open, 86% comm	82.4	B	0.72	19	11
M	100% residential	85	B	0.75	20	30
N	100% residential	85	B	0.75	9	9
O	100% commercial	95	B	0.88	1	1
P	100% commercial	95	B	0.88	12	12
Q	100% commercial	95	B	0.88	5	5
R	100% commercial	95	B	0.88	5	5
S	100% commercial	95	B	0.88	2	2
T	100% commercial	95	B	0.88	6	4
U	100% commercial	95	B	0.88	1	1
V	100% commercial	95	C	0.89	4	4
W	100% commercial	95	C	0.89	6	6
X	100% commercial	95	C	0.89	3	4
Y	100% residential	85	C	0.79	12	12
Z1	100% residential	84	C	0.79	6	6
Z2	100% residential	85	C	0.79	5	5
				Total =	422	426

Sources:
Percent Impervious: 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.

Appendix 3: Hydrology Parameters

Time of Concentration and Peak Discharge Calculations for Offsite Basins

Modify Offsite Basins time of concentration and peak discharge calculations for Existing Alignment Alternative and Modified Alignment Alternative as shown on following pages:

Purpose: Time of Concentration for Offsite Basins

Offsite Basins - Modified Alignment

Basin	Overland Flow (min)	Channel Flow (min)	Total t_c (min)	Regional t_c (min)
A	18	75	93	52
B	6	8	14	14
C	14	19	33	19
D	28	5	33	16
E	8	9	17	15
F	8	5	13	15
G	8	23	31	22
H	5	8	13	16
I	10	1	11	11
J	8	2	10	13
K	7	17	25	19
L	9	13	22	17
M	8	9	17	19
N	8	10	18	21
O	5	2	8	13
P	7	15	22	18
Q	7	9	15	15
R	7	5	11	13
S	7	3	9	12
T	7	8	14	16
U	7	2	9	12
V	5	12	17	16
W	5	9	14	15
X	3	11	13	15
Y	2	19	22	19
Z1	2	18	20	18
Z2	2	12	14	16

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 he total travel length.

Data Presentation:
The total tc and regional tc are calculated from unrounded values, with the results rounded.

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin A

I. Catchment Hydrologic Data

Catchment ID = A
Area = 195.00 Acres
Percent Imperviousness = 95.00 %
NRCS Soil Type = B A, B, C, or D

For catchments larger than 90 acres, CUHP hydrograph and routing are recommended.

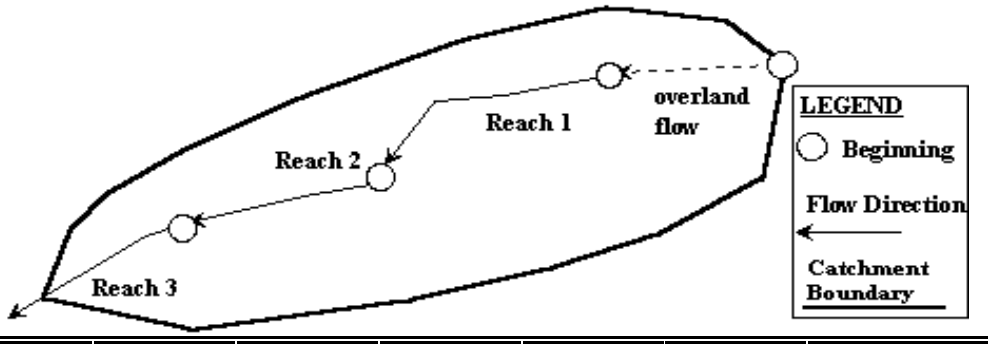
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0030	500	0.81	N/A	0.47	17.65
1	0.0060	7,000		20.00	1.55	75.31
2						
3						
4						
5						
	Sum	7,500			Computed Tc =	92.96
					Regional Tc =	51.67
					User-Entered Tc =	51.67

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	1.99	inch/hr	Peak Flowrate, Qp =	341.01	cfs
Rainfall Intensity at Regional Tc, I =	2.98	inch/hr	Peak Flowrate, Qp =	510.19	cfs
Rainfall Intensity at User-Defined Tc, I =	2.98	inch/hr	Peak Flowrate, Qp =	510.19	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin B

I. Catchment Hydrologic Data

Catchment ID =	B	
Area =	5.00	Acres
Percent Imperviousness =	10.00	%
NRCS Soil Type =	B	A, B, C, or D

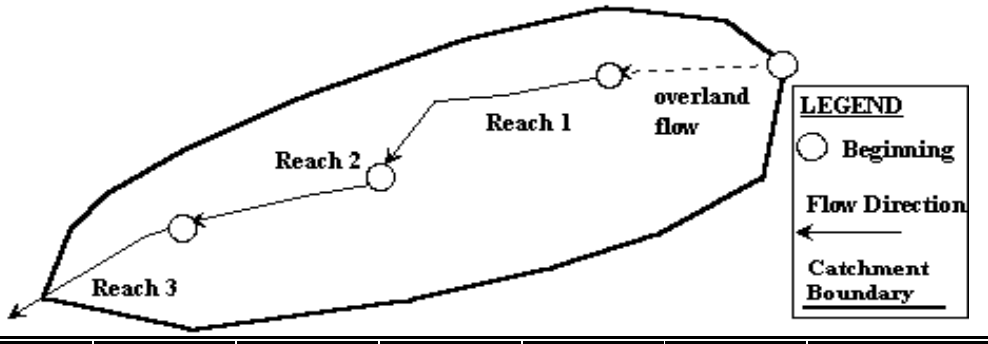
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.40	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.14	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	20	0.14	N/A	0.05	6.19
1	0.0050	700		20.00	1.41	8.25
2						
3						
4						
5						
	Sum	720			Computed Tc =	14.44
					Regional Tc =	14.00
					User-Entered Tc =	14.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.17	inch/hr	Peak Flowrate, Qp =	12.45	cfs
Rainfall Intensity at Regional Tc, I =	6.26	inch/hr	Peak Flowrate, Qp =	12.62	cfs
Rainfall Intensity at User-Defined Tc, I =	6.26	inch/hr	Peak Flowrate, Qp =	12.62	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin C

I. Catchment Hydrologic Data

Catchment ID =	C	
Area =	14.00	Acres
Percent Imperviousness =	20.00	%
NRCS Soil Type =	B	A, B, C, or D

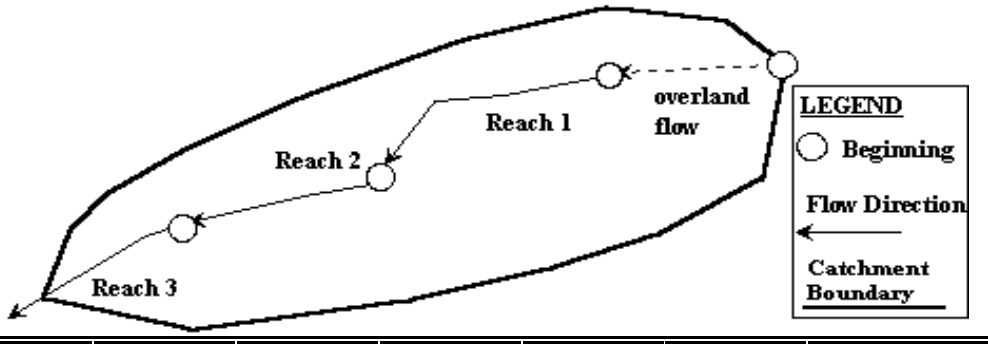
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.44	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.20	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0060	50	0.20	N/A	0.06	13.64
1	0.0050	1,600		20.00	1.41	18.86
2						
3						
4						
5						
	Sum	1,650			Computed Tc =	32.50
					Regional Tc =	19.17
					User-Entered Tc =	19.17

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	3.99	inch/hr	Peak Flowrate, Qp =	24.66	cfs
Rainfall Intensity at Regional Tc, I =	5.37	inch/hr	Peak Flowrate, Qp =	33.15	cfs
Rainfall Intensity at User-Defined Tc, I =	5.37	inch/hr	Peak Flowrate, Qp =	33.15	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin D

I. Catchment Hydrologic Data

Catchment ID =	D	
Area =	10.00	Acres
Percent Imperviousness =	10.00	%
NRCS Soil Type =	B	A, B, C, or D

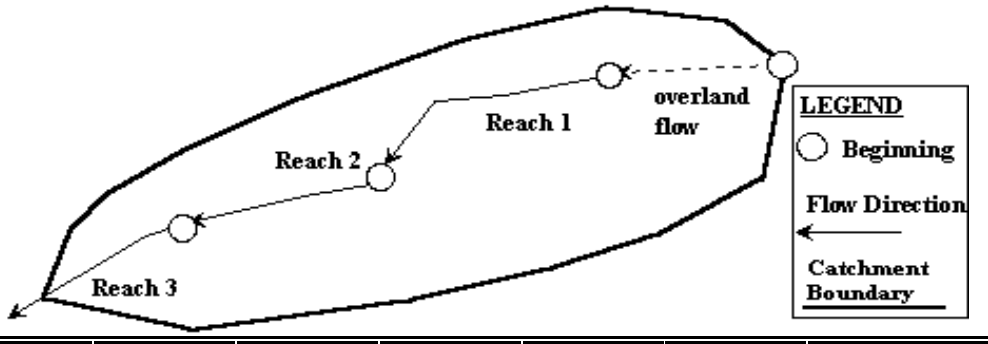
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.40	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.14	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	250	0.14	N/A	0.15	27.51
1	0.0130	750		20.00	2.28	5.48
2						
3						
4						
5						
	Sum	1,000			Computed Tc =	32.99
					Regional Tc =	15.56
					User-Entered Tc =	15.56

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	3.96	inch/hr	Peak Flowrate, Qp =	15.97	cfs
Rainfall Intensity at Regional Tc, I =	5.96	inch/hr	Peak Flowrate, Qp =	24.03	cfs
Rainfall Intensity at User-Defined Tc, I =	5.96	inch/hr	Peak Flowrate, Qp =	24.03	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin E

I. Catchment Hydrologic Data

Catchment ID =	E	
Area =	3.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

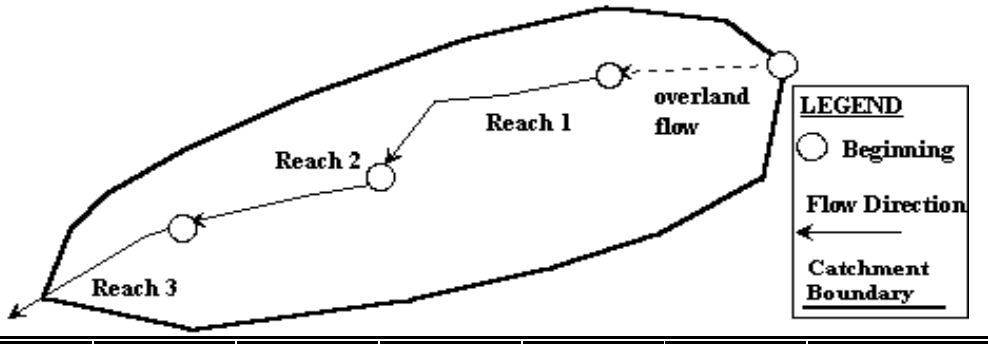
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0060	800		20.00	1.55	8.61
2						
3						
4						
5						
	Sum	900			Computed Tc =	16.62
					Regional Tc =	15.00
					User-Entered Tc =	15.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.77	inch/hr	Peak Flowrate, Qp =	13.00	cfs
Rainfall Intensity at Regional Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	13.65	cfs
Rainfall Intensity at User-Defined Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	13.65	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin F

I. Catchment Hydrologic Data

Catchment ID =	F	
Area =	3.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

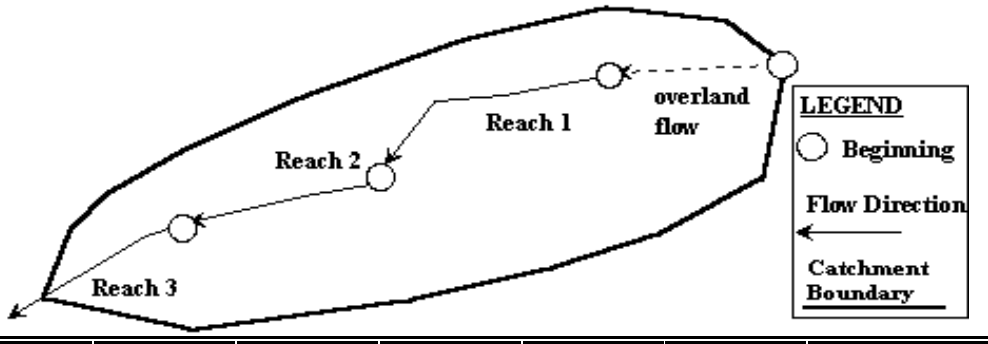
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0200	800		20.00	2.83	4.71
2						
3						
4						
5						
	Sum	900			Computed Tc =	12.72
					Regional Tc =	15.00
					User-Entered Tc =	12.72

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.53	inch/hr	Peak Flowrate, Qp =	14.72	cfs
Rainfall Intensity at Regional Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	13.65	cfs
Rainfall Intensity at User-Defined Tc, I =	6.53	inch/hr	Peak Flowrate, Qp =	14.72	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin G

I. Catchment Hydrologic Data

Catchment ID =	G	
Area =	35.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

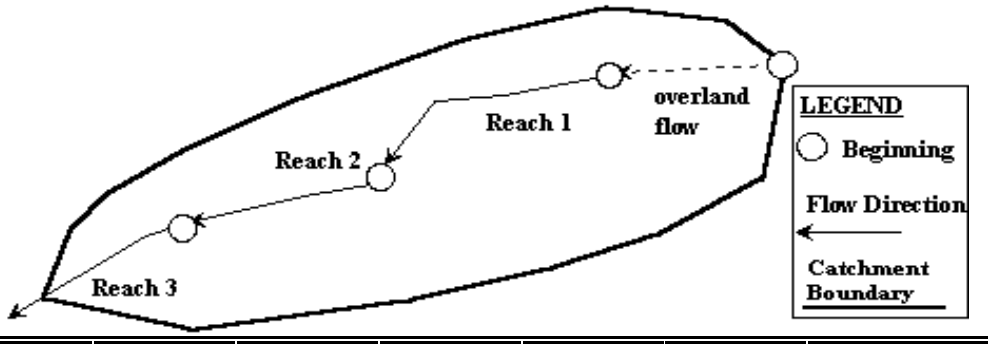
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0060	2,100		20.00	1.55	22.59
2						
3						
4						
5						
	Sum	2,200			Computed Tc =	30.60
					Regional Tc =	22.22
					User-Entered Tc =	22.22

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	4.14	inch/hr	Peak Flowrate, Qp =	108.82	cfs
Rainfall Intensity at Regional Tc, I =	4.97	inch/hr	Peak Flowrate, Qp =	130.50	cfs
Rainfall Intensity at User-Defined Tc, I =	4.97	inch/hr	Peak Flowrate, Qp =	130.50	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin H

