DRAINAGE STUDY

FOR

Parkview Townhomes

550 W EL NORTE PARKWAY
ESCONDIDO, CA 92026
APN: 226-380-48

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Preparation Date: June, 2024

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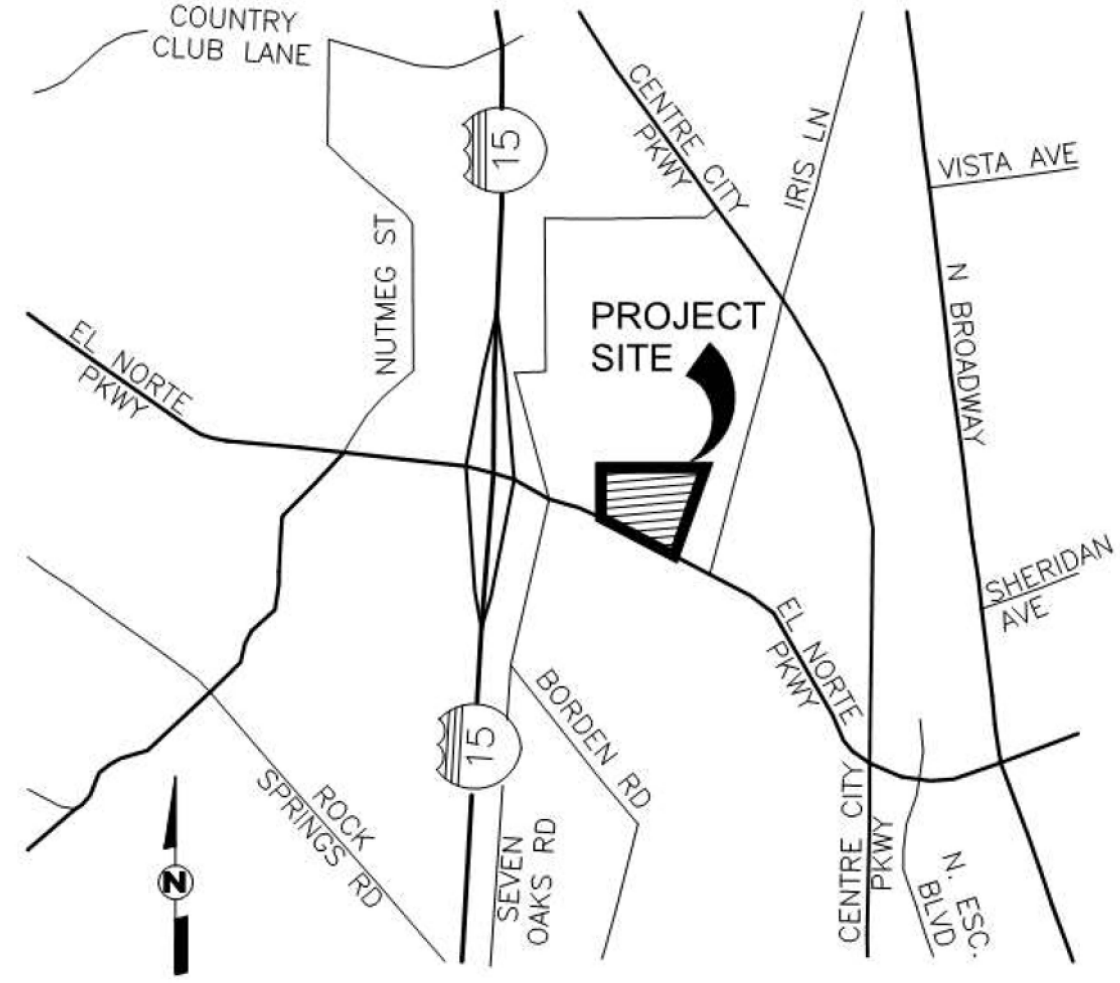
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VICINITY MAP



CURRENT CONDITION



1. Introduction

The purpose of this drainage study is to analyze the existing and proposed drainage patterns, peak flow rates, and drainage systems associated with the Parkview Townhomes residential project. The proposed project is on a 4.96-acre site, located on West El Norte Parkway between Seven Oakes Road and South Iris Lane, in the City of Escondido, California. The project will consist of 70 Townhome units, a pool and patio area, a Tot-Lot children's park, private drive aisles, parking, and associated improvements. This drainage study has been prepared in accordance with the requirements of the County of San Diego Hydrology manual, analyzing the 6-hour 100-year storm event.

2. Existing Conditions

The existing site is mostly undeveloped other than one single family home with a long, paved driveway.

The topography of the site is relatively steep and generally slopes from the north to the south. The existing site is split into 3 drainage basins:

Basin 1 (1.18 acres) on the west side of the site drains into an existing concrete brow ditch and leaves the site westerly.

Basin 2 (4.63 acres) is the majority of the site and drains north to south to an existing concrete drainage ditch which discharges to the curb line of W. El Norte.

Basin 3 (0.65 acres) is on the east side of the site and sheet flows towards adjacent properties to the east.

Analysis Point 1: Analysis point 1 is the runoff collected from the site at the existing brow ditch located on the west property line.

Analysis Point 2: Analysis point 2 is the curb line along W. El Norte where the majority of rainfall from the site confluences.

The on-site "C" factor 0.35 (Basin 1) and 0.41(Basin 2) was used to calculate existing flow rates, based on existing impervious area.

3. Proposed Conditions

The major development activities include, but are not limited to, clearing & grubbing, demolition, grading, & construction of the Townhome project.

The associated improvements will also include drainage improvements, and construction of Best Management Practices (BMPs). A biofiltration basin BMP#1 is proposed for dual purpose for water quality/hydromodification management and detention to maintain the existing condition peak flow rates in the proposed condition. The site is designed to maintain the existing drainage patterns.

Analysis Point 1: In the proposed condition, less area and flow will be sent to Analysis point 1 and peek flow rates are maintained.

Analysis Point 2: The peak flow rate discharging into analysis point 2 is maintained after mitigating through detention within biofiltration basin #2. Because the peak flow rate from the overall site is mitigated in the proposed condition, the redevelopment will not create drainage impacts to the existing receiving drain systems.

Analysis Point 3: In the proposed condition, there will be no flow to analysis point 3, as this storm water is now diverted to analysis point 2.

A "C" factor 0.63 was used to calculate the proposed conditions flows, based on the proposed land use type.

4. Soil Characteristics

Soils are assumed as type D for both existing and proposed conditions.

5. Methodology

Rational Method:

To determine the impacts of the proposed development on the existing drainage patterns, the pre- and post-peak flow rates are analyzed and compared for the 100-year storm event using the Rational Method. This report has been prepared in accordance with the requirements of the County of San Diego Hydrology Manual and City of Escondido Design Standards and Standard Drawings.

A rational method analysis was utilized to perform hydrologic calculations in this study. The Rational Method is a physically based numerical method where runoff is assumed to be directly proportional to rainfall and area, less losses for infiltration and depression storage

Rational Equation: $Q = C * I * A$

Where;
Q = Peak discharge, cfs
C = Rational method runoff coefficient
I = Rainfall intensity, inch/hour
A = Drainage area, acre

A computer model CivilD is used to automate the hydrology analysis process. This computer version of the rational method analysis allows user to develop a node-link model of the watershed. CivilD computer program has the capability of performing calculations utilizing mathematical functions. These functions are assigned code numbers, which appear in the printed results. The code numbers and their corresponding functions are described below;

Sub area Hydrologic Processes;

Code 1 - INITIAL subarea input, top of stream

Code 2 - STREET flow through subarea, includes subarea runoff
Code 3 - ADDITION of runoff from subarea to stream
Code 4 - STREET INLET + parallel street & pipe flow + area
Code 5 - PIPEFLOW travel time (program estimated pipe size)**
Code 6 - PIPEFLOW travel time (user specified pipe size)
Code 7 - IMPROVED channel travel time (open or box)**
Code 8 - IRREGULAR channel travel time**
Code 9 - USER specified entry of data at a point
Code 10 - CONFLUENCE at downstream point in current stream
Code 11 - CONFLUENCE of mainstreams
**NOTE: These options do not include subarea runoff
**NOTE: (#) - Required pipe size determined by the hydrology program

6. Calculations

Onsite Hydrology & Hydraulic Analysis: The peak flow rates for the 6-hour, 100-year storm events are calculated for both existing as well as proposed conditions and summarized in Table 7-1 for comparison purpose. The detailed calculations (CivilD results) for existing and proposed conditions analysis are in Appendices A and B, respectively.

