APPENDIX F

Water Quality/Drainage

TM DRAINAGE STUDY
For
OTAY RANCH VILLAGE 2 NORTH

City of Chula Vista, California

Prepared for:
Baldwin & Sons, Inc.
610 W. Ash Street
Suite 1500
San Diego, CA 92121

W.O. 2807-35

November 13, 2013

Hunsaker & Associates
San Diego, Inc.

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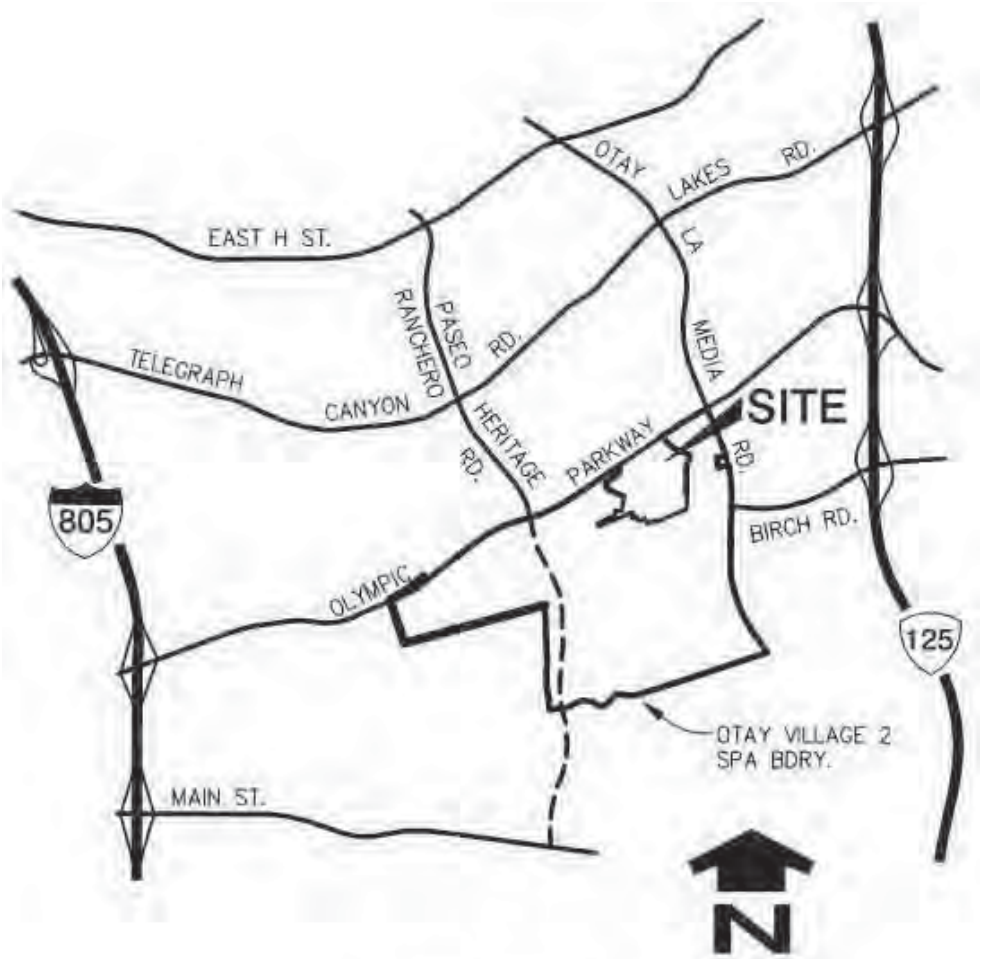
CHAPTER 1 - EXECUTIVE SUMMARY

1.1 Introduction

This Preliminary Drainage Study has been prepared to assess the pre-developed and post developed condition peak runoff rates from the proposed Otay Ranch Village 2 North project for Baldwin & Sons, Inc.

The Otay Ranch Village 2 North Tentative Map project site is located within the City of Chula Vista, south of Olympic Parkway and north of Santa Diana Road. Neighborhoods R-8a, R-8b, and R-9b are to the west and it is located immediately west of Santa Victoria Road. See Vicinity Map below. The gross subdivision acreage is 36.46 acres which will include lots for multi-family units, open spaces, a park, and two CPF sites.



VICINITY MAP

NOT TO SCALE

Refer to Chapter 4 Exhibits 1.1 and 1.2 for an overview of the existing and proposed drainage patterns of the site. The site drains towards one of two watersheds in both the pre and post developed condition. Both watersheds flow in a north or northwesterly direction and eventually confluence with flows in Poggi Canyon.