I. Catchment Hydrologic Data

Catchment ID =	H	
Area =	4.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

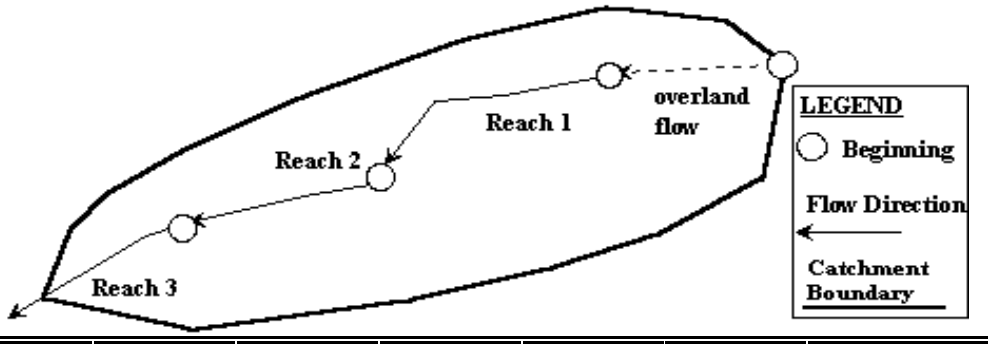
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.81	N/A	0.31	5.30
1	0.0120	1,000		20.00	2.19	7.61
2						
3						
4						
5						
	Sum	1,100				

Computed Tc =	12.91
Regional Tc =	16.11
User-Entered Tc =	12.91

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.49	inch/hr	Peak Flowrate, Qp =	22.79	cfs
Rainfall Intensity at Regional Tc, I =	5.86	inch/hr	Peak Flowrate, Qp =	20.57	cfs
Rainfall Intensity at User-Defined Tc, I =	6.49	inch/hr	Peak Flowrate, Qp =	22.79	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin I

I. Catchment Hydrologic Data

Catchment ID =	I	
Area =	2.00	Acres
Percent Imperviousness =	10.00	%
NRCS Soil Type =	B	A, B, C, or D

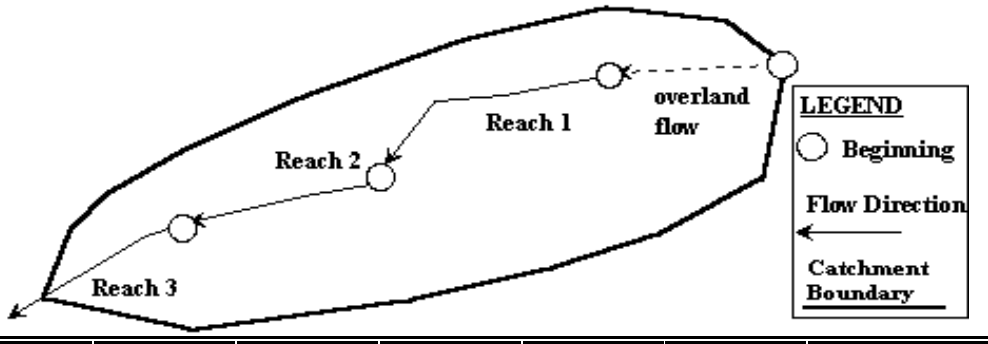
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.40	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.14	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	50	0.14	N/A	0.09	9.79
1	0.0250	150		20.00	3.16	0.79
2						
3						
4						
5						
	Sum	200			Computed Tc =	10.58
					Regional Tc =	11.11
					User-Entered Tc =	10.58

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.06	inch/hr	Peak Flowrate, Qp =	5.70	cfs
Rainfall Intensity at Regional Tc, I =	6.92	inch/hr	Peak Flowrate, Qp =	5.59	cfs
Rainfall Intensity at User-Defined Tc, I =	7.06	inch/hr	Peak Flowrate, Qp =	5.70	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin J

I. Catchment Hydrologic Data

Catchment ID =	J	
Area =	3.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

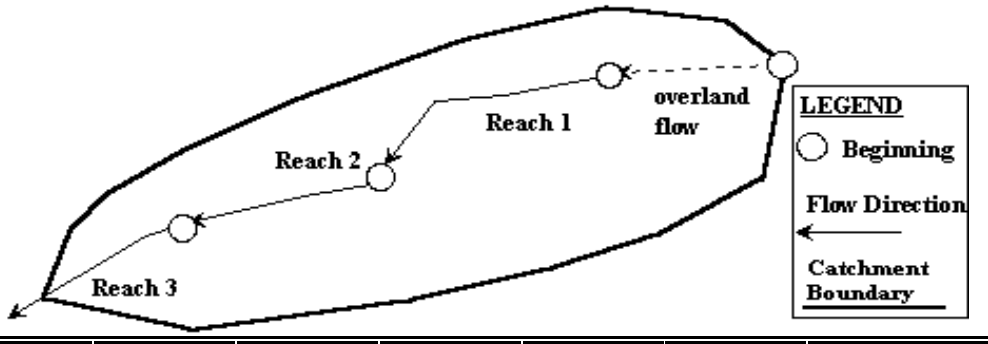
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0200	400		20.00	2.83	2.36
2						
3						
4						
5						
	Sum	500			Computed Tc =	10.37
					Regional Tc =	12.78
					User-Entered Tc =	10.37

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.12	inch/hr	Peak Flowrate, Qp =	16.04	cfs
Rainfall Intensity at Regional Tc, I =	6.52	inch/hr	Peak Flowrate, Qp =	14.69	cfs
Rainfall Intensity at User-Defined Tc, I =	7.12	inch/hr	Peak Flowrate, Qp =	16.04	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin K

I. Catchment Hydrologic Data

Catchment ID =	K	
Area =	32.00	Acres
Percent Imperviousness =	87.30	%
NRCS Soil Type =	B	A, B, C, or D

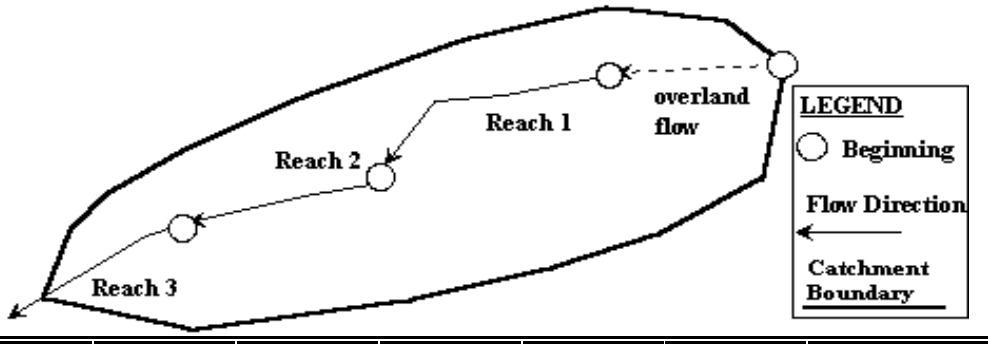
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.69	N/A	0.22	7.44
1	0.0060	1,600		20.00	1.55	17.21
2						
3						
4						
5						
	Sum	1,700			Computed Tc =	24.66
					Regional Tc =	19.44
					User-Entered Tc =	19.44

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	4.69	inch/hr	Peak Flowrate, Qp =	116.56	cfs
Rainfall Intensity at Regional Tc, I =	5.33	inch/hr	Peak Flowrate, Qp =	132.52	cfs
Rainfall Intensity at User-Defined Tc, I =	5.33	inch/hr	Peak Flowrate, Qp =	132.52	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin L

I. Catchment Hydrologic Data

Catchment ID =	L	
Area =	19.00	Acres
Percent Imperviousness =	82.40	%
NRCS Soil Type =	B	A, B, C, or D

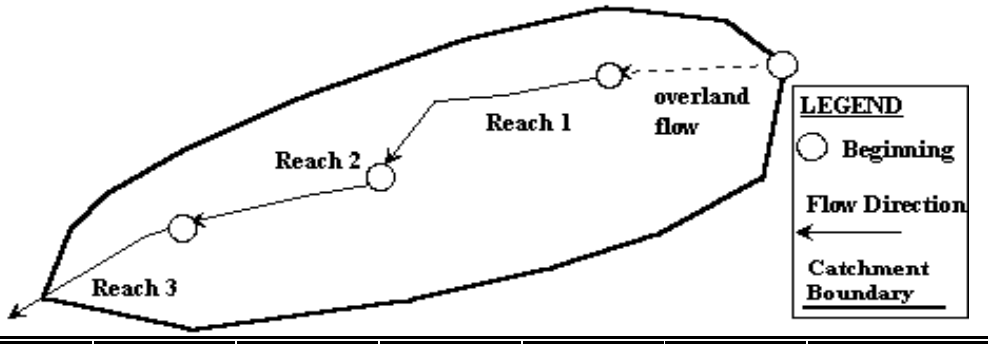
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.62	N/A	0.19	8.61
1	0.0050	1,100		20.00	1.41	12.96
2						
3						
4						
5						
	Sum	1,200			Computed Tc =	21.57
					Regional Tc =	16.67
					User-Entered Tc =	16.67

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.05	inch/hr	Peak Flowrate, Qp =	69.37	cfs
Rainfall Intensity at Regional Tc, I =	5.76	inch/hr	Peak Flowrate, Qp =	79.21	cfs
Rainfall Intensity at User-Defined Tc, I =	5.76	inch/hr	Peak Flowrate, Qp =	79.21	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin M

I. Catchment Hydrologic Data

Catchment ID =	M	
Area =	20.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

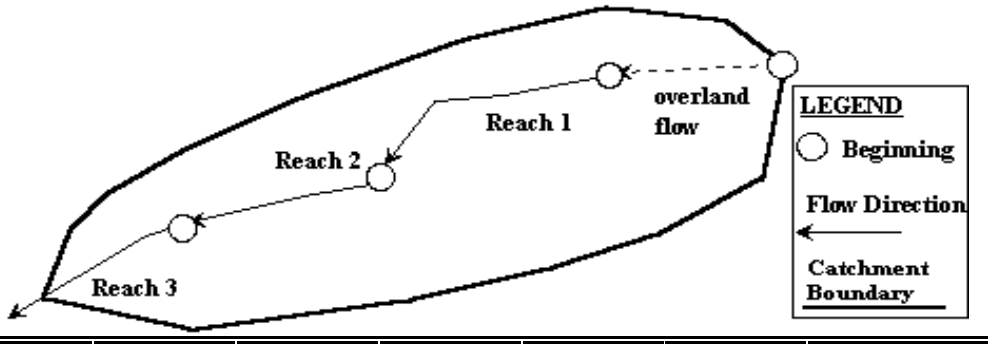
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0200	1,500		20.00	2.83	8.84
2						
3						
4						
5						
	Sum	1,600			Computed Tc =	16.85
					Regional Tc =	18.89
					User-Entered Tc =	16.85

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.73	inch/hr	Peak Flowrate, Qp =	86.06	cfs
Rainfall Intensity at Regional Tc, I =	5.41	inch/hr	Peak Flowrate, Qp =	81.25	cfs
Rainfall Intensity at User-Defined Tc, I =	5.73	inch/hr	Peak Flowrate, Qp =	86.06	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin N

I. Catchment Hydrologic Data

Catchment ID =	N	
Area =	9.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

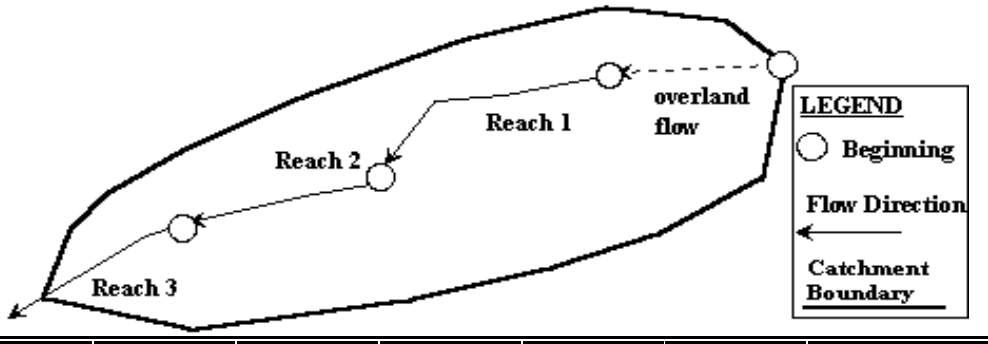
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0230	1,800		20.00	3.03	9.89
2						
3						
4						
5						
	Sum	1,900			Computed Tc =	17.90
					Regional Tc =	20.56
					User-Entered Tc =	17.90

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.56	inch/hr	Peak Flowrate, Qp =	37.58	cfs
Rainfall Intensity at Regional Tc, I =	5.18	inch/hr	Peak Flowrate, Qp =	34.98	cfs
Rainfall Intensity at User-Defined Tc, I =	5.56	inch/hr	Peak Flowrate, Qp =	37.58	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin O

I. Catchment Hydrologic Data

Catchment ID =	O	
Area =	1.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

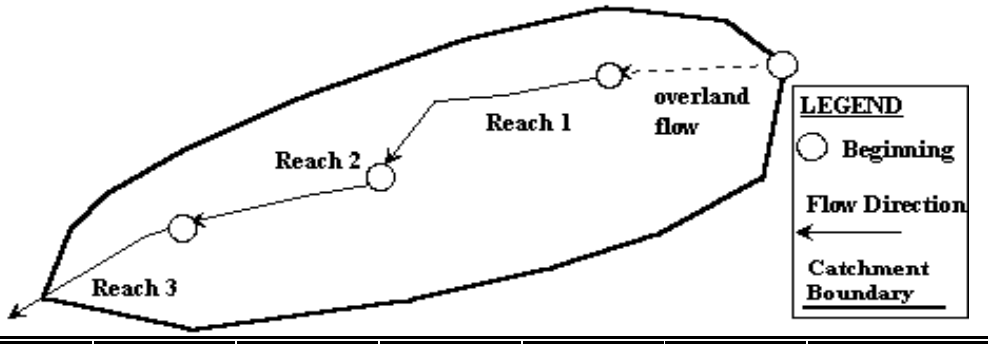
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.81	N/A	0.31	5.30
1	0.0280	500		20.00	3.35	2.49
2						
3						
4						
5						
	Sum	600			Computed Tc =	7.79
					Regional Tc =	13.33
					User-Entered Tc =	7.79

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.92	inch/hr	Peak Flowrate, Qp =	6.95	cfs
Rainfall Intensity at Regional Tc, I =	6.40	inch/hr	Peak Flowrate, Qp =	5.62	cfs
Rainfall Intensity at User-Defined Tc, I =	7.92	inch/hr	Peak Flowrate, Qp =	6.95	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin P

I. Catchment Hydrologic Data

Catchment ID =	P	
Area =	12.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