Table 7-1 Existing and Proposed Conditions Peak Flow Rates Summary

Analysis Point	Existing Area (AC)	Proposed Area (AC)	Existing Q_{100} (cfs)	Proposed Q_{100} (cfs)	Proposed Mitigated Q_{100} (cfs)
1	1.18	1.16	2.93	2.61	2.61
2	4.63	5.30	12.87	14.95	11.57*
3	0.65	0	1.47	0	0.0
Total	**6.46**	**6.46**	**17.27**	**17.56**	**14.18**

*See BMP Detention Analysis Appendix C.

In the proposed condition the unmitigated runoff during the 100-year, 6-hour storm event for the combined project is calculated to increase by 0.29 cfs. The increase in peak flow rate is primarily due to the increase in impervious area from the existing condition. The proposed condition 100-year peak flow rate is reduced from 17.56 cfs to 14.18 cfs due to flow routing through the detention system. The detained flow rate is subtracted from the unmitigated proposed condition peak flow rate to obtain the mitigated peak flow rate.

Per Table 7-1 above, each POC is analyzed to determine post-development 100-year peak flow rate comparisons. The runoff at POC 1 is lowered to 2.61 CFS in the post-development conditions. The runoff at POC 2 is decreased to 11.57 CFS (14.95-3.38)* in the post-development mitigated condition from 12.87 CFS in the existing condition. The

runoff at POC 3 is completely removed as this water is directed to POC 2 in the proposed condition.

The proposed storm drain systems will be designed to convey the calculated 100-year, 6-hour peak flow rate. Detailed sizing calculations for detention routing is provided in Appendix C.

7. Conclusion

The site is designed to mitigate the stormwater impacts due to the redevelopment. The new storm drain systems are designed to convey the runoff for the 6-hour, 100-year storm event.

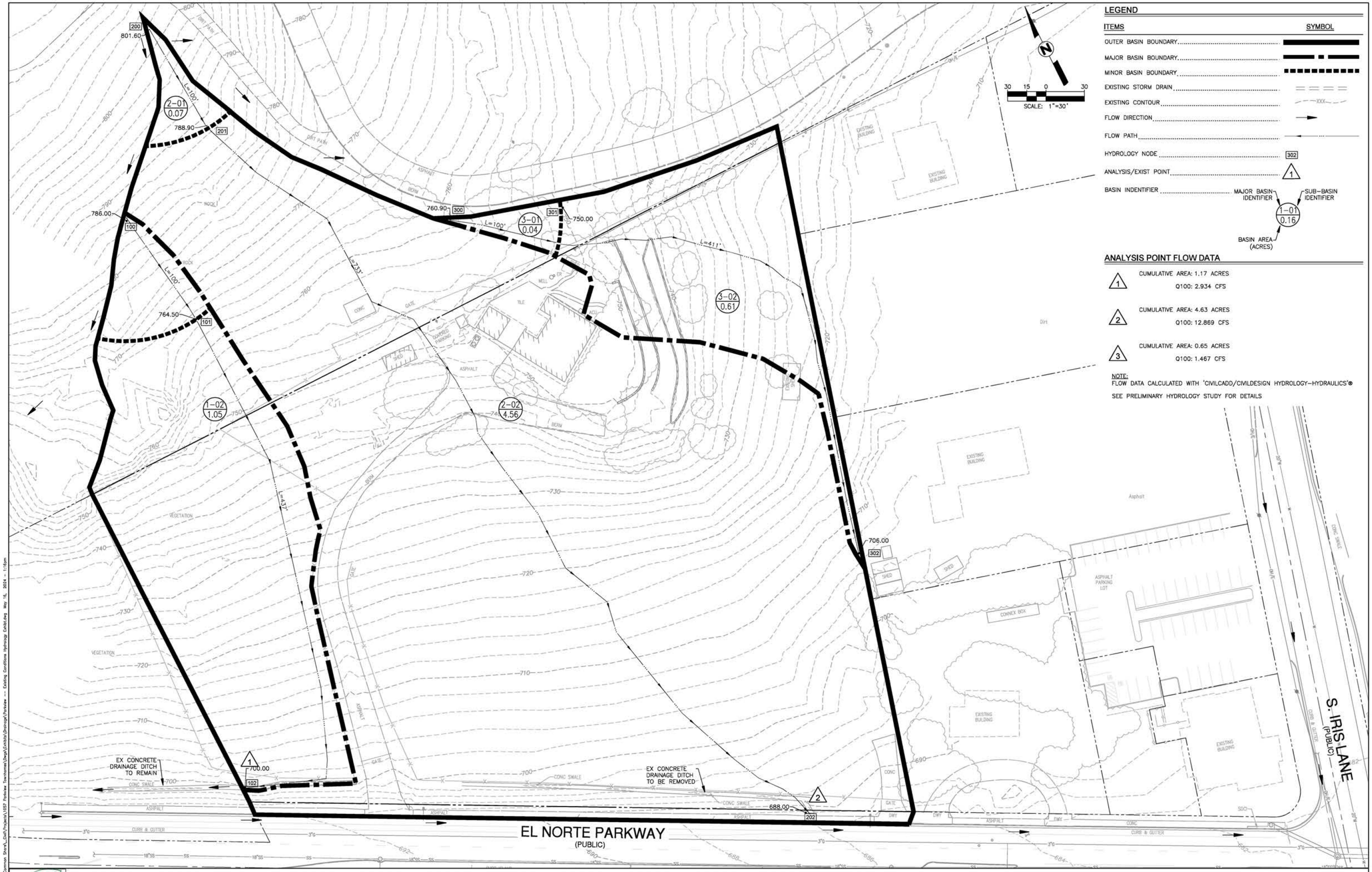
The existing drainage patterns and flow rates between the existing condition and the proposed development are generally maintained. The runoff from the proposed development has been minimized by using a biofiltration basin to treat and detain runoff prior to discharging offsite. Downstream drainage impacts are not anticipated as a result of the development of this site.

8. References

- County of San Diego Hydrology Manual, 2003
- City of Escondido Design Standards and Standard Drawings, April 2, 2014.

APPENDIX A:

Existing Condition Hydrology Calculations
Existing Condition Hydrology Map



LEGEND

ITEMS	SYMBOL
OUTER BASIN BOUNDARY	
MAJOR BASIN BOUNDARY	
MINOR BASIN BOUNDARY	
EXISTING STORM DRAIN	
EXISTING CONTOUR	XXX
FLOW DIRECTION	
FLOW PATH	
HYDROLOGY NODE	302
ANALYSIS/EXIST POINT	1
BASIN INDENTIFIER	MAJOR BASIN IDENTIFIER / SUB-BASIN IDENTIFIER; BASIN AREA (ACRES)

BASIN INDENTIFIER: 1-01 / 0.16 (MAJOR BASIN IDENTIFIER / SUB-BASIN IDENTIFIER; BASIN AREA (ACRES))

ANALYSIS POINT FLOW DATA

1 — CUMULATIVE AREA: 1.17 ACRES
Q100: 2.934 CFS

2 — CUMULATIVE AREA: 4.63 ACRES
Q100: 12.869 CFS

3 — CUMULATIVE AREA: 0.65 ACRES
Q100: 1.467 CFS

NOTE:
FLOW DATA CALCULATED WITH 'CIVILCADD/CIVILDESIGN HYDROLOGY-HYDRAULICS'®
SEE PRELIMINARY HYDROLOGY STUDY FOR DETAILS

TOUCHSTONE DEVELOPMENT

EXISTING CONDITIONS HYDROLOGY EXHIBIT

Z:\Common Share_Civil\Projects\1507 Parkview Townhomes\Design\Exhibits\Drainage\Parkview — Existing Conditions Hydrology Exhibit.dwg May 16, 2024 - 11:16am

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 05/08/24

 *********   Hydrology Study Control Information **********

Program License Serial Number 6413

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.400
24 hour precipitation(inches) = 6.500
P6/P24 =   52.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   100.000 to Point/Station   101.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 786.000(Ft.)
Lowest elevation = 764.500(Ft.)
Elevation difference =   21.500(Ft.) Slope = 21.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 21.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.85 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]

```
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  21.500^(1/3)]=   4.85
Calculated TC of    4.855 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      8.958(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.376(CFS)
Total initial stream area =        0.120(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      1.705(CFS)
Depth of flow =   0.144(Ft.), Average velocity =   3.291(Ft/s)
        ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2             25.00              0.00
        3             50.00              1.00
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =      1.705(CFS)
  '     '        flow top width =      7.198(Ft.)
  '     '    velocity=    3.291(Ft/s)
  '     '        area =      0.518(Sq.Ft)
  '     '        Froude number =     2.162

Upstream point elevation =   764.500(Ft.)
Downstream point elevation =   700.000(Ft.)
Flow length =   437.000(Ft.)
Travel time  =    2.21 min.
Time of concentration =    7.07 min.
Depth of flow =   0.144(Ft.)
Average velocity =   3.291(Ft/s)
Total irregular channel flow =     1.705(CFS)
Irregular channel normal depth above invert elev. =   0.144(Ft.)
Average velocity of channel(s) =   3.291(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      7.166(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
```

Rainfall intensity = 7.166(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350 CA = 0.409
Subarea runoff = 2.558(CFS) for 1.050(Ac.)
Total runoff = 2.934(CFS) Total area = 1.170(Ac.)
Depth of flow = 0.176(Ft.), Average velocity = 3.769(Ft/s)
End of computations, total study area = 1.170 (Ac.)