This study will evaluate the site's current condition runoff and will compare it with the expected post-developed flows. Because the areas associated with this report have previously been included in past studies which have been used to construct some of the existing storm drain infrastructure, this study will integrate some of the established and approved data and calculations. The same methodology was used on both the referenced material and the new calculations per this study.

Per County of San Diego drainage criteria, the Modified Rational Method should be used to determine peak design flow rates when the contributing drainage area is less than 1.0-square mile. Since the total watershed area discharging from the Otay Ranch Village 2 North site is less than 1.0-square mile, the AES-2003 computer software was used to model the runoff response per the Modified Rational Method.

Methodology used for the computation of design rainfall events, runoff coefficients, and rainfall intensity values are consistent with criteria set forth in the most current "San Diego County Hydrology Manual" and the "City of Chula Vista Subdivision Manual". A more detailed explanation of methodology and model development used for this analysis is listed in Chapter 2 of this report.

1.2 Summary of Pre-Developed Conditions

The Village 2 North site for this study is composed of two general watersheds. The watershed on the west side of the site is currently rough graded and slopes towards the west at a flat grade. Hydrology Map 1 located in Chapter 4 outlines the current western watershed. The western watershed values shown on the map were established by the delineated watersheds which were part of the *Rough Grading Hydrology Study for Otay Ranch Village 2 North* dated March 2, 2007. The storm drain infrastructure throughout much of the western watershed has been constructed per the calculated 'developed' flows established in the 2007 report. As such, the values obtained at the western boundary of this watershed establish the 'existing' condition peak flow limit for this watershed. For reference, Appendix A contains an excerpt from the approved 2007 report.

The eastern watershed is currently comprised of open space natural steep slopes and a rough graded pad which is a future park site. The park pad slopes towards the north at about 2% and contains a sediment basin, riser, and outlet storm drain. The park pad was originally designed as part of the *Rough Grading Hydrology Study for Otay Ranch Village 2, Phase 1* dated May 24, 2006. The storm drain from the

park pad connects to an existing system which extends both upstream and downstream of the park per the Rough Grading Plans for Otay Ranch Village 2, Phase 1. The hydrologic analysis for this watershed is included in Chapter 3. However, the upstream hydrologic model from the 2006 study was not included in this study but was accounted for in the hydrologic calculations. The hydrologic model extends downstream to coincide with the downstream point defined on the proposed condition hydrology map (Map 2 of 2). The runoff from this watershed confluences with Poggi Canyon flows.

Table 1 below summarizes the 50-year pre-development peak flows to each of the delineated watersheds. Per the City of Chula Vista Subdivision Manual, runoff coefficients of 0.30 and 0.60 were assumed for the park pad and steep vegetated slopes, respectively.

TABLE 1 - Summary of Pre-Developed Flows to Poggi Channel

Watershed Name	Drainage Area (ac)	50-Year Peak Flow (cfs)
Western	67.32	177.55
Eastern	83.26	166.35
TOTAL	**150.58**	**343.90**

Supporting calculations for the data presented in Table 1 are located in Chapter 3 and Appendix A of this report. The corresponding hydrology map is Map 1 in Chapter 4.

1.3 Summary of Developed Conditions

The Otay Ranch Village 2 North Tentative Map will consist of multi-family units, open spaces, a park, and two CPF sites. Relative to the existing condition, the park site will be extended west, a CPF site has been added within the eastern portion of the park area, the slope area along the northern portion has been moved north, and the proposed residential areas and streets within Neighborhoods R-8b and R-9b have been increased. Neighborhood R-8C was added along the northeastern slope.

As with the Pre-developed analysis discussed above, the Developed Condition for this study was separated into two watersheds. For comparison purposes, the downstream points for both the pre and post condition models were made to coincide. Please refer to the Developed Condition Hydrologic analysis in Chapter 3 and the corresponding Hydrology Map 2 in Chapter 4.

The hydrologic model for the western watershed was integrated with the downstream hydrologic model which was prepared as part of the *Rough Grading Hydrology Study for Otay Ranch Village 2 North* dated March 2, 2007. The calculated downstream value for the western watershed is as shown on Table 2 below and the Hydrology Map 2.

Similar to the existing condition hydrologic analysis, the eastern model integrated the upstream model from the approved *Rough Grading Hydrology Study for Otay Ranch Village 2, Phase 1* dated May 24, 2006. The downstream value for the eastern watershed is as shown on Table 2 below and the Hydrology Map 2

Table 2 below summarizes the 50-year post-development peak flows to each of the delineated watersheds. Runoff coefficients assumed for the proposed roads, multi-family development, single family development, CPF sites, and park sites are per the City of Chula Vista Subdivision Manual.