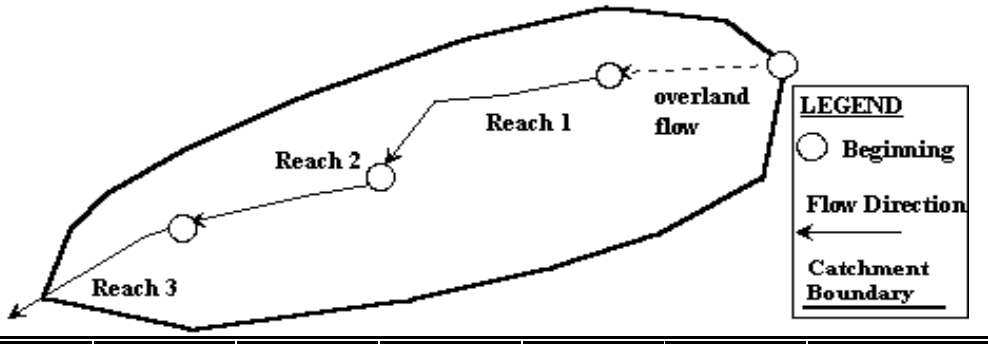
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	1,300		20.00	1.41	15.32
2						
3						
4						
5						
	Sum	1,450			Computed Tc =	21.82
					Regional Tc =	18.06
					User-Entered Tc =	18.06

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.01	inch/hr	Peak Flowrate, Qp =	52.81	cfs
Rainfall Intensity at Regional Tc, I =	5.54	inch/hr	Peak Flowrate, Qp =	58.30	cfs
Rainfall Intensity at User-Defined Tc, I =	5.54	inch/hr	Peak Flowrate, Qp =	58.30	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Q

I. Catchment Hydrologic Data

Catchment ID =	Q	
Area =	6.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

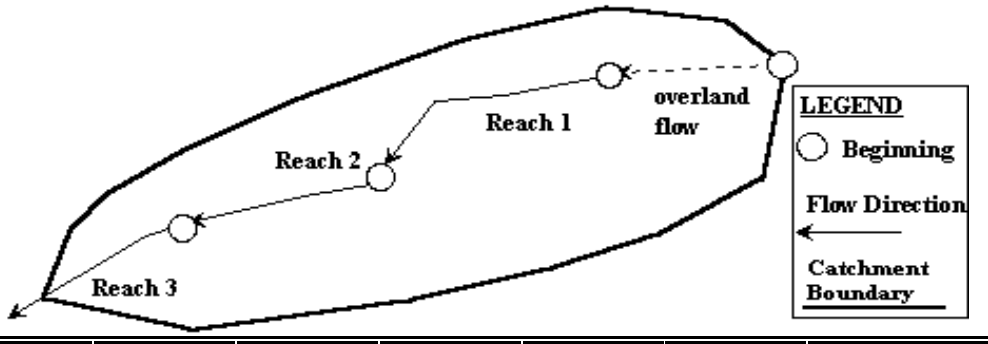
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	750		20.00	1.41	8.84
2						
3						
4						
5						
	Sum	900				

Computed Tc =	15.34
Regional Tc =	15.00
User-Entered Tc =	15.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.00	inch/hr	Peak Flowrate, Qp =	31.58	cfs
Rainfall Intensity at Regional Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	31.92	cfs
Rainfall Intensity at User-Defined Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	31.92	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin R

I. Catchment Hydrologic Data

Catchment ID =	R	
Area =	5.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

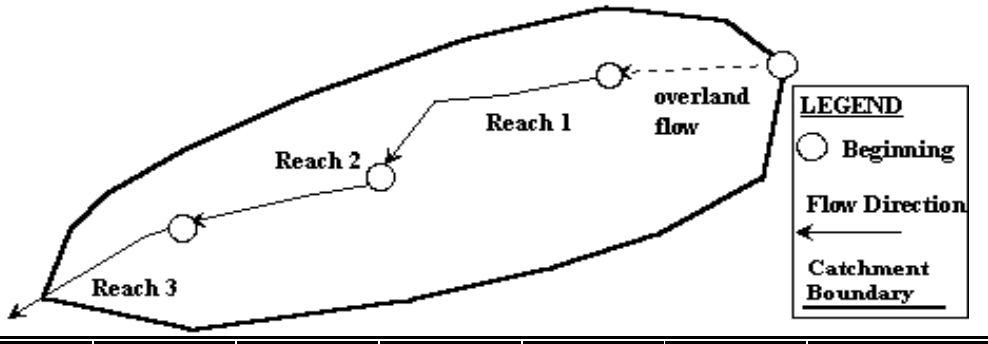
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	400		20.00	1.41	4.71
2						
3						
4						
5						
	Sum	550			Computed Tc =	11.21
					Regional Tc =	13.06
					User-Entered Tc =	11.21

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.90	inch/hr	Peak Flowrate, Qp =	30.27	cfs
Rainfall Intensity at Regional Tc, I =	6.46	inch/hr	Peak Flowrate, Qp =	28.34	cfs
Rainfall Intensity at User-Defined Tc, I =	6.90	inch/hr	Peak Flowrate, Qp =	30.27	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin S

I. Catchment Hydrologic Data

Catchment ID =	S	
Area =	2.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

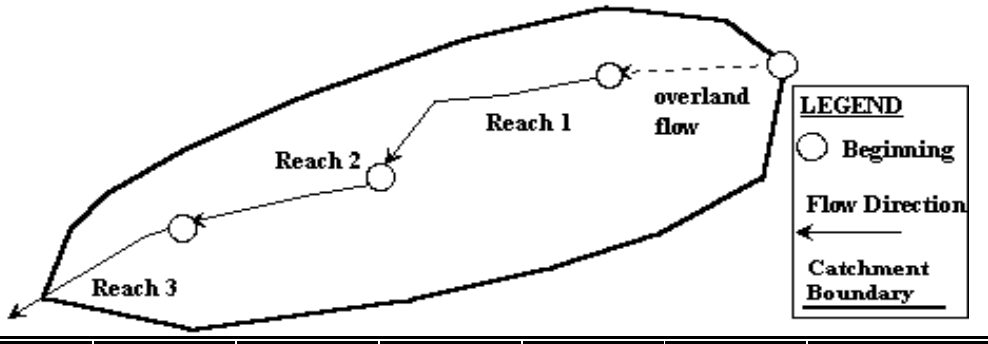
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	250		20.00	1.41	2.95
2						
3						
4						
5						
	Sum	400				

Computed Tc =	9.44
Regional Tc =	12.22
User-Entered Tc =	9.44

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.39	inch/hr	Peak Flowrate, Qp =	12.97	cfs
Rainfall Intensity at Regional Tc, I =	6.65	inch/hr	Peak Flowrate, Qp =	11.67	cfs
Rainfall Intensity at User-Defined Tc, I =	7.39	inch/hr	Peak Flowrate, Qp =	12.97	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin T

I. Catchment Hydrologic Data

Catchment ID =	T	
Area =	6.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

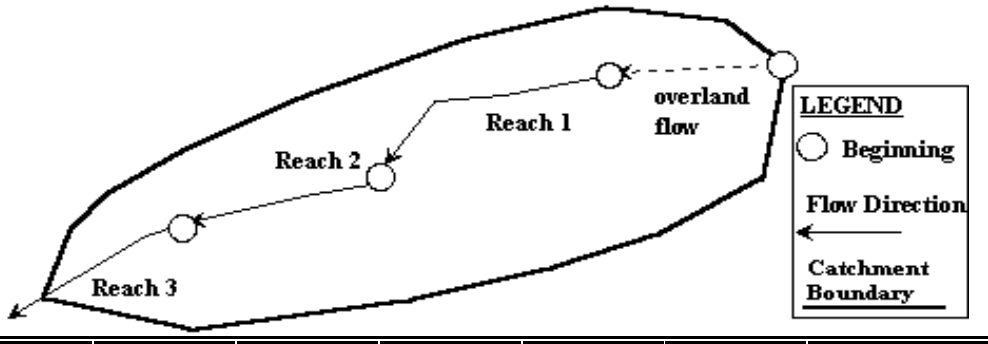
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0080	850		20.00	1.79	7.92
2						
3						
4						
5						
	Sum	1,000			Computed Tc =	14.42
					Regional Tc =	15.56
					User-Entered Tc =	14.42

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.17	inch/hr	Peak Flowrate, Qp =	32.51	cfs
Rainfall Intensity at Regional Tc, I =	5.96	inch/hr	Peak Flowrate, Qp =	31.37	cfs
Rainfall Intensity at User-Defined Tc, I =	6.17	inch/hr	Peak Flowrate, Qp =	32.51	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin U

I. Catchment Hydrologic Data

Catchment ID =	U	
Area =	1.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

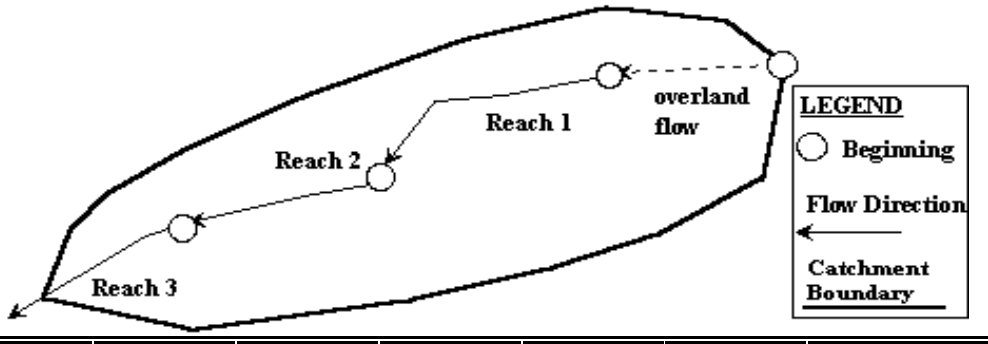
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0080	250		20.00	1.79	2.33
2						
3						
4						
5						
	Sum	400			Computed Tc =	8.83
					Regional Tc =	12.22
					User-Entered Tc =	8.83

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.57	inch/hr	Peak Flowrate, Qp =	6.65	cfs
Rainfall Intensity at Regional Tc, I =	6.65	inch/hr	Peak Flowrate, Qp =	5.84	cfs
Rainfall Intensity at User-Defined Tc, I =	7.57	inch/hr	Peak Flowrate, Qp =	6.65	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin V

I. Catchment Hydrologic Data

Catchment ID =	V	
Area =	4.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	C	A, B, C, or D

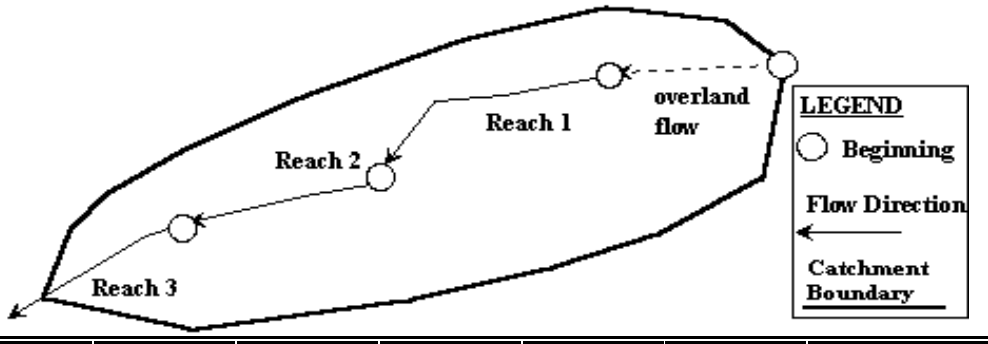
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.89	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.82	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.82	N/A	0.33	5.12
1	0.0050	1,000		20.00	1.41	11.79
2						
3						
4						
5						
	Sum	1,100			Computed Tc =	16.90
					Regional Tc =	16.11
					User-Entered Tc =	16.11

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.72	inch/hr	Peak Flowrate, Qp =	20.40	cfs
Rainfall Intensity at Regional Tc, I =	5.86	inch/hr	Peak Flowrate, Qp =	20.88	cfs
Rainfall Intensity at User-Defined Tc, I =	5.86	inch/hr	Peak Flowrate, Qp =	20.88	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin W

I. Catchment Hydrologic Data

Catchment ID =	W	
Area =	6.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	C	A, B, C, or D

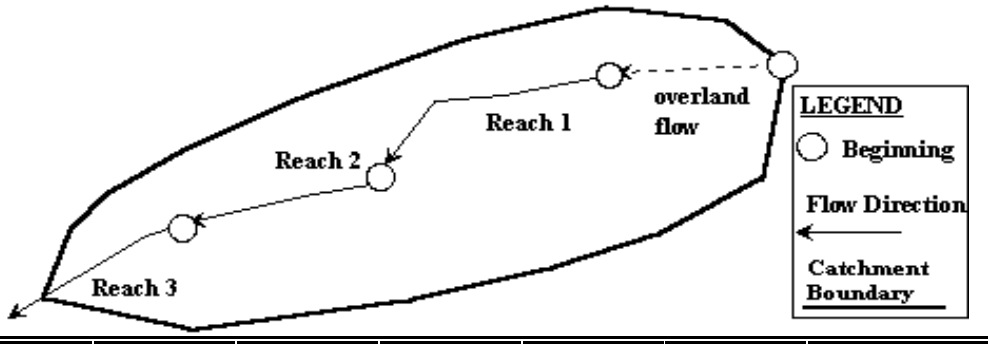
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.89	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.82	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.82	N/A	0.33	5.12
1	0.0050	750		20.00	1.41	8.84
2						
3						
4						
5						
	Sum	850			Computed Tc =	13.96
					Regional Tc =	14.72
					User-Entered Tc =	13.96

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.27	inch/hr	Peak Flowrate, Qp =	33.51	cfs
Rainfall Intensity at Regional Tc, I =	6.12	inch/hr	Peak Flowrate, Qp =	32.69	cfs
Rainfall Intensity at User-Defined Tc, I =	6.27	inch/hr	Peak Flowrate, Qp =	33.51	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin X

I. Catchment Hydrologic Data

Catchment ID =	X	
Area =	3.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	C	A, B, C, or D

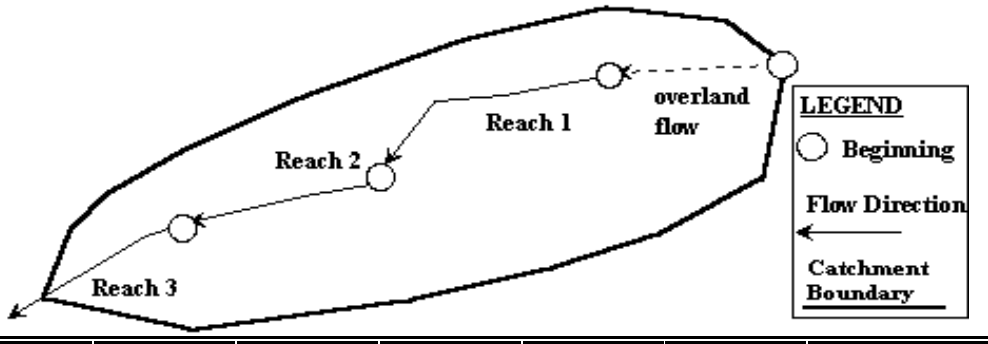
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.89	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.82	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	40	0.82	N/A	0.26	2.57
1	0.0050	900		20.00	1.41	10.61
2						
3						
4						
5						
	Sum	940			Computed Tc =	13.18
					Regional Tc =	15.22
					User-Entered Tc =	13.18