San Diego County Rational Hydrology Program

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Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 05/08/24

 *********   Hydrology Study Control Information **********

Program License Serial Number 6413

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.400
24 hour precipitation(inches) = 6.500
P6/P24 =   52.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   200.000 to Point/Station   201.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 801.600(Ft.)
Lowest elevation = 788.900(Ft.)
Elevation difference =   12.700(Ft.) Slope = 12.700 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 12.70 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.79 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]

```
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  12.700^(1/3)]=   5.79
Rainfall intensity (I) =      8.153(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.200(CFS)
Total initial stream area =        0.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      6.579(CFS)
Depth of flow =   0.319(Ft.), Average velocity =   6.465(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              2.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      6.579(CFS)
  '     '        flow top width =      6.380(Ft.)
  '     '    velocity=    6.465(Ft/s)
  '     '        area =      1.018(Sq.Ft)
  '     '        Froude number =     2.853

Upstream point elevation =   788.900(Ft.)
Downstream point elevation =   688.000(Ft.)
Flow length =   733.000(Ft.)
Travel time  =    1.89 min.
Time of concentration =    7.68 min.
Depth of flow =   0.319(Ft.)
Average velocity =   6.465(Ft/s)
Total irregular channel flow =     6.579(CFS)
Irregular channel normal depth above invert elev. =   0.319(Ft.)
Average velocity of channel(s) =   6.465(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      6.794(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Rainfall intensity =      6.794(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
```

(Q=KCIA) is C = 0.409 CA = 1.894
Subarea runoff = 12.669(CFS) for 4.560(Ac.)
Total runoff = 12.869(CFS) Total area = 4.630(Ac.)
Depth of flow = 0.410(Ft.), Average velocity = 7.645(Ft/s)
End of computations, total study area = 4.630 (Ac.)

San Diego County Rational Hydrology Program

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Rational method hydrology program based on
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        Rational Hydrology Study   Date: 05/08/24

 *********   Hydrology Study Control Information **********

Program License Serial Number 6413

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.400
24 hour precipitation(inches) = 6.500
P6/P24 =   52.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   300.000 to Point/Station   301.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 760.900(Ft.)
Lowest elevation = 750.000(Ft.)
Elevation difference =   10.900(Ft.) Slope = 10.900 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 10.90 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.09 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]

```
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  10.900^(1/3)]=   6.09
Rainfall intensity (I) =      7.889(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.110(CFS)
Total initial stream area =        0.040(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      0.831(CFS)
Depth of flow =   0.165(Ft.), Average velocity =   3.059(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              2.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.831(CFS)
  '     '        flow top width =      3.297(Ft.)
  '     '    velocity=    3.059(Ft/s)
  '     '        area =      0.272(Sq.Ft)
  '     '        Froude number =     1.878

Upstream point elevation =   750.000(Ft.)
Downstream point elevation =   706.000(Ft.)
Flow length =   411.000(Ft.)
Travel time  =    2.24 min.
Time of concentration =    8.33 min.
Depth of flow =   0.165(Ft.)
Average velocity =   3.059(Ft/s)
Total irregular channel flow =     0.831(CFS)
Irregular channel normal depth above invert elev. =   0.165(Ft.)
Average velocity of channel(s) =   3.059(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      6.446(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      6.446(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
```

(Q=KCIA) is C = 0.350 CA = 0.227
Subarea runoff = 1.356(CFS) for 0.610(Ac.)
Total runoff = 1.467(CFS) Total area = 0.650(Ac.)
Depth of flow = 0.204(Ft.), Average velocity = 3.526(Ft/s)
End of computations, total study area = 0.650 (Ac.)

APPENDIX B:

Proposed Condition Hydrology Calculations
Proposed Condition Hydrology Map

LEGEND

ITEMS	SYMBOL
OUTER BASIN BOUNDARY	
MAJOR BASIN BOUNDARY	
MINOR BASIN BOUNDARY	
EXISTING STORM DRAIN	
PROPOSED STORM DRAIN	
EXISTING CONTOUR	XXX
FLOW DIRECTION	
FLOW PATH	
HYDROLOGY NODE	200
ANALYSIS/EXIST POINT	1
BASIN INDENTIFIER/AREA (ACRES)	MAJOR BASIN IDENTIFIER: 1–01; SUB-BASIN IDENTIFIER: 0.16; BASIN AREA (ACRES)

ANALYSIS POINT FLOW DATA

1 — CUMULATIVE AREA: 1.16 ACRES
Q100: 2.611 CFS

2 — CUMULATIVE AREA: 5.30 ACRES
Q100: 14.95 CFS (UNMITIGATED)
11.57 CFS (MITIGATED)

3 — CUMULATIVE AREA: 0.0 ACRES
Q100: 0.0 CFS

NOTE:
FLOW DATA CALCULATED WITH 'CIVILCADD/CIVILDESIGN HYDROLOGY–HYDRAULICS'®
SEE PRELIMINARY HYDROLOGY STUDY FOR DETAILS

801.60
788.90
772.00
764.50
751.25
729.50
725.20
731.00
731.50
726.25
728.50
698.00
693.00
688.00
685.50
700.00
694.00
731.50 DITCH COLLECTED IN TYPE F AND DISCHARGED AT NODE-243 (NEAR R.O.W.)
EX CONCRETE DRAINAGE DITCH TO REMAIN
CONNECT NEW STORM DRAIN TO EXISTING MANHOLE
EL NORTE PARKWAY (PUBLIC)
S. IRIS LANE (PUBLIC)
SCALE: 1"=30'

PROPOSED CONDITIONS HYDROLOGY EXHIBIT

Z:\Common Share_Civil\Projects\1057 Parkview Townhomes\Dwgs\Exhibits\Drainage\Parkview — Proposed Conditions Hydrology Exhibit.dwg Jun 19, 2024 - 4:23pm

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 05/09/24

 *********   Hydrology Study Control Information **********

Program License Serial Number 6413

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.400
24 hour precipitation(inches) = 6.500
P6/P24 =   52.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   100.000 to Point/Station   101.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 801.600(Ft.)
Lowest elevation = 788.900(Ft.)
Elevation difference =   12.700(Ft.) Slope = 12.700 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 12.70 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.79 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]

```
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  12.700^(1/3)]=   5.79
Rainfall intensity (I) =      8.153(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.171(CFS)
Total initial stream area =        0.060(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Depth of flow =   0.084(Ft.), Average velocity =   2.429(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              2.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.171(CFS)
  '     '        flow top width =      1.679(Ft.)
  '     '    velocity=    2.429(Ft/s)
  '     '        area =      0.070(Sq.Ft)
  '     '        Froude number =     2.089

Upstream point elevation =   788.900(Ft.)
Downstream point elevation =   751.250(Ft.)
Flow length =   227.000(Ft.)
Travel time  =    1.56 min.
Time of concentration =    7.34 min.
Depth of flow =   0.084(Ft.)
Average velocity =   2.429(Ft/s)
Total irregular channel flow =     0.171(CFS)
Irregular channel normal depth above invert elev. =   0.084(Ft.)
Average velocity of channel(s) =   2.429(Ft/s)


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Process from Point/Station      102.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   751.250(Ft.)
Downstream point elevation =   700.000(Ft.)
Channel length thru subarea  =   522.000(Ft.)
Channel base width      =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      1.437(CFS)
```

```
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      1.437(CFS)
Depth of flow =   0.229(Ft.), Average velocity =   8.591(Ft/s)
Channel flow top width =    0.959(Ft.)
Flow Velocity =    8.59(Ft/s)
Travel time  =    1.01 min.
Time of concentration =    8.36 min.
Critical depth =      0.469(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.432(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      6.432(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.406
Subarea runoff =      2.440(CFS) for      1.100(Ac.)
Total runoff =      2.611(CFS)  Total area =       1.160(Ac.)
Depth of flow =   0.317(Ft.), Average velocity =  10.091(Ft/s)
Critical depth =      0.633(Ft.)
End of computations, total study area =           1.160 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 05/09/24

 *********   Hydrology Study Control Information **********

Program License Serial Number 6413

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.400
24 hour precipitation(inches) = 6.500
P6/P24 =   52.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   200.000 to Point/Station   201.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL   ]
(14.5 DU/A or Less   )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Initial subarea total flow distance =   65.000(Ft.)
Highest elevation = 731.500(Ft.)
Lowest elevation = 731.000(Ft.)
Elevation difference =   0.500(Ft.) Slope = 0.769 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of   0.77 %, in a development type of
 14.5 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.44 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]