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.43	inch/hr	Peak Flowrate, Qp =	17.20	cfs
Rainfall Intensity at Regional Tc, I =	6.02	inch/hr	Peak Flowrate, Qp =	16.09	cfs
Rainfall Intensity at User-Defined Tc, I =	6.43	inch/hr	Peak Flowrate, Qp =	17.20	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Y

I. Catchment Hydrologic Data

Catchment ID =	Y	
Area =	12.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	C	A, B, C, or D

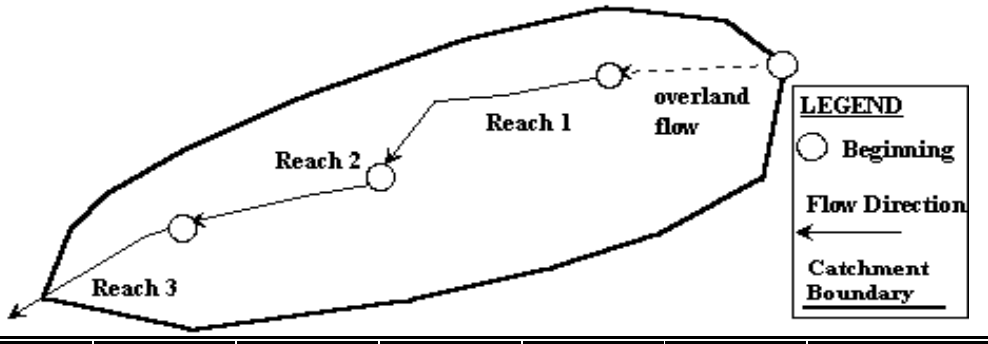
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	12	0.68	N/A	0.10	2.08
1	0.0050	1,650		20.00	1.41	19.45
2						
3						
4						
5						
	Sum	1,662			Computed Tc =	21.53
					Regional Tc =	19.23
					User-Entered Tc =	19.23

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.05	inch/hr	Peak Flowrate, Qp =	47.60	cfs
Rainfall Intensity at Regional Tc, I =	5.36	inch/hr	Peak Flowrate, Qp =	50.52	cfs
Rainfall Intensity at User-Defined Tc, I =	5.36	inch/hr	Peak Flowrate, Qp =	50.52	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Z1

I. Catchment Hydrologic Data

Catchment ID =	Z1	
Area =	6.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	C	A, B, C, or D

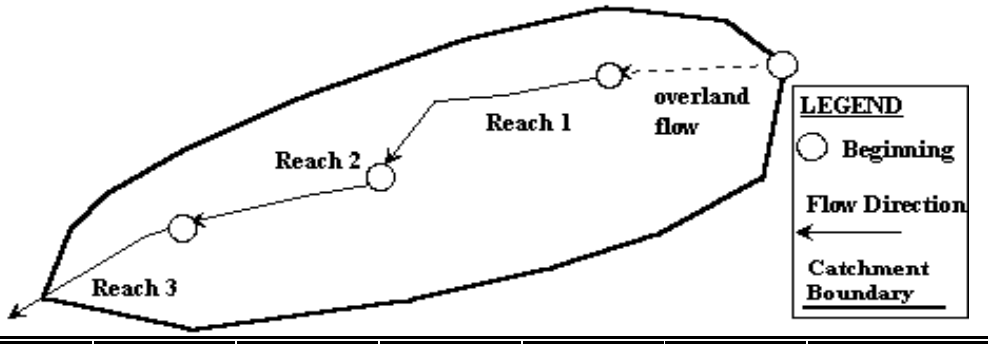
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	12	0.68	N/A	0.10	2.08
1	0.0050	1,500		20.00	1.41	17.68
2						
3						
4						
5						
	Sum	1,512			Computed Tc =	19.76
					Regional Tc =	18.40
					User-Entered Tc =	18.40

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.29	inch/hr	Peak Flowrate, Qp =	24.91	cfs
Rainfall Intensity at Regional Tc, I =	5.48	inch/hr	Peak Flowrate, Qp =	25.84	cfs
Rainfall Intensity at User-Defined Tc, I =	5.48	inch/hr	Peak Flowrate, Qp =	25.84	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Z2

I. Catchment Hydrologic Data

Catchment ID =	Z2	
Area =	5.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	C	A, B, C, or D

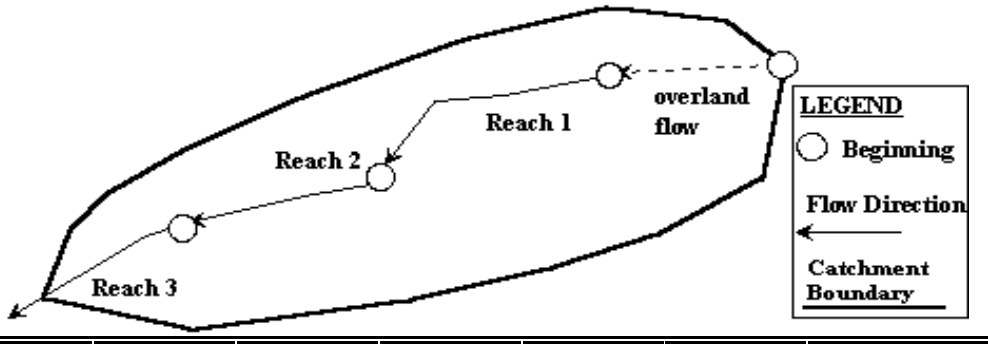
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	12	0.68	N/A	0.10	2.08
1	0.0050	1,000		20.00	1.41	11.79
2						
3						
4						
5						
	Sum	1,012			Computed Tc =	13.87
					Regional Tc =	15.62
					User-Entered Tc =	13.87

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.29	inch/hr	Peak Flowrate, Qp =	24.69	cfs
Rainfall Intensity at Regional Tc, I =	5.95	inch/hr	Peak Flowrate, Qp =	23.35	cfs
Rainfall Intensity at User-Defined Tc, I =	6.29	inch/hr	Peak Flowrate, Qp =	24.69	cfs

Purpose: Time of Concentration for Offsite Basins

Offsite Basins - Modified Alignment

Basin	Overland Flow (min)	Channel Flow (min)	Total t_c (min)	Regional t_c (min)
A	18	75	93	52
B	6	8	14	14
C	14	19	33	19
D	28	5	33	16
E	8	9	17	15
F	8	5	13	15
G	8	23	31	22
H	5	9	14	17
I	10	1	11	11
J	8	2	10	13
K	7	17	25	19
L	9	13	22	17
M	8	10	18	20
N	8	10	18	21
O	5	2	8	13
P	7	15	22	18
Q	7	9	15	15
R	7	5	11	13
S	7	3	9	12
T	7	5	11	14
U	7	2	9	12
V	5	12	17	16
W	5	9	14	15
X	3	11	14	16
Y	2	19	22	19
Z1	2	18	20	18
Z2	2	12	14	16

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 he total travel length.

Data Presentation:
The total tc and regional tc are calculated from unrounded values, with the results rounded.

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin A

I. Catchment Hydrologic Data

Catchment ID = A
Area = 195.00 Acres
Percent Imperviousness = 95.00 %
NRCS Soil Type = B A, B, C, or D

For catchments larger than 90 acres, CUHP hydrograph and routing are recommended.

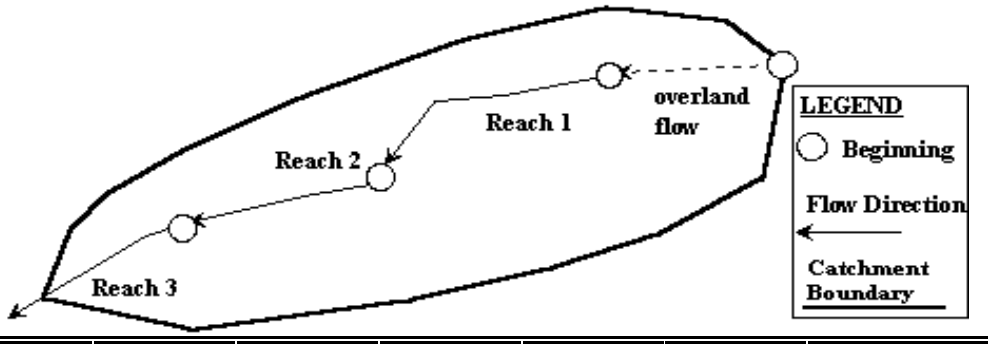
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0030	500	0.81	N/A	0.47	17.65
1	0.0060	7,000		20.00	1.55	75.31
2						
3						
4						
5						
	Sum	7,500			Computed Tc =	92.96
					Regional Tc =	51.67
					User-Entered Tc =	51.67

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	1.99	inch/hr	Peak Flowrate, Qp =	341.01	cfs
Rainfall Intensity at Regional Tc, I =	2.98	inch/hr	Peak Flowrate, Qp =	510.19	cfs
Rainfall Intensity at User-Defined Tc, I =	2.98	inch/hr	Peak Flowrate, Qp =	510.19	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin B

I. Catchment Hydrologic Data

Catchment ID =	B	
Area =	5.00	Acres
Percent Imperviousness =	10.00	%
NRCS Soil Type =	B	A, B, C, or D

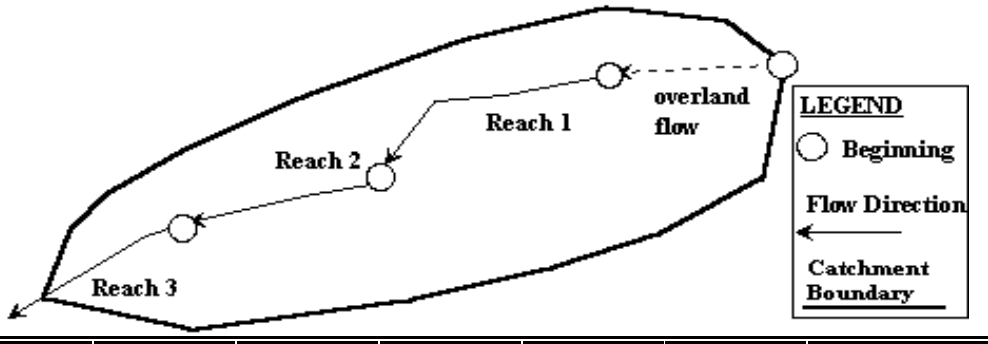
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.40	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.14	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	20	0.14	N/A	0.05	6.19
1	0.0050	700		20.00	1.41	8.25
2						
3						
4						
5						
	Sum	720			Computed Tc =	14.44
					Regional Tc =	14.00
					User-Entered Tc =	14.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.17	inch/hr	Peak Flowrate, Qp =	12.45	cfs
Rainfall Intensity at Regional Tc, I =	6.26	inch/hr	Peak Flowrate, Qp =	12.62	cfs
Rainfall Intensity at User-Defined Tc, I =	6.26	inch/hr	Peak Flowrate, Qp =	12.62	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin C

I. Catchment Hydrologic Data

Catchment ID =	C	
Area =	14.00	Acres
Percent Imperviousness =	20.00	%
NRCS Soil Type =	B	A, B, C, or D

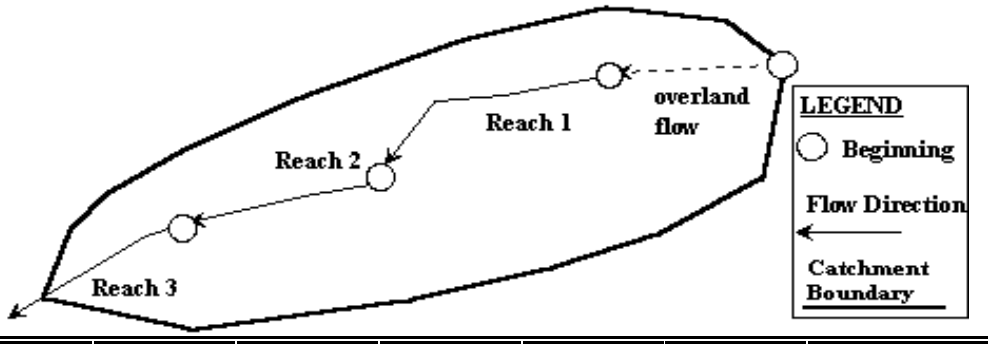
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.44	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.20	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0060	50	0.20	N/A	0.06	13.64
1	0.0050	1,600		20.00	1.41	18.86
2						
3						
4						
5						
	Sum	1,650			Computed Tc =	32.50
					Regional Tc =	19.17
					User-Entered Tc =	19.17

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	3.99	inch/hr	Peak Flowrate, Qp =	24.66	cfs
Rainfall Intensity at Regional Tc, I =	5.37	inch/hr	Peak Flowrate, Qp =	33.15	cfs
Rainfall Intensity at User-Defined Tc, I =	5.37	inch/hr	Peak Flowrate, Qp =	33.15	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin D

I. Catchment Hydrologic Data

Catchment ID =	D	
Area =	10.00	Acres
Percent Imperviousness =	10.00	%
NRCS Soil Type =	B	A, B, C, or D

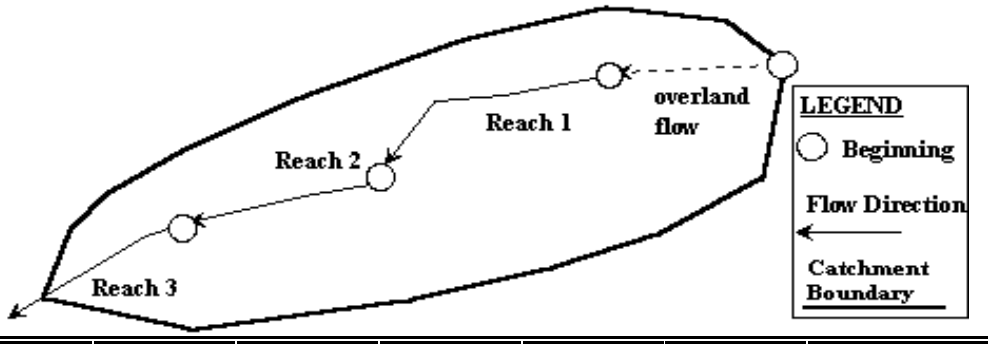
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.40	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.14	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	250	0.14	N/A	0.15	27.51
1	0.0130	750		20.00	2.28	5.48
2						
3						
4						
5						
	Sum	1,000			Computed Tc =	32.99
					Regional Tc =	15.56
					User-Entered Tc =	15.56

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	3.96	inch/hr	Peak Flowrate, Qp =	15.97	cfs
Rainfall Intensity at Regional Tc, I =	5.96	inch/hr	Peak Flowrate, Qp =	24.03	cfs
Rainfall Intensity at User-Defined Tc, I =	5.96	inch/hr	Peak Flowrate, Qp =	24.03	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin E

I. Catchment Hydrologic Data

Catchment ID =	E	
Area =	3.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

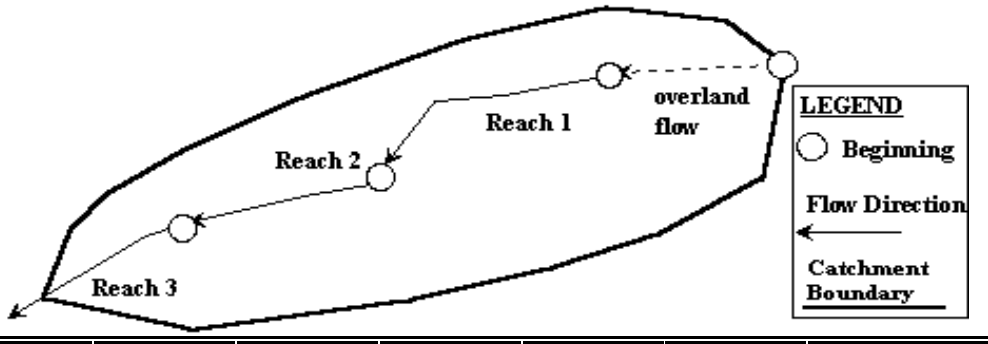
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0060	800		20.00	1.55	8.61
2						
3						
4						
5						
	Sum	900			Computed Tc =	16.62
					Regional Tc =	15.00
					User-Entered Tc =	15.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.77	inch/hr	Peak Flowrate, Qp =	13.00	cfs
Rainfall Intensity at Regional Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	13.65	cfs
Rainfall Intensity at User-Defined Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	13.65	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin F

I. Catchment Hydrologic Data

Catchment ID =	F	
Area =	3.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

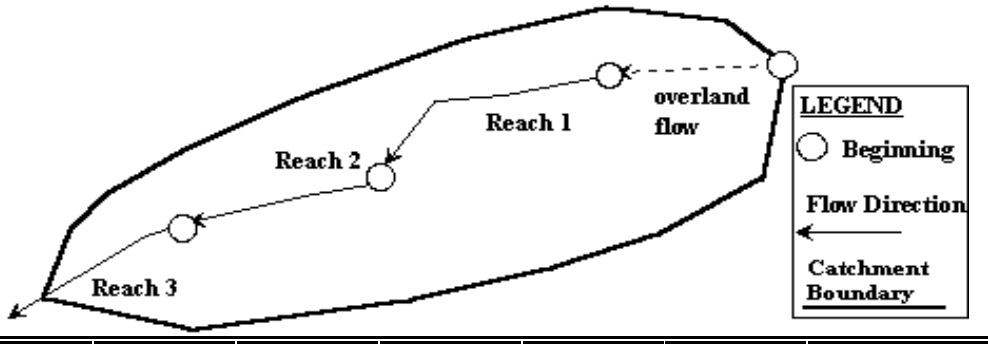
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0200	800		20.00	2.83	4.71
2						
3						
4						
5						
	Sum	900			Computed Tc =	12.72
					Regional Tc =	15.00
					User-Entered Tc =	12.72

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.53	inch/hr	Peak Flowrate, Qp =	14.72	cfs
Rainfall Intensity at Regional Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	13.65	cfs
Rainfall Intensity at User-Defined Tc, I =	6.53	inch/hr	Peak Flowrate, Qp =	14.72	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin G

I. Catchment Hydrologic Data

Catchment ID =	G	
Area =	35.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

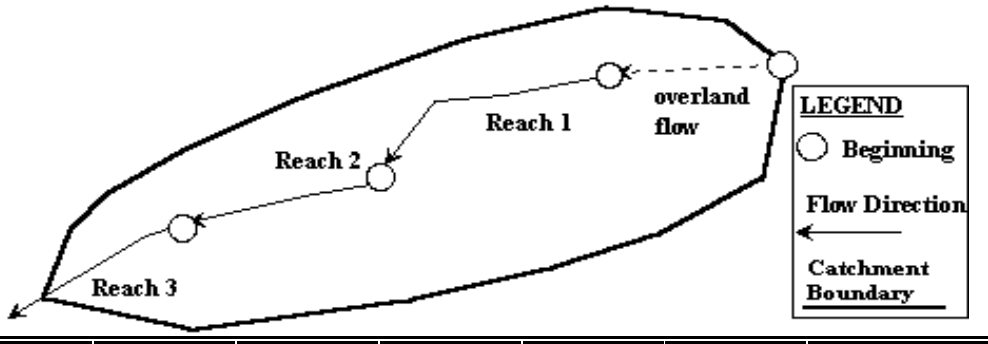
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0060	2,100		20.00	1.55	22.59
2						
3						
4						
5						
	Sum	2,200			Computed Tc =	30.60
					Regional Tc =	22.22
					User-Entered Tc =	22.22

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	4.14	inch/hr	Peak Flowrate, Qp =	108.82	cfs
Rainfall Intensity at Regional Tc, I =	4.97	inch/hr	Peak Flowrate, Qp =	130.50	cfs
Rainfall Intensity at User-Defined Tc, I =	4.97	inch/hr	Peak Flowrate, Qp =	130.50	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin H

I. Catchment Hydrologic Data

Catchment ID =	H	
Area =	6.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

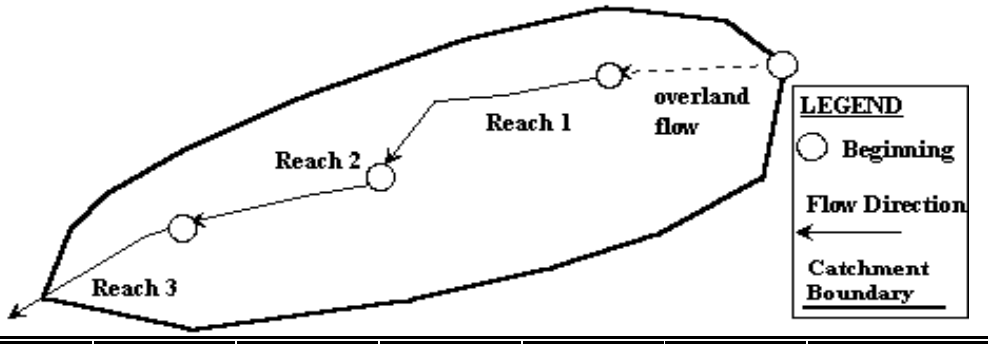
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.81	N/A	0.31	5.30
1	0.0120	1,200		20.00	2.19	9.13
2						
3						
4						
5						
	Sum	1,300			Computed Tc =	14.43
					Regional Tc =	17.22
					User-Entered Tc =	14.43

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.17	inch/hr	Peak Flowrate, Qp =	32.50	cfs
Rainfall Intensity at Regional Tc, I =	5.67	inch/hr	Peak Flowrate, Qp =	29.86	cfs
Rainfall Intensity at User-Defined Tc, I =	6.17	inch/hr	Peak Flowrate, Qp =	32.50	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin I

I. Catchment Hydrologic Data

Catchment ID =	I	
Area =	1.00	Acres
Percent Imperviousness =	10.00	%
NRCS Soil Type =	B	A, B, C, or D

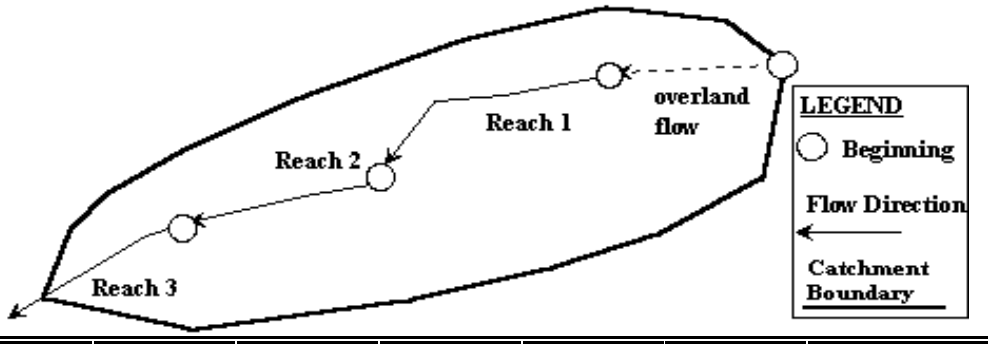
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.40	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.14	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	50	0.14	N/A	0.09	9.79
1	0.0250	150		20.00	3.16	0.79
2						
3						
4						
5						
	Sum	200			Computed Tc =	10.58
					Regional Tc =	11.11
					User-Entered Tc =	10.58

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.06	inch/hr	Peak Flowrate, Qp =	2.85	cfs
Rainfall Intensity at Regional Tc, I =	6.92	inch/hr	Peak Flowrate, Qp =	2.79	cfs
Rainfall Intensity at User-Defined Tc, I =	7.06	inch/hr	Peak Flowrate, Qp =	2.85	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin J

I. Catchment Hydrologic Data

Catchment ID =	J	
Area =	5.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

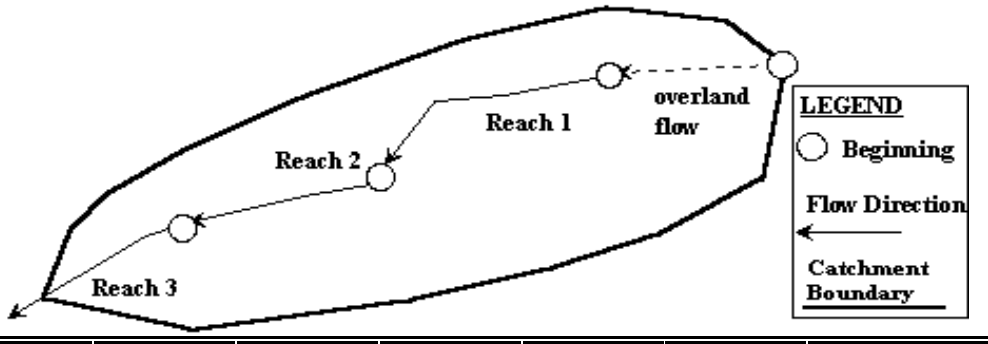
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0200	400		20.00	2.83	2.36
2						
3						
4						
5						
	Sum	500			Computed Tc =	10.37
					Regional Tc =	12.78
					User-Entered Tc =	10.37

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.12	inch/hr	Peak Flowrate, Qp =	26.73	cfs
Rainfall Intensity at Regional Tc, I =	6.52	inch/hr	Peak Flowrate, Qp =	24.48	cfs
Rainfall Intensity at User-Defined Tc, I =	7.12	inch/hr	Peak Flowrate, Qp =	26.73	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin K

I. Catchment Hydrologic Data

Catchment ID =	K	
Area =	32.00	Acres
Percent Imperviousness =	87.30	%
NRCS Soil Type =	B	A, B, C, or D

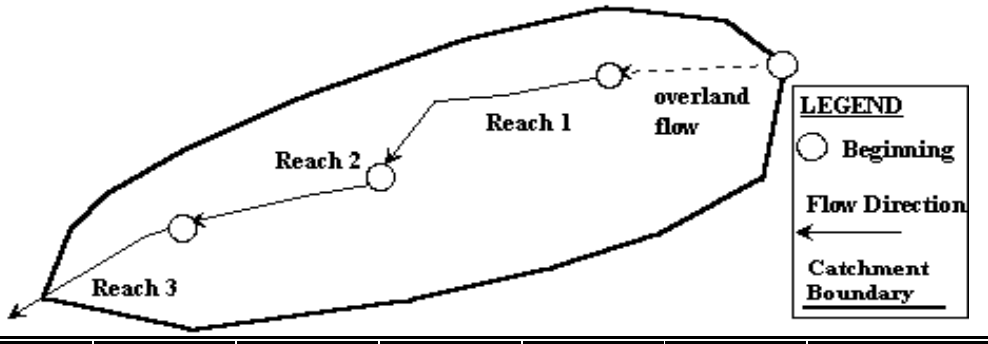
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.69	N/A	0.22	7.44
1	0.0060	1,600		20.00	1.55	17.21
2						
3						
4						
5						
	Sum	1,700			Computed Tc =	24.66
					Regional Tc =	19.44
					User-Entered Tc =	19.44

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	4.69	inch/hr	Peak Flowrate, Qp =	116.56	cfs
Rainfall Intensity at Regional Tc, I =	5.33	inch/hr	Peak Flowrate, Qp =	132.52	cfs
Rainfall Intensity at User-Defined Tc, I =	5.33	inch/hr	Peak Flowrate, Qp =	132.52	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin L

I. Catchment Hydrologic Data

Catchment ID =	L	
Area =	11.00	Acres
Percent Imperviousness =	82.40	%
NRCS Soil Type =	B	A, B, C, or D

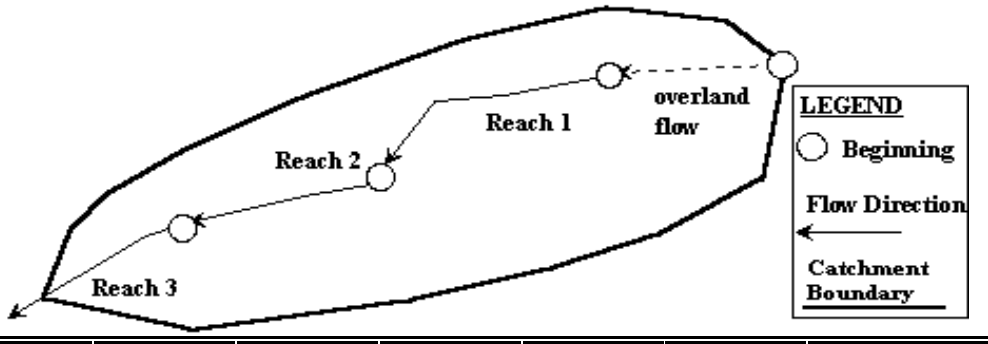
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.62	N/A	0.19	8.61
1	0.0050	1,100		20.00	1.41	12.96
2						
3						
4						
5						
	Sum	1,200			Computed Tc =	21.57
					Regional Tc =	16.67
					User-Entered Tc =	16.67

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.05	inch/hr	Peak Flowrate, Qp =	40.16	cfs
Rainfall Intensity at Regional Tc, I =	5.76	inch/hr	Peak Flowrate, Qp =	45.86	cfs
Rainfall Intensity at User-Defined Tc, I =	5.76	inch/hr	Peak Flowrate, Qp =	45.86	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin M

I. Catchment Hydrologic Data

Catchment ID =	M	
Area =	30.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