```
TC = [1.8*(1.1-0.6300)*(  65.000^.5)/(   0.769^(1/3)]=   7.44
Rainfall intensity (I) =      6.930(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.630
Subarea runoff =      0.393(CFS)
Total initial stream area =        0.090(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   731.000(Ft.)
Downstream point elevation =   728.500(Ft.)
Channel length thru subarea  =   353.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank =  12.000
Slope or 'Z' of right channel bank =  12.000
!!Warning: Water is above left or right bank elevations
!!Warning: Water is above left or right bank elevations
!!Warning: Water is above left or right bank elevations
!!Warning: Water is above left or right bank elevations
!!Warning: Water is above left or right bank elevations
Estimated mean flow rate at midpoint of channel =      2.522(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.240(Ft.)
Flow(q) thru subarea =      2.522(CFS)
Depth of flow =   0.291(Ft.), Average velocity =   2.562(Ft/s)
!!Warning: Water is above left or right bank elevations
Channel flow top width =    5.760(Ft.)
Flow Velocity =    2.56(Ft/s)
Travel time  =    2.30 min.
Time of concentration =    9.74 min.
Critical depth =      0.301(Ft.)
ERROR - Channel depth exceeds maximum allowable depth
 Adding area flow to channel
Rainfall intensity (I) =      5.826(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Rainfall intensity =      5.826(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.630  CA =      0.787
Subarea runoff =      4.195(CFS) for      1.160(Ac.)
Total runoff =      4.588(CFS)  Total area =       1.250(Ac.)
Depth of flow =   0.365(Ft.), Average velocity =   3.255(Ft/s)
```

```
!!Warning: Water is above left or right bank elevations
ERROR - Channel depth exceeds maximum allowable depth
Critical depth =      0.391(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =     2.400(Ft.)
Downstream point/station elevation =     0.000(Ft.)
Pipe length  =   240.00(Ft.) Slope =   0.0100  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.588(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.588(CFS)
Normal flow depth in pipe =    9.34(In.)
Flow top width inside pipe =   14.54(In.)
Critical Depth =   10.42(In.)
Pipe flow velocity =      5.71(Ft/s)
Travel time through pipe =    0.70 min.
Time of concentration (TC) =    10.44 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Rainfall intensity (I) =      5.571(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Time of concentration =    10.44 min.
Rainfall intensity =      5.571(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.630  CA =      1.732
Subarea runoff =      5.064(CFS) for      1.500(Ac.)
Total runoff =      9.652(CFS)  Total area =       2.750(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =     1.000(Ft.)
Downstream point/station elevation =     0.000(Ft.)
```

```
Pipe length  =    50.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.652(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     9.652(CFS)
Normal flow depth in pipe =   10.57(In.)
Flow top width inside pipe =   17.72(In.)
Critical Depth =   14.39(In.)
Pipe flow velocity =      8.95(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    10.53 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      204.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Rainfall intensity (I) =      5.539(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Time of concentration =    10.53 min.
Rainfall intensity =      5.539(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.630  CA =      1.858
Subarea runoff =      0.643(CFS) for      0.200(Ac.)
Total runoff =     10.295(CFS)  Total area =       2.950(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =    25.000(Ft.)
Downstream point/station elevation =     0.000(Ft.)
Pipe length  =    71.00(Ft.) Slope =   0.3521  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.295(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    10.295(CFS)
Normal flow depth in pipe =    5.91(In.)
Flow top width inside pipe =   12.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     26.74(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    10.58 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Rainfall intensity (I) =      5.524(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration =    10.58 min.
Rainfall intensity =      5.524(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.592  CA =      2.023
Subarea runoff =      0.881(CFS) for      0.470(Ac.)
Total runoff =     11.176(CFS)  Total area =       3.420(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.420(Ac.)
Runoff from this stream =     11.176(CFS)
Time of concentration =   10.58 min.
Rainfall intensity =     5.524(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      210.000 to Point/Station      211.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Initial subarea total flow distance  =   65.000(Ft.)
Highest elevation =  729.500(Ft.)
Lowest elevation =  725.200(Ft.)
Elevation difference =    4.300(Ft.) Slope =  6.615 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
```

```
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.62 %, in a development type of
 14.5 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.51 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6300)*( 100.000^.5)/(   6.615^(1/3)]=   4.51
Calculated TC of    4.507 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      8.958(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.630
Subarea runoff =      0.169(CFS)
Total initial stream area =        0.030(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      211.000 to Point/Station      212.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   725.200(Ft.)
Downstream point elevation =   698.000(Ft.)
Channel length thru subarea  =   208.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank =  24.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      0.508(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      0.508(CFS)
Depth of flow =   0.094(Ft.), Average velocity =   4.609(Ft/s)
Channel flow top width =    2.347(Ft.)
Flow Velocity =    4.61(Ft/s)
Travel time  =    0.75 min.
Time of concentration =    5.26 min.
Critical depth =      0.159(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      8.671(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Rainfall intensity =      8.671(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.630  CA =      0.095
Subarea runoff =      0.650(CFS) for      0.120(Ac.)
Total runoff =      0.819(CFS)  Total area =       0.150(Ac.)
```

```
Depth of flow =   0.112(Ft.), Average velocity =   5.194(Ft/s)
Critical depth =      0.193(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   698.000(Ft.)
Downstream point/station elevation =   693.000(Ft.)
Pipe length  =    77.00(Ft.) Slope =   0.0649  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.819(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.819(CFS)
Normal flow depth in pipe =    3.26(In.)
Flow top width inside pipe =    5.98(In.)
Critical Depth =    5.38(In.)
Pipe flow velocity =      7.53(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     5.43 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.150(Ac.)
Runoff from this stream =      0.819(CFS)
Time of concentration =    5.43 min.
Rainfall intensity =     8.495(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       11.176     10.58                5.524
2        0.819      5.43                8.495
Qmax(1) =
           1.000 *    1.000 *    11.176) +
           0.650 *    1.000 *     0.819) + =      11.709
Qmax(2) =
           1.000 *    0.513 *    11.176) +
           1.000 *    1.000 *     0.819) + =       6.555

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.176       0.819
Maximum flow rates at confluence using above data:
```

```
       11.709        6.555
Area of streams before confluence:
        3.420        0.150
Results of confluence:
Total flow rate =     11.709(CFS)
Time of concentration =    10.579 min.
Effective stream area after confluence =      3.570(Ac.)


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Process from Point/Station      205.000 to Point/Station      206.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =     2.000(Ft.)
Downstream point/station elevation =     0.000(Ft.)
Pipe length  =    40.00(Ft.) Slope =   0.0500  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.709(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    11.709(CFS)
Normal flow depth in pipe =   10.24(In.)
Flow top width inside pipe =   13.96(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.11(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    10.63 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      206.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.570(Ac.)
Runoff from this stream =     11.709(CFS)
Time of concentration =   10.63 min.
Rainfall intensity =     5.507(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      240.000 to Point/Station      241.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
```

```
Initial subarea total flow distance  =   65.000(Ft.)
Highest elevation =  751.250(Ft.)
Lowest elevation =  733.000(Ft.)
Elevation difference =   18.250(Ft.) Slope = 28.077 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  28.08 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.44 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  28.077^(1/3)]=   4.44
Calculated TC of    4.442 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      8.958(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.125(CFS)
Total initial stream area =        0.040(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      241.000 to Point/Station      242.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   733.000(Ft.)
Downstream point elevation =   731.500(Ft.)
Channel length thru subarea  =   245.000(Ft.)
Channel base width      =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      0.345(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      0.345(CFS)
Depth of flow =   0.224(Ft.), Average velocity =   2.122(Ft/s)
Channel flow top width =    0.949(Ft.)
Flow Velocity =    2.12(Ft/s)
Travel time  =    1.92 min.
Time of concentration =    6.37 min.
Critical depth =      0.211(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      7.666(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
```

```
Rainfall intensity =      7.666(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.063
Subarea runoff =      0.358(CFS) for      0.140(Ac.)
Total runoff =      0.483(CFS)  Total area =       0.180(Ac.)
Depth of flow =   0.270(Ft.), Average velocity =   2.326(Ft/s)
Critical depth =      0.258(Ft.)


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Process from Point/Station      242.000 to Point/Station      243.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   731.500(Ft.)
Downstream point/station elevation =   694.000(Ft.)
Pipe length  =   235.00(Ft.) Slope =   0.1596  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.483(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.483(CFS)
Normal flow depth in pipe =    1.89(In.)
Flow top width inside pipe =    5.58(In.)
Critical Depth =    4.25(In.)
Pipe flow velocity =      9.10(Ft/s)
Travel time through pipe =    0.43 min.
Time of concentration (TC) =     6.80 min.


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Process from Point/Station      243.000 to Point/Station      206.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   694.000(Ft.)
Downstream point elevation =   688.000(Ft.)
Channel length thru subarea  =   392.000(Ft.)
Channel base width      =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      1.494(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      1.494(CFS)
Depth of flow =   0.385(Ft.), Average velocity =   4.389(Ft/s)
Channel flow top width =    1.269(Ft.)
Flow Velocity =    4.39(Ft/s)
Travel time  =    1.49 min.
Time of concentration =    8.28 min.
Critical depth =      0.477(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.468(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      6.468(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.378
Subarea runoff =      1.962(CFS) for      0.900(Ac.)
Total runoff =      2.445(CFS)  Total area =       1.080(Ac.)
Depth of flow =   0.494(Ft.), Average velocity =   4.978(Ft/s)
Critical depth =      0.617(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      206.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.080(Ac.)
Runoff from this stream =      2.445(CFS)
Time of concentration =    8.28 min.
Rainfall intensity =     6.468(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       11.709     10.63                5.507
2        2.445      8.28                6.468
Qmax(1) =
           1.000 *    1.000 *    11.709) +
           0.851 *    1.000 *     2.445) + =      13.791
Qmax(2) =
           1.000 *    0.779 *    11.709) +
           1.000 *    1.000 *     2.445) + =      11.571

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.709       2.445
Maximum flow rates at confluence using above data:
       13.791       11.571
Area of streams before confluence:
        3.570        1.080
Results of confluence:
Total flow rate =     13.791(CFS)
Time of concentration =    10.630 min.
```

```
Effective stream area after confluence =      4.650(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      207.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =     1.700(Ft.)
Downstream point/station elevation =     0.000(Ft.)
Pipe length  =    85.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.791(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    13.791(CFS)
Normal flow depth in pipe =   13.71(In.)
Flow top width inside pipe =   15.34(In.)
Critical Depth =   16.50(In.)
Pipe flow velocity =      9.55(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    10.78 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      207.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Rainfall intensity (I) =      5.458(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.630
Time of concentration =    10.78 min.
Rainfall intensity =      5.458(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.538  CA =      2.533
Subarea runoff =      0.037(CFS) for      0.060(Ac.)
Total runoff =     13.828(CFS)  Total area =       4.710(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      208.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =     0.500(Ft.)
Downstream point/station elevation =     0.000(Ft.)
Pipe length  =    25.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.828(CFS)
```

```
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    13.828(CFS)
Normal flow depth in pipe =   13.73(In.)
Flow top width inside pipe =   15.31(In.)
Critical Depth =   16.52(In.)
Pipe flow velocity =      9.55(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    10.82 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      208.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.710(Ac.)
Runoff from this stream =     13.828(CFS)
Time of concentration =   10.82 min.
Rainfall intensity =     5.444(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      220.000 to Point/Station      221.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  772.000(Ft.)
Lowest elevation =  764.500(Ft.)
Elevation difference =    7.500(Ft.) Slope =  7.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   7.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.90 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(   7.500^(1/3)]=   6.90
Rainfall intensity (I) =      7.280(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.076(CFS)
Total initial stream area =        0.030(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      221.000 to Point/Station      222.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Depth of flow =   0.065(Ft.), Average velocity =   1.818(Ft/s)
        ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              2.00
        2             20.00              0.00
        3             40.00              2.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.076(CFS)
  '     '        flow top width =      1.297(Ft.)
  '     '    velocity=    1.818(Ft/s)
  '     '        area =      0.042(Sq.Ft)
  '     '        Froude number =     1.779

Upstream point elevation =   764.500(Ft.)
Downstream point elevation =   751.250(Ft.)
Flow length =   101.000(Ft.)
Travel time  =    0.93 min.
Time of concentration =    7.82 min.
Depth of flow =   0.065(Ft.)
Average velocity =   1.818(Ft/s)
Total irregular channel flow =     0.076(CFS)
Irregular channel normal depth above invert elev. =   0.065(Ft.)
Average velocity of channel(s) =   1.818(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      222.000 to Point/Station      208.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   751.250(Ft.)
Downstream point elevation =   685.500(Ft.)
Channel length thru subarea  =   832.000(Ft.)
Channel base width      =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      0.672(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      0.672(CFS)
Depth of flow =   0.159(Ft.), Average velocity =   6.408(Ft/s)
Channel flow top width =    0.818(Ft.)
Flow Velocity =    6.41(Ft/s)
```

```
Travel time  =    2.16 min.
Time of concentration =    9.99 min.
Critical depth =      0.309(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.734(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.734(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.207
Subarea runoff =      1.108(CFS) for      0.560(Ac.)
Total runoff =      1.184(CFS)  Total area =       0.590(Ac.)
Depth of flow =   0.219(Ft.), Average velocity =   7.529(Ft/s)
Critical depth =      0.422(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      208.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.590(Ac.)
Runoff from this stream =      1.184(CFS)
Time of concentration =    9.99 min.
Rainfall intensity =     5.734(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       13.828     10.82                5.444
2        1.184      9.99                5.734
Qmax(1) =
           1.000 *    1.000 *    13.828) +
           0.950 *    1.000 *     1.184) + =      14.952
Qmax(2) =
           1.000 *    0.923 *    13.828) +
           1.000 *    1.000 *     1.184) + =      13.945

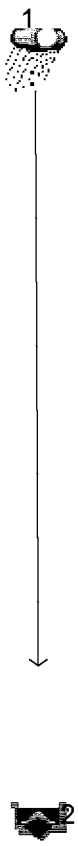
Total of 2 streams to confluence:
Flow rates before confluence point:
      13.828       1.184
Maximum flow rates at confluence using above data:
```