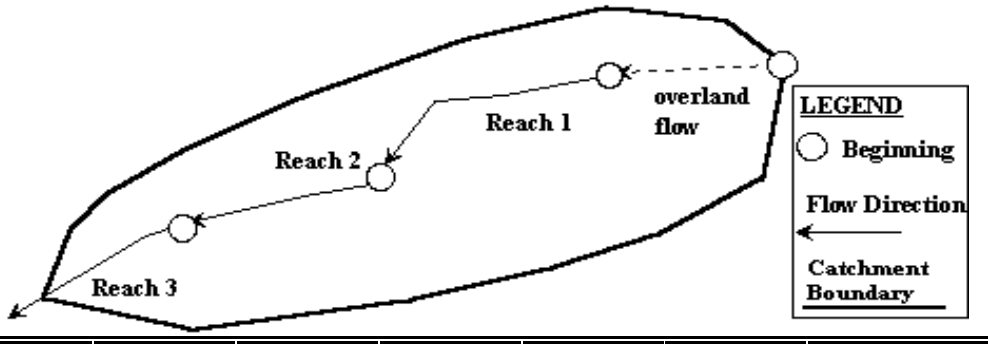
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0200	1,700		20.00	2.83	10.02
2						
3						
4						
5						
	Sum	1,800			Computed Tc =	18.03
					Regional Tc =	20.00
					User-Entered Tc =	18.03

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.54	inch/hr	Peak Flowrate, Qp =	124.80	cfs
Rainfall Intensity at Regional Tc, I =	5.25	inch/hr	Peak Flowrate, Qp =	118.31	cfs
Rainfall Intensity at User-Defined Tc, I =	5.54	inch/hr	Peak Flowrate, Qp =	124.80	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin N

I. Catchment Hydrologic Data

Catchment ID =	N	
Area =	9.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	B	A, B, C, or D

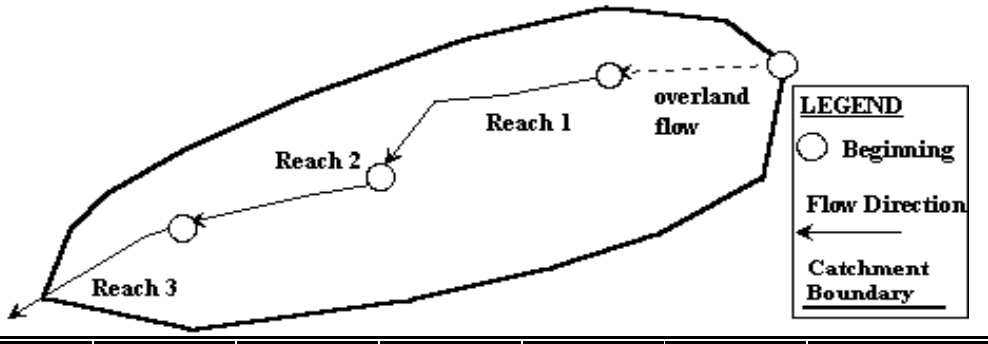
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.66	N/A	0.21	8.01
1	0.0230	1,800		20.00	3.03	9.89
2						
3						
4						
5						
	Sum	1,900			Computed Tc =	17.90
					Regional Tc =	20.56
					User-Entered Tc =	17.90

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.56	inch/hr	Peak Flowrate, Qp =	37.58	cfs
Rainfall Intensity at Regional Tc, I =	5.18	inch/hr	Peak Flowrate, Qp =	34.98	cfs
Rainfall Intensity at User-Defined Tc, I =	5.56	inch/hr	Peak Flowrate, Qp =	37.58	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin O

I. Catchment Hydrologic Data

Catchment ID =	O	
Area =	1.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

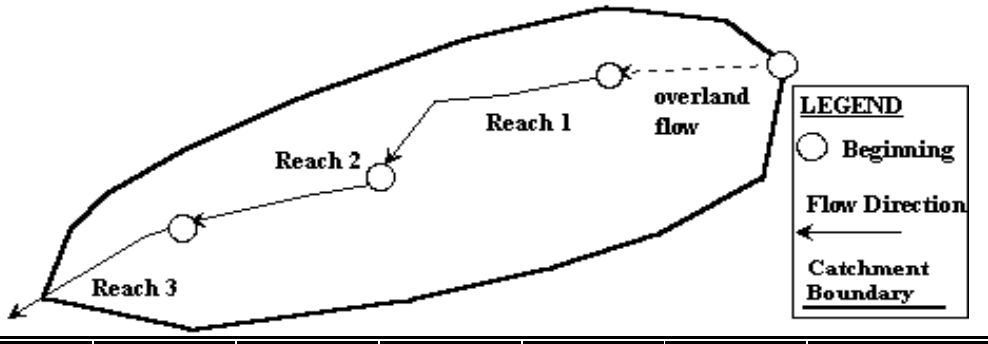
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.81	N/A	0.31	5.30
1	0.0280	500		20.00	3.35	2.49
2						
3						
4						
5						
	Sum	600			Computed Tc =	7.79
					Regional Tc =	13.33
					User-Entered Tc =	7.79

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.92	inch/hr	Peak Flowrate, Qp =	6.95	cfs
Rainfall Intensity at Regional Tc, I =	6.40	inch/hr	Peak Flowrate, Qp =	5.62	cfs
Rainfall Intensity at User-Defined Tc, I =	7.92	inch/hr	Peak Flowrate, Qp =	6.95	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin P

I. Catchment Hydrologic Data

Catchment ID =	P	
Area =	12.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

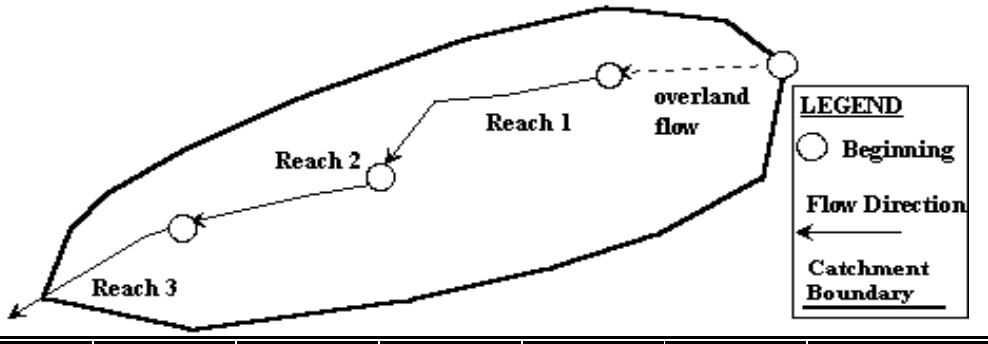
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	1,300		20.00	1.41	15.32
2						
3						
4						
5						
	Sum	1,450			Computed Tc =	21.82
					Regional Tc =	18.06
					User-Entered Tc =	18.06

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.01	inch/hr	Peak Flowrate, Qp =	52.81	cfs
Rainfall Intensity at Regional Tc, I =	5.54	inch/hr	Peak Flowrate, Qp =	58.30	cfs
Rainfall Intensity at User-Defined Tc, I =	5.54	inch/hr	Peak Flowrate, Qp =	58.30	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Q

I. Catchment Hydrologic Data

Catchment ID =	Q	
Area =	6.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

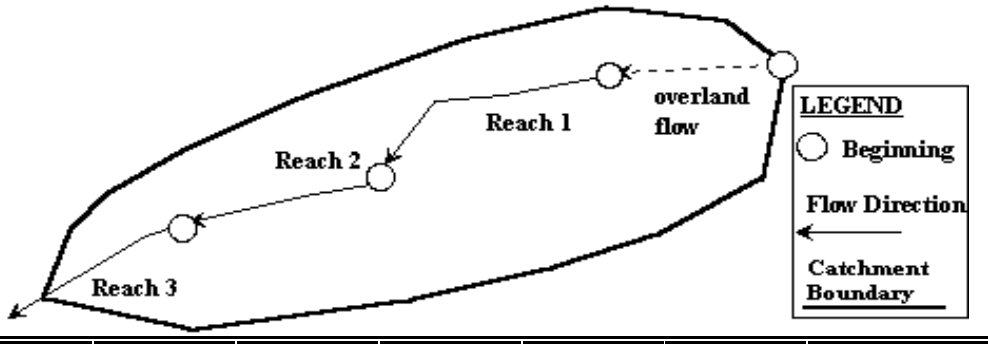
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	750		20.00	1.41	8.84
2						
3						
4						
5						
	Sum	900				

Computed Tc =	15.34
Regional Tc =	15.00
User-Entered Tc =	15.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.00	inch/hr	Peak Flowrate, Qp =	31.58	cfs
Rainfall Intensity at Regional Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	31.92	cfs
Rainfall Intensity at User-Defined Tc, I =	6.06	inch/hr	Peak Flowrate, Qp =	31.92	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin R

I. Catchment Hydrologic Data

Catchment ID =	R	
Area =	5.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

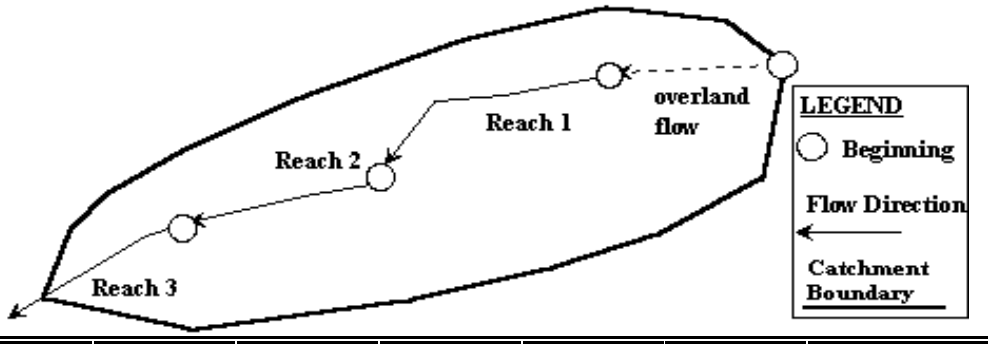
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	400		20.00	1.41	4.71
2						
3						
4						
5						
	Sum	550			Computed Tc =	11.21
					Regional Tc =	13.06
					User-Entered Tc =	11.21

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.90	inch/hr	Peak Flowrate, Qp =	30.27	cfs
Rainfall Intensity at Regional Tc, I =	6.46	inch/hr	Peak Flowrate, Qp =	28.34	cfs
Rainfall Intensity at User-Defined Tc, I =	6.90	inch/hr	Peak Flowrate, Qp =	30.27	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin S

I. Catchment Hydrologic Data

Catchment ID =	S	
Area =	2.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

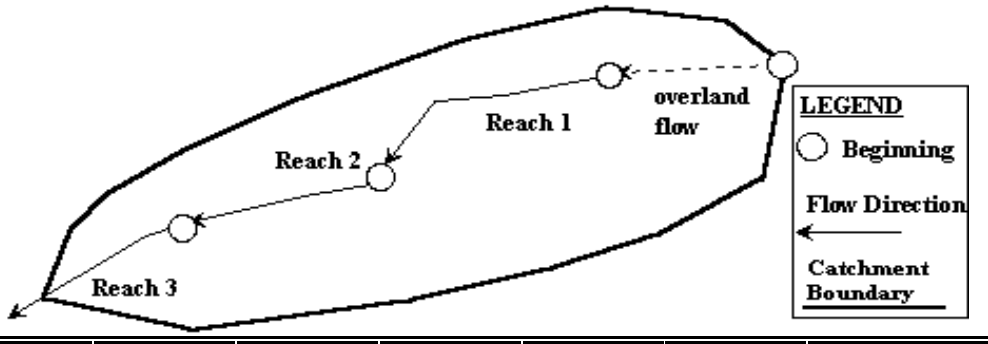
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0050	250		20.00	1.41	2.95
2						
3						
4						
5						
	Sum	400				

Computed Tc =	9.44
Regional Tc =	12.22
User-Entered Tc =	9.44

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.39	inch/hr	Peak Flowrate, Qp =	12.97	cfs
Rainfall Intensity at Regional Tc, I =	6.65	inch/hr	Peak Flowrate, Qp =	11.67	cfs
Rainfall Intensity at User-Defined Tc, I =	7.39	inch/hr	Peak Flowrate, Qp =	12.97	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin T

I. Catchment Hydrologic Data

Catchment ID =	T	
Area =	4.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

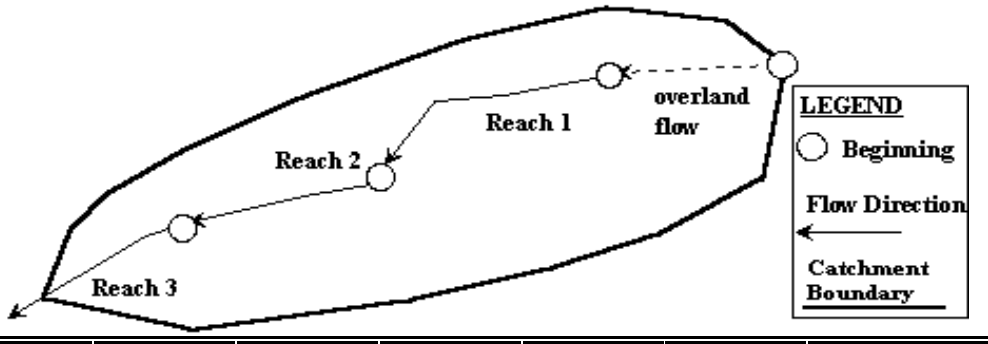
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0080	500		20.00	1.79	4.66
2						
3						
4						
5						
	Sum	650			Computed Tc =	11.16
					Regional Tc =	13.61
					User-Entered Tc =	11.16

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.91	inch/hr	Peak Flowrate, Qp =	24.26	cfs
Rainfall Intensity at Regional Tc, I =	6.34	inch/hr	Peak Flowrate, Qp =	22.26	cfs
Rainfall Intensity at User-Defined Tc, I =	6.91	inch/hr	Peak Flowrate, Qp =	24.26	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin U

I. Catchment Hydrologic Data

Catchment ID =	U	
Area =	1.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	B	A, B, C, or D

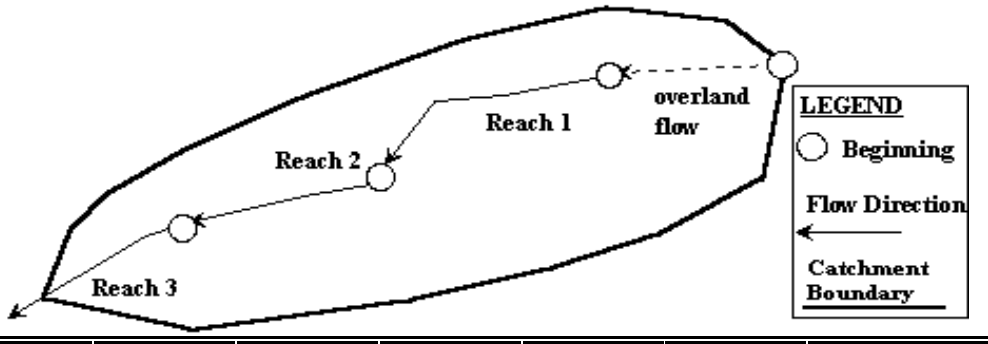
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	150	0.81	N/A	0.38	6.50
1	0.0080	250		20.00	1.79	2.33
2						
3						
4						
5						
	Sum	400			Computed Tc =	8.83
					Regional Tc =	12.22
					User-Entered Tc =	8.83