```
       14.952       13.945
Area of streams before confluence:
        4.710        0.590
Results of confluence:
Total flow rate =     14.952(CFS)
Time of concentration =    10.822 min.
Effective stream area after confluence =      5.300(Ac.)
End of computations, total study area =          5.300 (Ac.)
```

APPENDIX C:

Detention Basin Design

Watershed Model Schematic



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

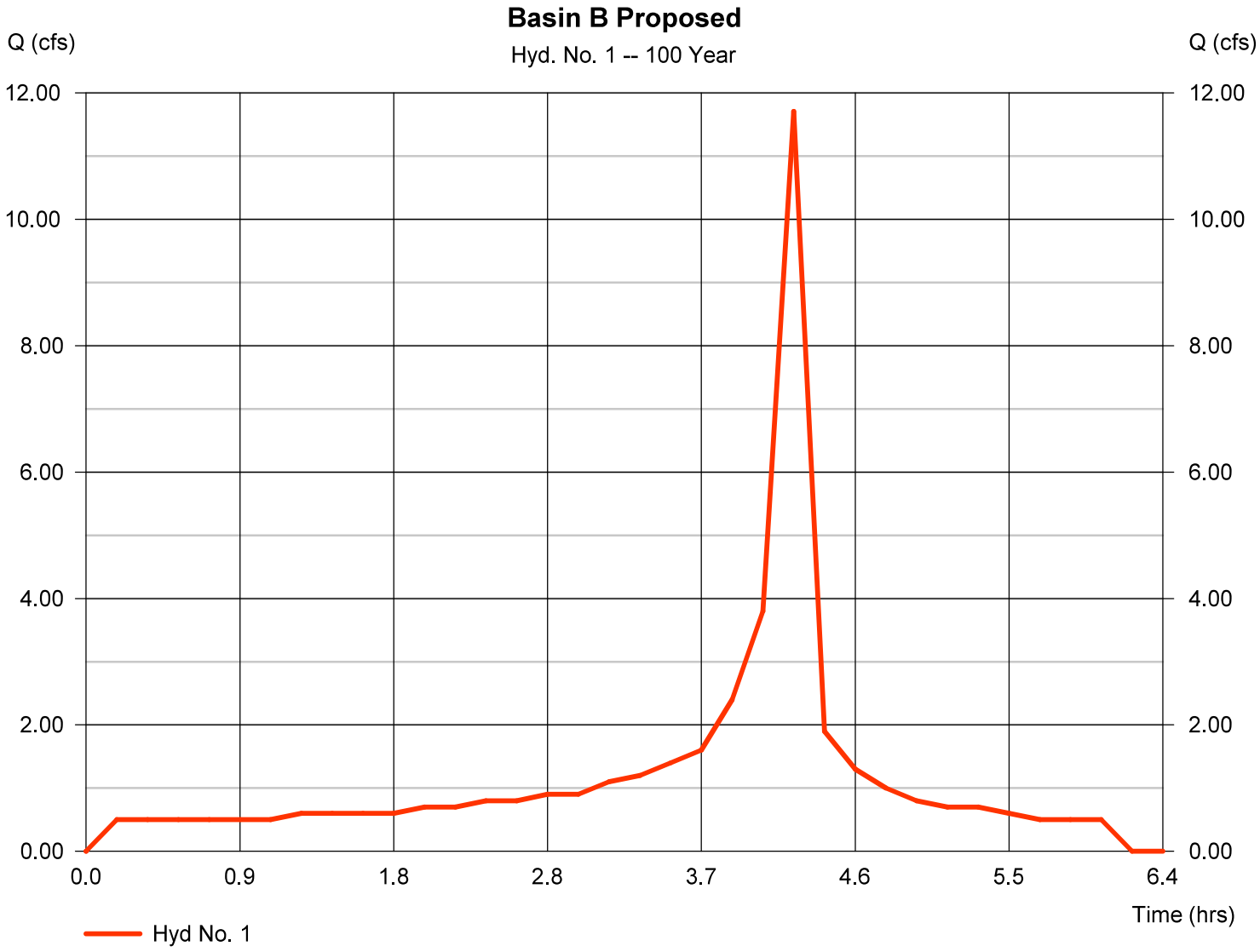
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	11.71	11	253	27,661	------	------	------	Basin B Proposed
2	Reservoir	8.331	11	253	25,877	1	695.13	8,108	BMP#1

Hydrograph Report

Hyd. No. 1

Basin B Proposed

Hydrograph type	= Manual	Peak discharge	= 11.71 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 27,661 cuft



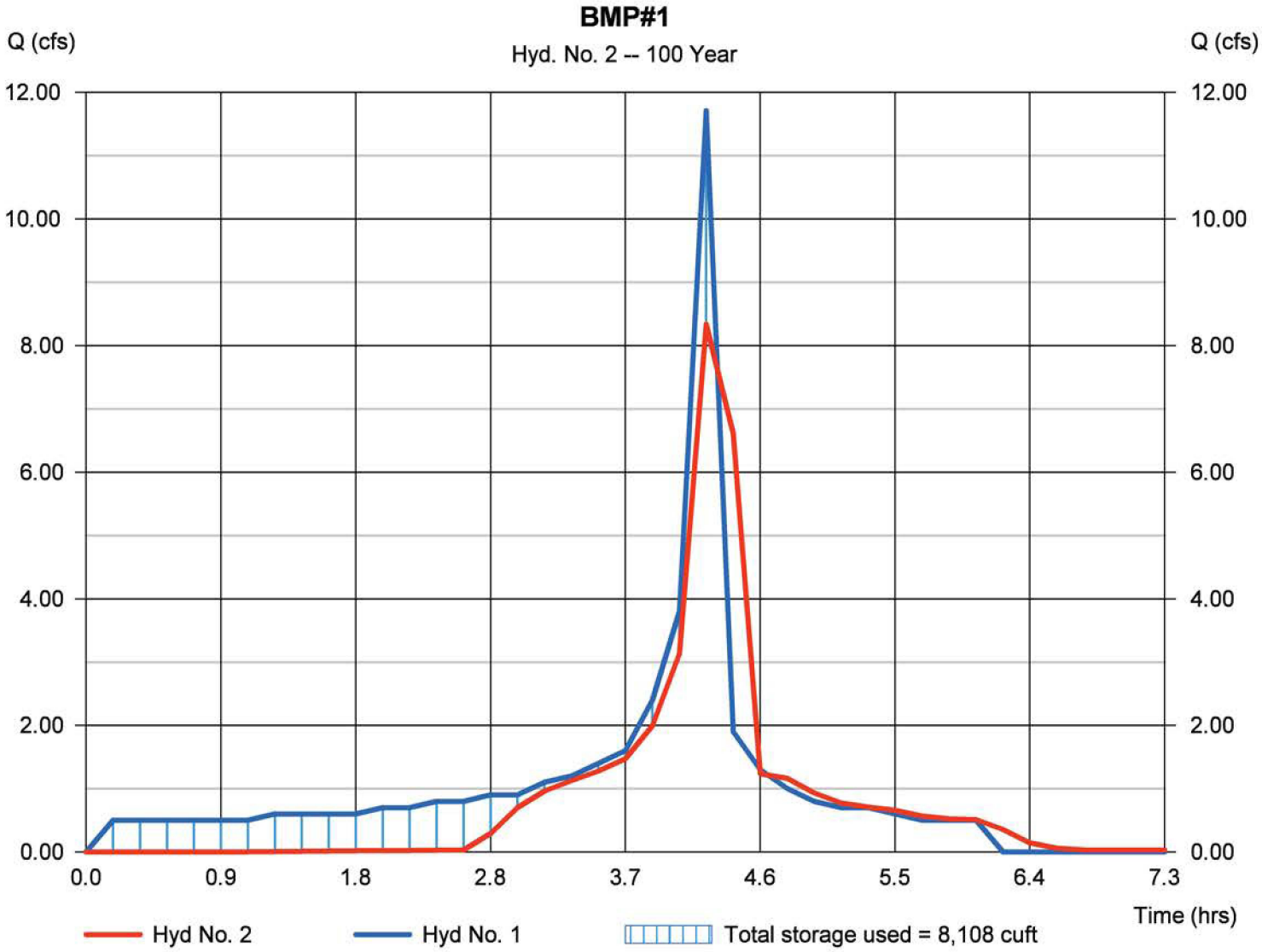
Hydrograph Report

Hyd. No. 2

BMP#1

Hydrograph type	= Reservoir	Peak discharge	= 8.331 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.22 hrs
Time interval	= 11 min	Hyd. volume	= 25,877 cuft
Inflow hyd. No.	= 1 - Basin B Proposed	Max. Elevation	= 695.13 ft
Reservoir name	= <New Pond>	Max. Storage	= 8,108 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - <New Pond>

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 693.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	693.00	3,042	0	0
1.00	694.00	3,740	3,391	3,391
2.00	695.00	4,461	4,101	7,492
3.00	696.00	5,208	4,835	12,326
4.00	697.00	5,979	5,594	17,920
5.00	708.00	6,776	6,378	24,297

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.75	0.85	0.00
Span (in)	= 18.00	0.75	0.85	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 685.50	693.50	693.75	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

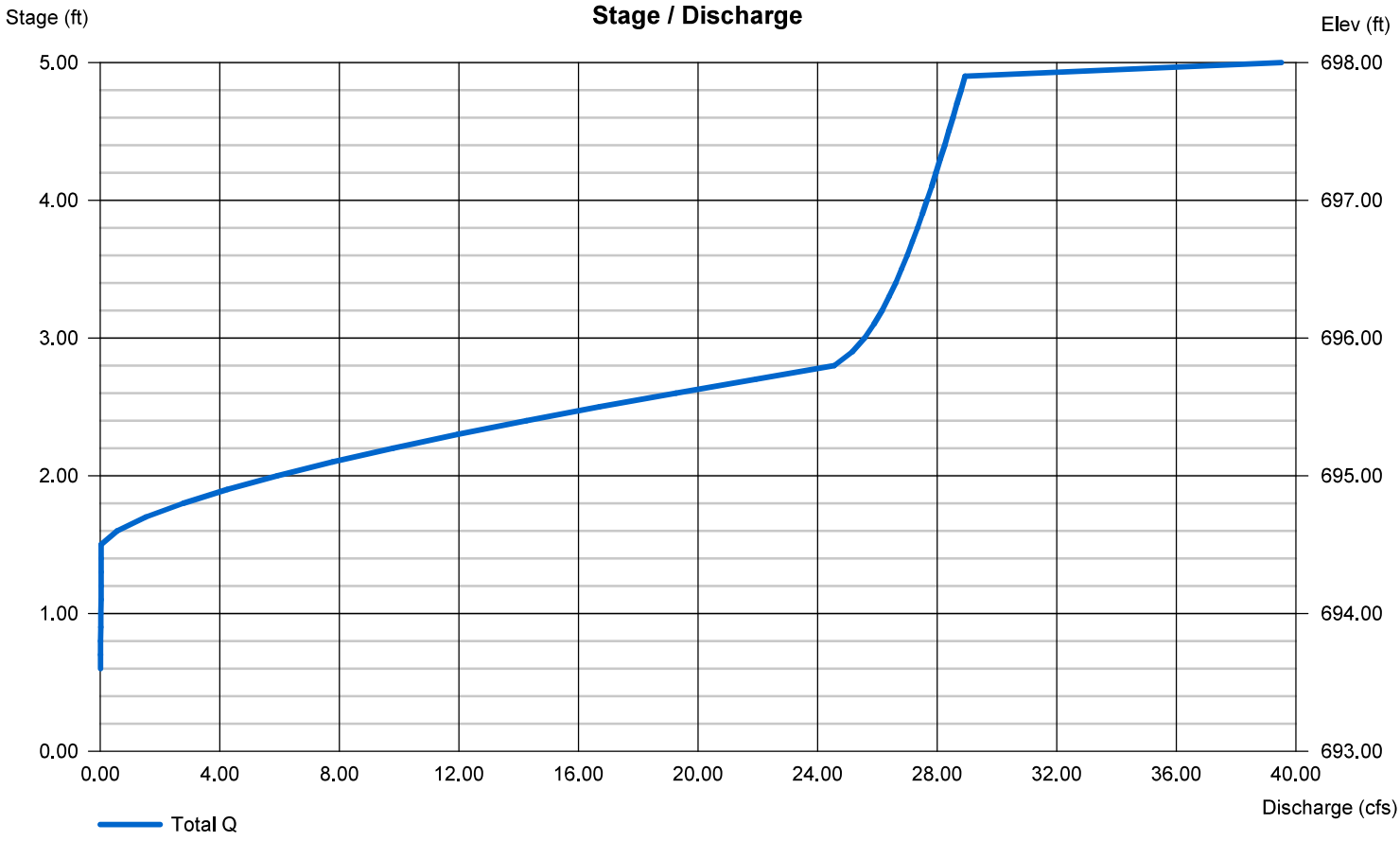
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 694.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



RATIONAL METHOD HYDROGRAPH PROGRAM
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RUN DATE 5/9/2024
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 11 MIN.
6 HOUR RAINFALL 3.4 INCHES
BASIN AREA 3.57 ACRES
RUNOFF COEFFICIENT 0.63
PEAK DISCHARGE 11.709 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 11	DISCHARGE (CFS) = 0.5
TIME (MIN) = 22	DISCHARGE (CFS) = 0.5
TIME (MIN) = 33	DISCHARGE (CFS) = 0.5
TIME (MIN) = 44	DISCHARGE (CFS) = 0.5
TIME (MIN) = 55	DISCHARGE (CFS) = 0.5
TIME (MIN) = 66	DISCHARGE (CFS) = 0.5
TIME (MIN) = 77	DISCHARGE (CFS) = 0.6
TIME (MIN) = 88	DISCHARGE (CFS) = 0.6
TIME (MIN) = 99	DISCHARGE (CFS) = 0.6
TIME (MIN) = 110	DISCHARGE (CFS) = 0.6
TIME (MIN) = 121	DISCHARGE (CFS) = 0.7
TIME (MIN) = 132	DISCHARGE (CFS) = 0.7
TIME (MIN) = 143	DISCHARGE (CFS) = 0.8
TIME (MIN) = 154	DISCHARGE (CFS) = 0.8
TIME (MIN) = 165	DISCHARGE (CFS) = 0.9