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	7.57	inch/hr	Peak Flowrate, Qp =	6.65	cfs
Rainfall Intensity at Regional Tc, I =	6.65	inch/hr	Peak Flowrate, Qp =	5.84	cfs
Rainfall Intensity at User-Defined Tc, I =	7.57	inch/hr	Peak Flowrate, Qp =	6.65	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin V

I. Catchment Hydrologic Data

Catchment ID =	V	
Area =	4.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	C	A, B, C, or D

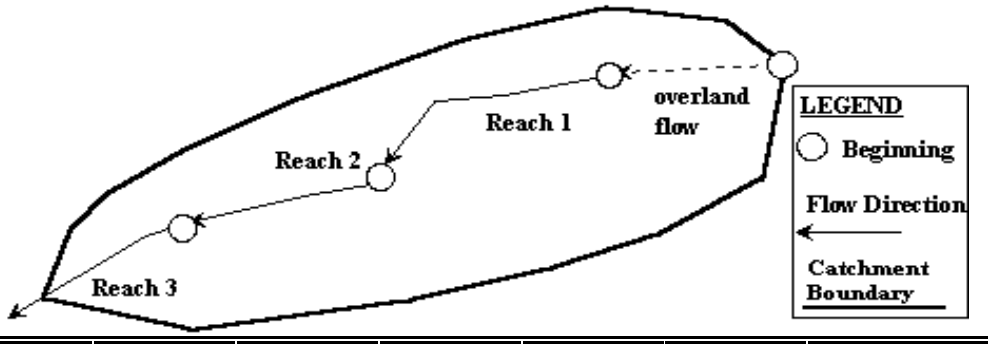
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.89	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.82	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.82	N/A	0.33	5.12
1	0.0050	1,000		20.00	1.41	11.79
2						
3						
4						
5						
	Sum	1,100			Computed Tc =	16.90
					Regional Tc =	16.11
					User-Entered Tc =	16.11

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.72	inch/hr	Peak Flowrate, Qp =	20.40	cfs
Rainfall Intensity at Regional Tc, I =	5.86	inch/hr	Peak Flowrate, Qp =	20.88	cfs
Rainfall Intensity at User-Defined Tc, I =	5.86	inch/hr	Peak Flowrate, Qp =	20.88	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin W

I. Catchment Hydrologic Data

Catchment ID =	W	
Area =	6.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	C	A, B, C, or D

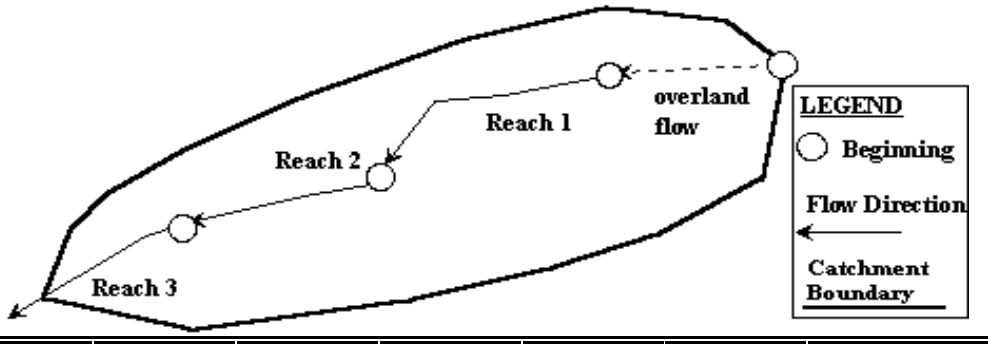
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.89	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.82	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0100	100	0.82	N/A	0.33	5.12
1	0.0050	750		20.00	1.41	8.84
2						
3						
4						
5						
	Sum	850			Computed Tc =	13.96
					Regional Tc =	14.72
					User-Entered Tc =	13.96

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.27	inch/hr	Peak Flowrate, Qp =	33.51	cfs
Rainfall Intensity at Regional Tc, I =	6.12	inch/hr	Peak Flowrate, Qp =	32.69	cfs
Rainfall Intensity at User-Defined Tc, I =	6.27	inch/hr	Peak Flowrate, Qp =	33.51	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin X

I. Catchment Hydrologic Data

Catchment ID =	X	
Area =	4.00	Acres
Percent Imperviousness =	95.00	%
NRCS Soil Type =	C	A, B, C, or D

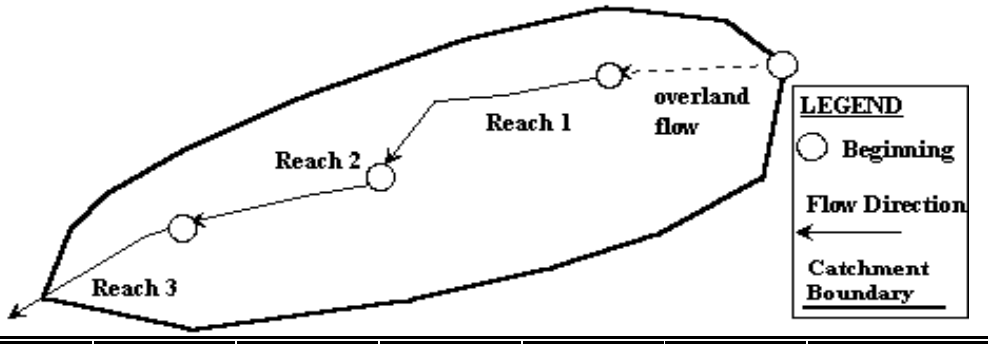
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 =	0.89	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.82	
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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	40	0.82	N/A	0.26	2.57
1	0.0050	950		20.00	1.41	11.20
2						
3						
4						
5						
	Sum	990			Computed Tc =	13.77
					Regional Tc =	15.50
					User-Entered Tc =	13.77

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.31	inch/hr	Peak Flowrate, Qp =	22.48	cfs
Rainfall Intensity at Regional Tc, I =	5.97	inch/hr	Peak Flowrate, Qp =	21.27	cfs
Rainfall Intensity at User-Defined Tc, I =	6.31	inch/hr	Peak Flowrate, Qp =	22.48	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Y

I. Catchment Hydrologic Data

Catchment ID =	Y	
Area =	12.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	C	A, B, C, or D

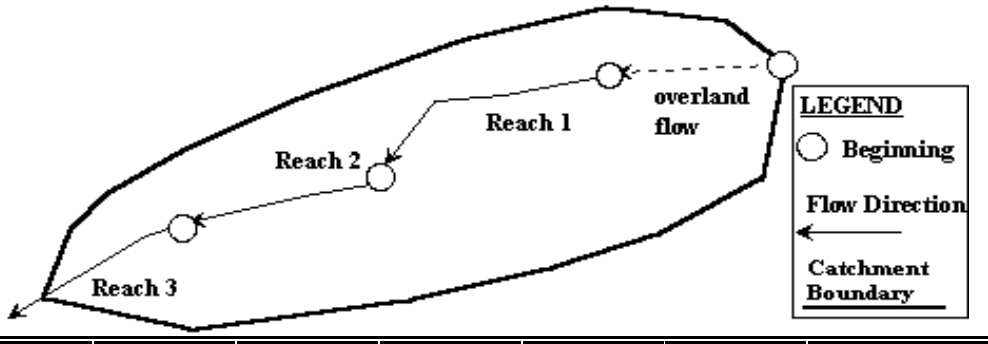
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	12	0.68	N/A	0.10	2.08
1	0.0050	1,650		20.00	1.41	19.45
2						
3						
4						
5						
	Sum	1,662			Computed Tc =	21.53
					Regional Tc =	19.23
					User-Entered Tc =	19.23

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.05	inch/hr	Peak Flowrate, Qp =	47.60	cfs
Rainfall Intensity at Regional Tc, I =	5.36	inch/hr	Peak Flowrate, Qp =	50.52	cfs
Rainfall Intensity at User-Defined Tc, I =	5.36	inch/hr	Peak Flowrate, Qp =	50.52	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Z1

I. Catchment Hydrologic Data

Catchment ID =	Z1	
Area =	6.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	C	A, B, C, or D

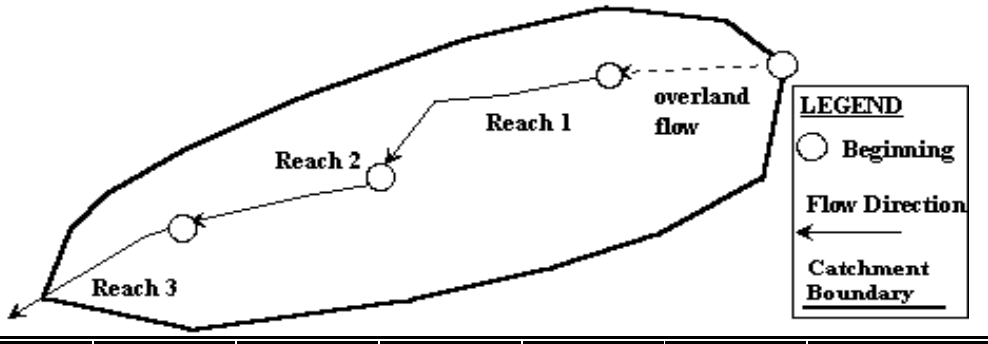
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	12	0.68	N/A	0.10	2.08
1	0.0050	1,500		20.00	1.41	17.68
2						
3						
4						
5						
	Sum	1,512			Computed Tc =	19.76
					Regional Tc =	18.40
					User-Entered Tc =	18.40

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.29	inch/hr	Peak Flowrate, Qp =	24.91	cfs
Rainfall Intensity at Regional Tc, I =	5.48	inch/hr	Peak Flowrate, Qp =	25.84	cfs
Rainfall Intensity at User-Defined Tc, I =	5.48	inch/hr	Peak Flowrate, Qp =	25.84	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Pueblo Freeway
Catchment ID: Offsite Basin Z2

I. Catchment Hydrologic Data

Catchment ID =	Z2	
Area =	5.00	Acres
Percent Imperviousness =	85.00	%
NRCS Soil Type =	C	A, B, C, or D

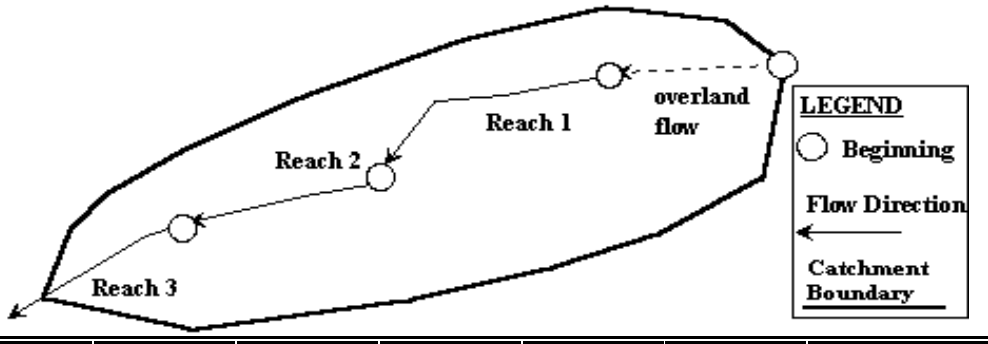
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

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 ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0200	12	0.68	N/A	0.10	2.08
1	0.0050	1,000		20.00	1.41	11.79
2						
3						
4						
5						
	Sum	1,012			Computed Tc =	13.87
					Regional Tc =	15.62
					User-Entered Tc =	13.87

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	6.29	inch/hr	Peak Flowrate, Qp =	24.69	cfs
Rainfall Intensity at Regional Tc, I =	5.95	inch/hr	Peak Flowrate, Qp =	23.35	cfs
Rainfall Intensity at User-Defined Tc, I =	6.29	inch/hr	Peak Flowrate, Qp =	24.69	cfs

Appendix 4: Pond Hydraulics

Modify the following four tables for incorporation of 20% additional volume for sedimentation as shown on the following pages:

1. Existing Alignment Pond Volume Calculations
2. Local Streets WQCV: Existing Alignment
3. Modified Alignment Pond Volume Calculations
4. Local Streets WQCV: Modified Alignment

Purpose: To calculate the pond volume required to acoomodate detention and WQCV

Existing Alignment

	Onsite System Hydrology										Local Streets				Total	
Basin	Percent Impervious	Soil Type	Runoff Coefficient C (100 yr)	Time of Concentration tc (min)	Rounded Area (ac)	Rainfall Depth (100-yr)	Inflow Qp100 (cfs)	Outlet Qp100 (cfs)	V100 (ac-ft)	WQCV (ac-ft)	Inflow Qp100 (cfs)	Outlet Qp100 (cfs)	V100 (ac-ft)	WQCV (ac-ft)	Detention and WQCV (ac-ft)	Outlet Qp100 (cfs)
1	36	B	0.48	58	107	2.67	150	20	14	1.9	N/A	N/A	N/A	N/A	16	20
2	65	B	0.59	15	24	2.67	90	30	3	0.7	N/A	N/A	N/A	N/A	3	30
3	72	B	0.64	12	22	2.67	100	20	3	0.7	N/A	N/A	N/A	N/A	3	20
4	41	B	0.50	18	34	2.67	100	30	3	0.7	N/A	N/A	N/A	N/A	3	30
5	41	B	0.50	20	32	2.67	90	30	2	0.6	80	10	1.5	0.7	5	40
6a	55	B	0.54	13	25	2.67	90	30	2	0.6	N/A	N/A	N/A	N/A	3	30
6b	61	B	0.56	9	12	2.67	60	20	1	0.3	N/A	N/A	N/A	N/A	2	20
7	70	B	0.62	10	13	2.67	60	20	2	0.4	N/A	N/A	N/A	N/A	2	20
8	41	B	0.50	5	36	2.67	170	40	3	0.7	N/A	N/A	N/A	N/A	4	40
8a	41	B	0.50	12	31	2.67	110	30	3	0.6	12	2	1	0.2	4	30
9	44	D	0.59	12	30	2.67	120	30	3	0.6	21	4	1	0.2	4	40
10	61	C	0.63	14	30	2.67	120	30	3	0.8	5	1	1	0.1	4	30
11	61	C	0.63	17	47	2.67	170	50	5	1.2	N/A	N/A	N/A	N/A	6	50
12	90	C	0.83	7	8	2.67	60	10	2	0.4	82	14	2	0.6	4	30
				Total =	451											

$WQCV = a*(0.91i^3-1.19i^2+0.78i)$

Where a = 1 for 40 hour drain time

Volume required = WQCV/12*AREA*1.20 (includes 20% increase for sedimentation)

Sources:

Percent Impervious	Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type	Natural Resources Conservation Service
Runoff Coeffient	Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.