TIME (MIN) = 176	DISCHARGE (CFS) = 0.9
TIME (MIN) = 187	DISCHARGE (CFS) = 1.1
TIME (MIN) = 198	DISCHARGE (CFS) = 1.2
TIME (MIN) = 209	DISCHARGE (CFS) = 1.4
TIME (MIN) = 220	DISCHARGE (CFS) = 1.6
TIME (MIN) = 231	DISCHARGE (CFS) = 2.4
TIME (MIN) = 242	DISCHARGE (CFS) = 3.8
TIME (MIN) = 253	DISCHARGE (CFS) = 11.709
TIME (MIN) = 264	DISCHARGE (CFS) = 1.9
TIME (MIN) = 275	DISCHARGE (CFS) = 1.3
TIME (MIN) = 286	DISCHARGE (CFS) = 1
TIME (MIN) = 297	DISCHARGE (CFS) = 0.8
TIME (MIN) = 308	DISCHARGE (CFS) = 0.7
TIME (MIN) = 319	DISCHARGE (CFS) = 0.7
TIME (MIN) = 330	DISCHARGE (CFS) = 0.6
TIME (MIN) = 341	DISCHARGE (CFS) = 0.5
TIME (MIN) = 352	DISCHARGE (CFS) = 0.5
TIME (MIN) = 363	DISCHARGE (CFS) = 0.5
TIME (MIN) = 374	DISCHARGE (CFS) = 0

APPENDIX D:

Reference Charts

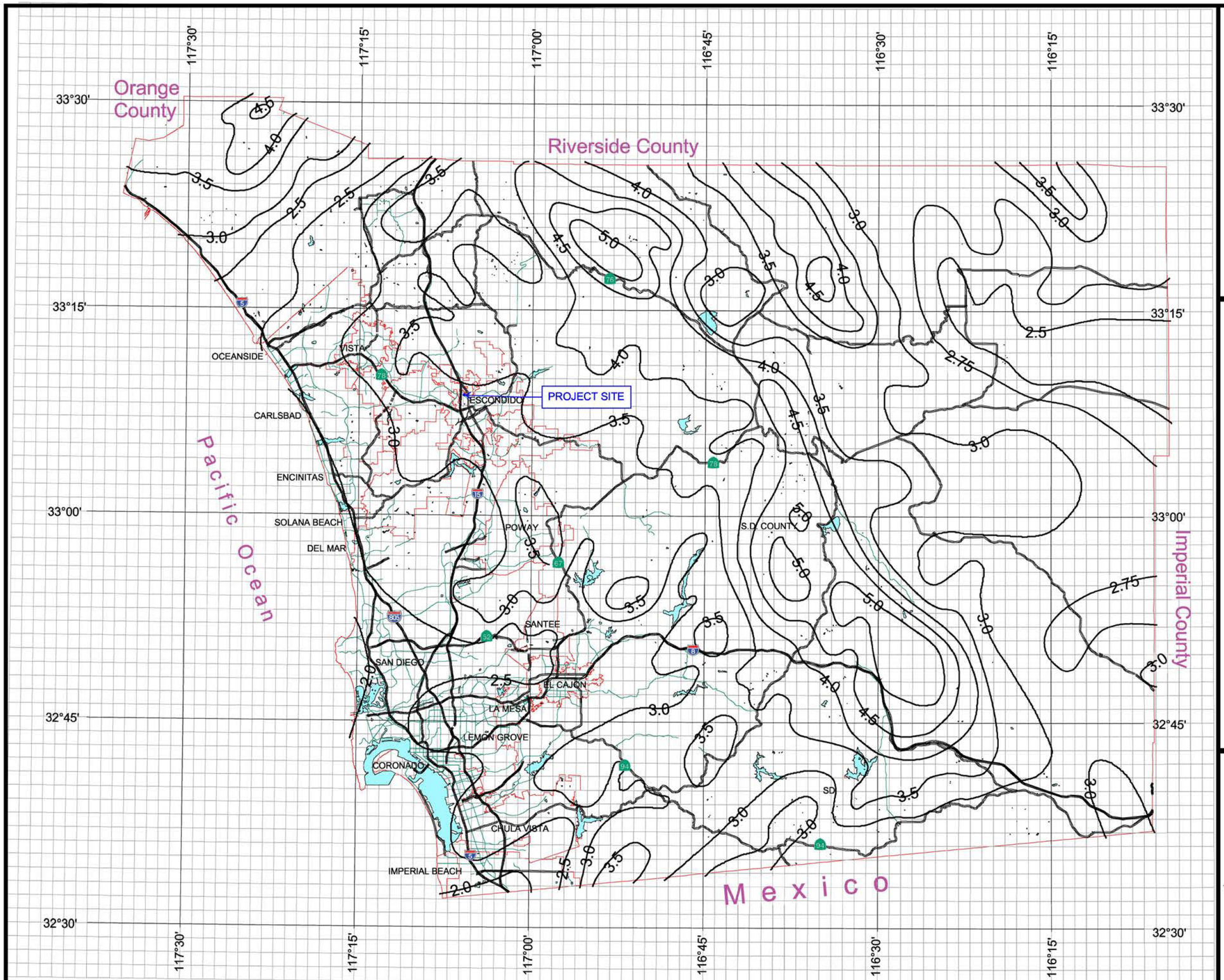
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Lat: 33°08'44"
Long: 117°05'58"
$P6_{100\ YR} = 3.4$"



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N W E S

3 0 3 Miles

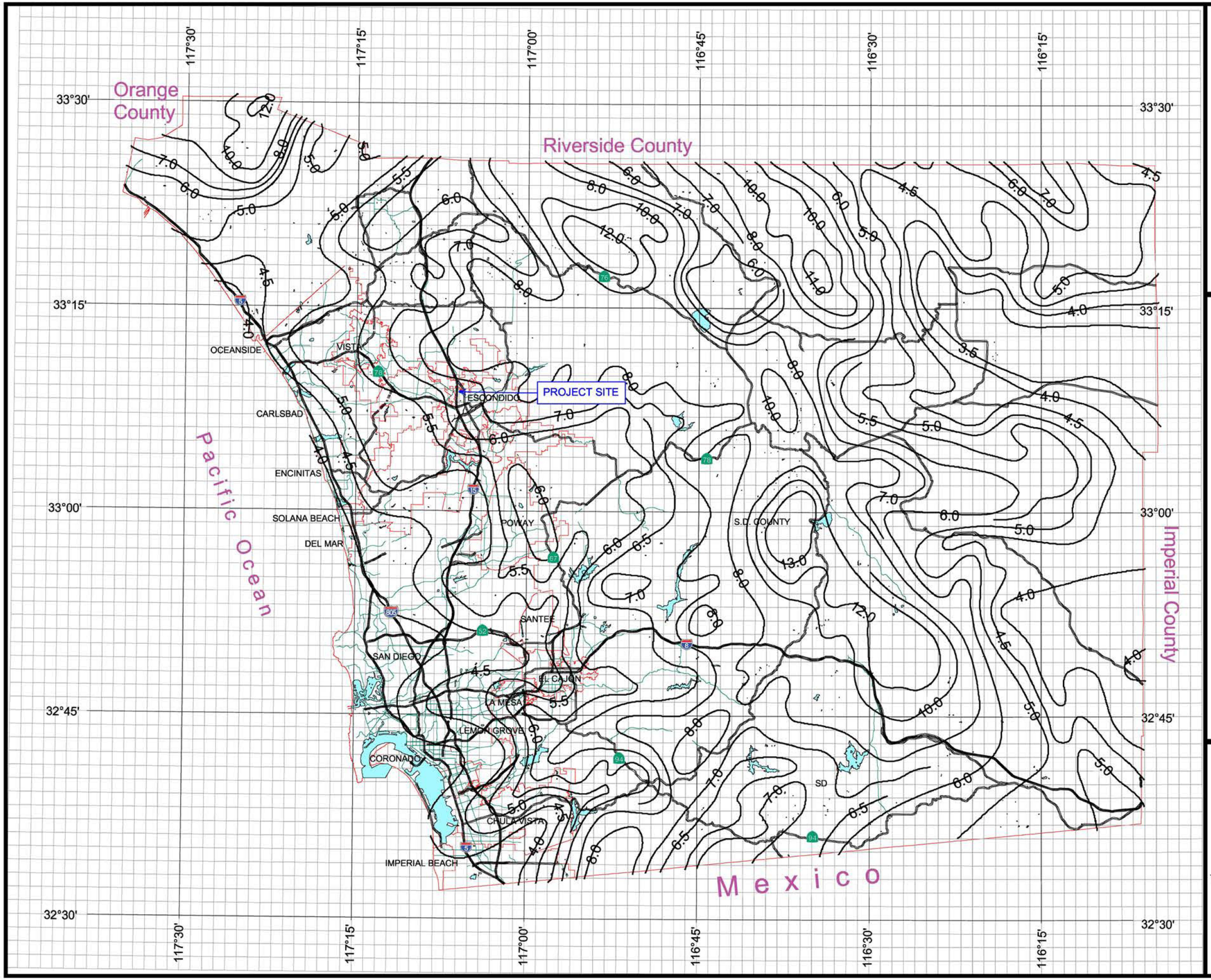
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Lat: 33°06'07"
Long: 117°04'15"
$P24_{100\ YR}$ = 6.5"



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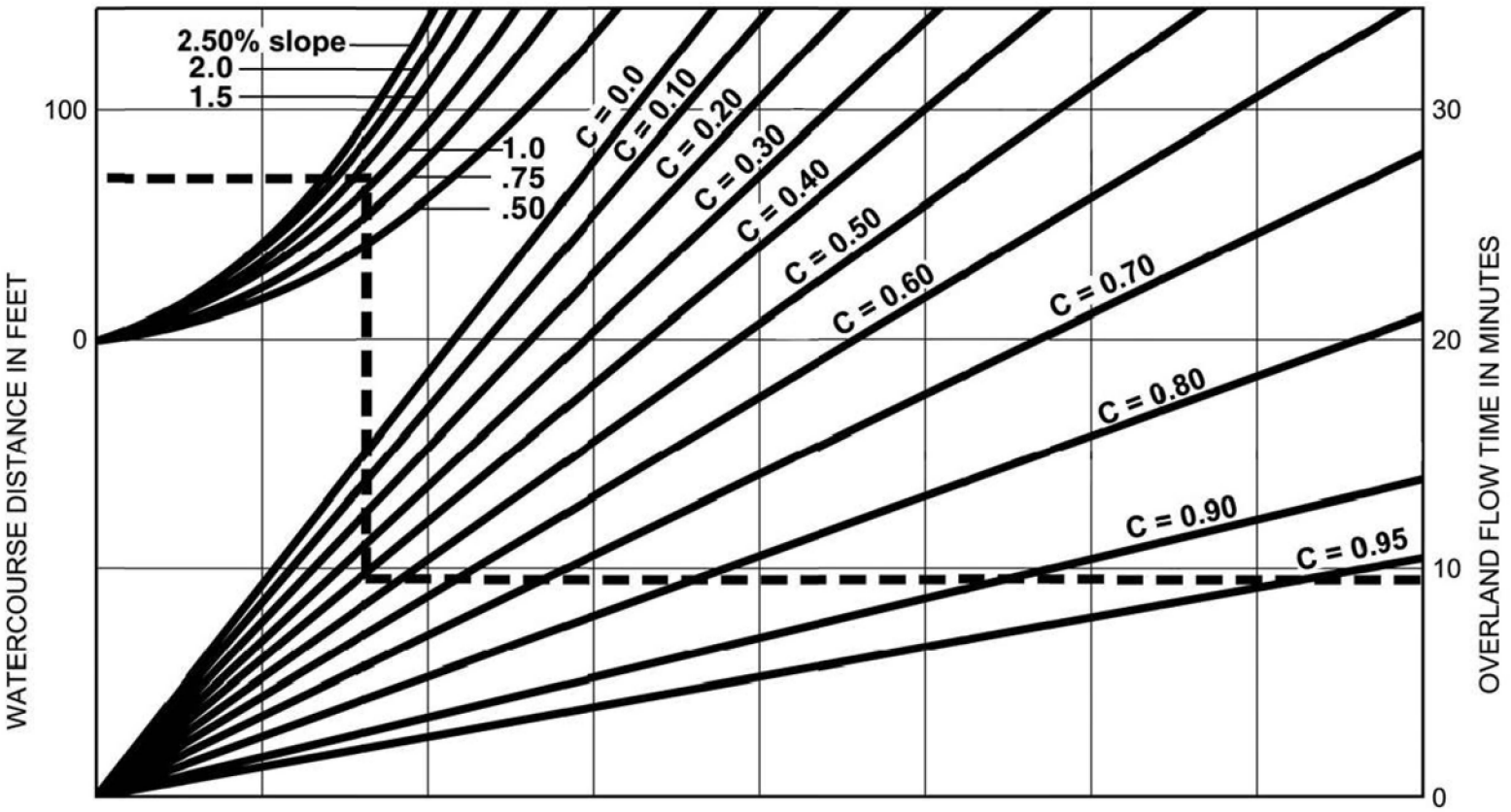
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3 0 3 Miles

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description