Data Presentation:

Values shown for the time of concentration, area, volume, and flowrate are rounded. The total volume was calculated from the unrounded values, with the results 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 (inches)	WQCV (ac-ft)
NFR	C	70	14	0.28	0.4
Dillon	C	100	8	0.50	0.4
Hwy 50B	C	61	16	0.24	0.4
Northern (W)	B	100	6	0.50	0.3
Northern (E)	B	80	4	0.33	0.2
Mesa (E)	B	100	1	0.50	0.1
Mesa (W)	B	100	1	0.50	0.1
1st (W)	D	100	1	0.50	0.1
1st (E)	D	100	1	0.50	0.1
4th (W)	D	100	1	0.50	0.1
4th (E)	D	100	1	0.50	0.1
8th (W)	D	100	1	0.50	0.1
8th (E)	C	46	3	0.20	0.1
13th	C	100	1	0.50	0.1
Pueblo Blvd	B	61	6	0.24	0.2

W = West of I-25
E = East of I-25

$WQCV = a*(0.91i^3-1.19i^2+0.78i)$
Where a = 1 for 40 hour drain time

Volume required = WQCV/12*AREA*1.20 (includes 20% increase for sedimentation)

Sources:
Percent Impervious Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type Natural Resources Conservation Service

Data Presentation:
Values shown for the time of concentration, area, volume, and flowrate are rounded.
WQCV was calculated from the unrounded values, with the results rounded.

Purpose: To calculate the pond volume required to acoomodate detention and WQCV

Modified Alignment

	Onsite System Hydrology										Local Streets				Total	
Basin	Percent Impervious	Soil Type	Runoff Coefficient C (100 yr)	Time of Concentration tc (min)	Area (ac)	Rainfall Depth (100-yr)	Inflow Qp100 (cfs)	Outlet Qp100 (cfs)	V100 (ac-ft)	WQCV (ac-ft)	Inflow Qp100 (cfs)	Outlet Qp100 (cfs)	V100 (ac-ft)	WQCV (ac-ft)	Detention and WQCV (ac-ft)	Outlet Qp100 (cfs)
1	50	B	0.52	56	107	2.67	150	20	14	2.3	N/A	N/A	N/A	N/A	16	20
2	61	B	0.56	18	23	2.67	80	20	2	0.6	N/A	N/A	N/A	N/A	3	20
3	41	B	0.5	14	16	2.67	50	20	2	0.3	N/A	N/A	N/A	N/A	2	20
4	61	B	0.56	18	52	2.67	170	50	5	1.3	N/A	N/A	N/A	N/A	6	50
5	41	A	0.41	11	17	2.67	40	10	2	0.4	N/A	N/A	N/A	N/A	2	10
6a&b	54	B	0.54	16	66	2.67	210	60	5	1.5	N/A	N/A	N/A	N/A	7	60
7	50	B	0.52	12	41	2.67	150	40	3	0.9	N/A	N/A	N/A	N/A	4	40
8	41	B	0.50	10	17	2.67	60	20	2	0.4	N/A	N/A	N/A	N/A	2	20
8a	41	B	0.50	12	31	2.67	110	30	3	0.6	12	2	0.3	0.2	4	30
9	44	D	0.59	12	30	2.67	120	30	3	0.6	21	4	0.4	0.2	4	40
10	61	C	0.63	14	30	2.67	120	30	3	0.8	5	1	0.1	0.1	4	30
11	61	C	0.63	17	47	2.67	170	50	5	1.2	N/A	N/A	N/A	N/A	6	50
12	90	C	0.83	7	8	2.67	60	10	2	0.4	82	14	1.4	0.6	4	30
				Total =	485											

$WQCV = a*(0.91i^3-1.19i^2+0.78i)$
Where a = 1 for 40 hour drain time

Volume required = WQCV/12*AREA*1.20 (includes 20% increase for sedimentation)

Sources:

Percent Impervious	Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type	Natural Resources Conservation Service
Runoff Coeffient	Based on landuse classifications given in the Colorado Department of Transportation, Drainage Design Manual, 2004.

Data Presentation:
Values shown for the time of concentration, area, volume, and flowrate are rounded. The total volume was calculated from the unrounded values, with the results rounded.

Purpose: To calculate the quantity of water quality capture volume required.

Local Streets WQCV: Modified Alignment

Location See Figure 6	Soil Type	Percent Impervious	Area (ac)	WQCV (inches)	WQCV (ac-ft)
NFR	C	70	14	0.28	0.4
Dillon	C	100	8	0.50	0.4
Hwy 50B	C	61	16	0.24	0.4
Northern (W)	B	100	2	0.50	0.1
Northern (E)	B	80	3	0.33	0.1
Mesa (E)	B	100	1	0.50	0.1
Mesa (W)	B	100	2	0.50	0.1
1st (W)	D	100	1	0.50	0.1
1st (E)	D	100	1	0.50	0.1
4th (W)	D	100	1	0.50	0.1
4th (E)	D	100	1	0.50	0.1
8th (W)	D	100	1	0.50	0.1
8th (E)	C	46	3	0.20	0.1
13th	C	100	1	0.50	0.1
Indiana (E)	B	100	1	0.50	0.1
Pueblo Blvd	B	61	6	0.24	0.2

W = West of I-25
E = East of I-25

$WQCV = a*(0.91i^3-1.19i^2+0.78i)$
Where a = 1 for 40 hour drain time

Volume required = WQCV/12*AREA*1.20 (includes 20% increase for sedimentation)

Sources:
Percent Impervious Colorado Department of Transportation, Drainage Design Manual, 2004.
Soil Type Natural Resources Conservation Service

Data Presentation:
Values shown for the time of concentration, area, volume, and flowrate are rounded.
WQCV was calculated from the unrounded values, with the results rounded.

Appendix 5: Conveyance

System Design

Modify the following two tables for incorporation of the new offsite basins as shown on the following pages:

1. Existing Alignment Conveyance System
2. Modified Alignment Conveyance System

Purpose: To judge feasibilty of conveyance system.

Existing Alignment Alternative

	Onsite Basins		Onsite Detention Ponds		Local Streets		Offsite Basins				Full flow diameter	
Reach ID	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	Design Discharge* 100-yr (cfs)	slope (flattest)	(computed from Flowmaster)	Selected Pipe Size
A	2	90	none		none		E & F	30	120	0.5%	51	54
B	3	100	pond 2	30	none		E, F & G	160	270	0.6%	67	72
C	4	100	ponds 2 & 3	40	none		E, F & G	160	300	2.0%	56	60
D	5	90	ponds 2, 3, 4	70	none		E, F, G, H, I & K	320	480	2.0%	66	66
E	6a	90	none		none		J	20	110	2.0%	38	42
F	6b	60	ponds 2, 3, 4 & 5	100	Northern and Mesa	80	E, F, G, H, I, K, & L	400	620	1.5%	77	78
G			ponds 2, 3, 4, 5, 6a & 6b	130	Northern and Mesa	80	E, F, G, H, I, J, K, & L	420	620	1.5%	77	78
H	7	60	none		none		none		60	1.3%	33	36
AA	8	170	none		none		none		170	1.3%	49	54
BB	8a	110	none		1st Street	20	none		120	1.3%	43	48
CC	9	120	none		8th Street	30	V	30	160	0.5%	57	60
DD	10	120	none		13th Street	10	X	20	140	0.6%	52	54
EE	11	170	none		none		none		170	0.6%	56	60
FF	12	60	none		Frontage Road	90	none		140	0.8%	50	54
Det 7 Outfall				20					20	0.5%	26	30
Det 8a Outfall				30	1st Street	2			30	0.5%	30	30
Det 8 Outfall				40					40	0.5%	34	36
Det 9 Outfall				30	8th Street	4			40	0.5%	34	36
Det 10 Outfall				30	13th Street	1			30	0.5%	30	30
Det 11 Outfall				50					50	0.5%	37	42
Det 12 Outfall				10	Frontage Road	14			30	0.5%	30	30
Det 11 & 12 Outfall				60	Frontage Road	14			70	0.5%	42	42

* Design Discharge = $Q_{onsite\ basin} + Q_{detention\ release} + Q_{local\ street} + Q_{offsite\ basin}$

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 results being rounded.

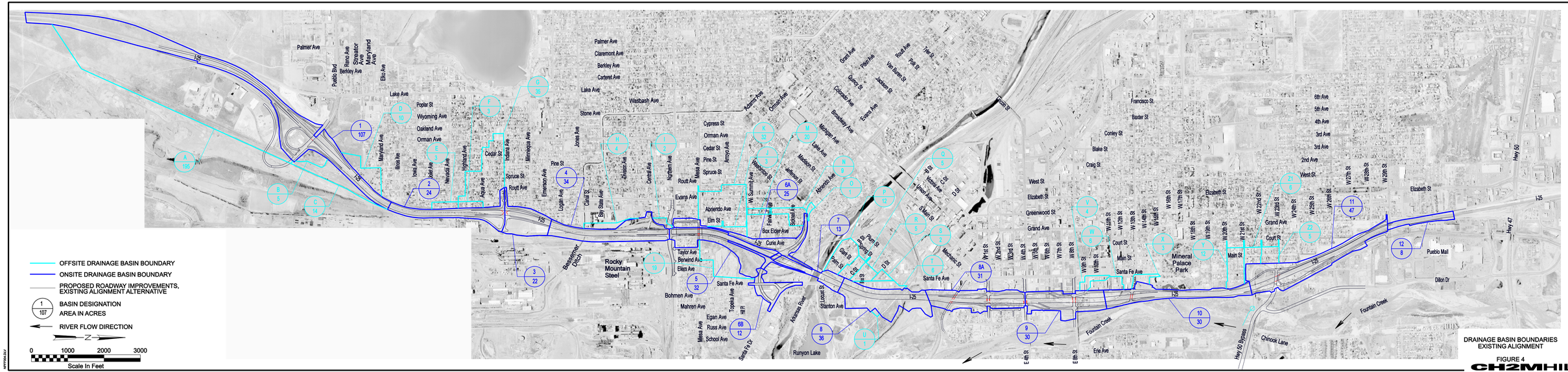
Purpose: To judge feasibilty of conveyance system.

Modified Alignment Alternative

	Onsite Basins		Onsite Detention Ponds		Local Streets		Offsite Basins				Full flow diameter	
Reach ID	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	ID	Peak Discharge 100-yr (cfs)	Design Discharge* 100-yr (cfs)	slope (flattest)	(computed from Flowmaster)	Selected Pipe Size
A	2	80	none		none		E & F	30	100	0.5%	48	48
B	3	50	pond 2	20	none		E, F & G	160	230	0.6%	63	66
C	4	170	ponds 2 & 3	40	none		E, F & G	160	360	2.0%	60	60
D			ponds 2, 3, 4a & 4b	80	none		E, F, G, H, I, K & L	380	450	2.0%	65	66
E	5	40	none		none		J	30	70	2.0%	32	36
F	6	210	ponds 2, 3, 4a, 4b & 5	90	none		E, F, G, H, I, J, K, & L	400	700	1.5%	81	84
G			ponds 2, 3, 4a, 4b, 5, 6a & 6b	150	none		E, F, G, H, I, J, K, & L	400	550	1.5%	74	78
H	7	150	none		none		T & U	40	180	1.3%	50	54
AA	8	60	none		none		none		60	1.3%	33	36
BB	8a	110	none		1st Street	20	none		120	1.3%	43	48
CC	9	120	none		8th Street	30	V	30	160	0.5%	57	60
DD	10	120	none		13th Street	10	X	30	150	0.6%	54	54
EE	11	170	none		none		none		170	0.6%	57	60
FF	12	60	none		Frontage Road	90	none		140	0.8%	50	54
Det 7 Outfall				40			T & U	40	70	0.5%	42	42
Det 8a Outfall				30	1st Street	2			30	0.5%	30	30
Det 8 Outfall				20					20	0.5%	26	30
Det 9 Outfall				30	8th Street	4			40	0.5%	34	36
Det 10 Outfall				30	13th Street	1			30	0.5%	30	30
Det 11 Outfall				50			Z2	30	80	0.5%	44	48
Det 12 Outfall				10	Frontage Road	14			30	0.5%	30	30
Det 11 & 12 Outfall				60	Frontage Road	14	Z2	30	100	0.5%	48	48

* Design Discharge = $Q_{onsite\ basin} + Q_{detention\ release} + Q_{local\ street} + Q_{offsite\ basin}$

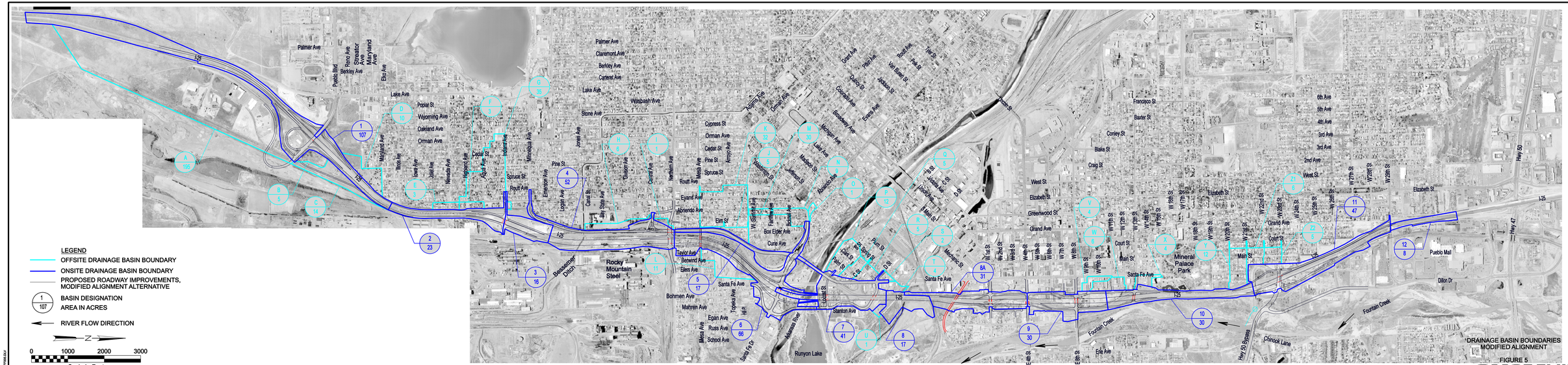
Data Presentation:
Values shown for contributing discharges are rounded. Where multiple values were summed to find a flow, the unrounded values were summed with the results being rounded.



DRAINAGE BASIN BOUNDARIES
EXISTING ALIGNMENT

FIGURE 4

CH2MHILL



DRAINAGE BASIN BOUNDARIES
MODIFIED ALIGNMENT

FIGURE 5

CH2MHILL