TABLE 2 - Summary of Developed Flows to Poggi Channel

Watershed Name	Drainage Area (ac)	50-Year Peak Flow (cfs)
Western	59.38	140.12
Eastern	84.33	185.52
Total	**143.71**	**325.64**

Supporting calculations for the data presented in Table 2 is located in Chapter 3 of this report. The corresponding hydrology map is Exhibit 1.2 in Chapter 4.

The downstream end of the western watershed ties in to the existing storm drain which connects to the Heritage Road storm drain. This storm drain outlets into Poggi Canyon at the southwestern corner of the Heritage Road-Olympic Parkway intersection. The water quality treatment of runoff from the western watershed is being accomplished via vortechnic-stormfilter treatment units located upstream of the outlet into Poggi Canyon at Heritage Road. The newly permitted areas of Village 2 North per this TM study will include additional water quality measures. Please refer to the *Water Quality Technical Report for Village 2 North TM* (November 2013) for additional information.

The downstream end of the eastern watershed outlets immediately upstream of its confluence with Poggi Canyon northwest of the Otay Ranch High School. A headwall and rip rap will be included to reduce velocities at the outlet. A vortechnic-stormfilter treatment train has been approved per the Otay Ranch Village 2 Phase 1 Grading Plans to treat the developed areas upstream of the outlet excluding the flows from Neighborhood R-8C. The units will be located approximately 775’ west of Santa Victoria Road. Water quality treatment for Neighborhood R-8C will be

accomplished with a bioretention basin located at the bottom of the constructed slope south of Poggi Canyon. The additional areas in the eastern watershed relative to the approved Otay Ranch Village 2 Phase 1 Grading Plans will need to address any additional water quality and hydromodification measures to comply with current City of Chula Vista SUSMP and HMP requirements. These areas include the park and the CPF site. Please refer to the *Water Quality Technical Report for Village 2 North TM* (November 2013) for additional information.

1.4 Results & Recommendations

Table 3 summarizes the cumulative effects of site development.

TABLE 3 - Summary of Pre vs. Post-Developed Condition Flows to Otay River

	Pre-Developed		Post-Developed		Difference	
Watershed Name	**Drainage Area (ac)**	**50-Year Peak Flow (cfs)**	**Drainage Area (ac)**	**50-Year Peak Flow (cfs)**	**Drainage Area (ac)**	**50-Year Peak Flow (cfs)**
Western	67.32*	177.55	59.38	140.12	7.94	37.43
Eastern	83.26	166.35	84.33	185.52	-1.07	19.17
Total	**150.58***	**343.90**	**143.71**	**325.64**	**-6.87**	**-18.26**

* -Includes double-counted acreage within the eastern portion of the western watershed.

The table above shows a reduction of area and anticipated runoff when both watersheds are summed up. The discrepancy in acreage can be attributed to the values used for the existing condition hydrology scenario for the western watershed. This scenario and model which is included in Appendix A was a conservative 'Ultimate' build out design. This was necessary in order to adequately design the downstream storm drain infrastructure. Therefore, the pre-developed figures in the table above double-count acreage on the eastern side of the western watershed.

The existing storm drain infrastructure within the western watershed was constructed based on an 'Ultimate' build out scenario which included the areas per this TM study. Therefore, the existing storm drain system within the western watershed will adequately convey the proposed developed flows per this TM. The revised flows for the eastern watershed will also not adversely affect the existing storm drain system since the changes proposed with this TM will be minor and will occur at the downstream end of the existing storm drain system which currently has available capacity. Neighborhood R-8C will include storm drain and inlets to capture and convey runoff north towards the proposed water quality basin and then into Poggi Canyon.

The Otay Ranch Village 2 development was included in the *Master Drainage Study for Otay Ranch Village 2, 3, & 4* prepared by Hunsaker & Associates in 2005. This

study assessed the development of the overall Village 2 Master Plan and designed the Poggi Canyon Detention Facility to maintain developed peak flowrates below the pre-developed amount. This basin, which is located approximately one mile downstream of the study area, has been constructed and attenuates peak flows from the Village 2 North TM project area. The predeveloped Q100 inflow to the detention basin was determined to be 1,320 cfs. Peak flow attenuation performed by the detention basin will decrease basin (Q100) inflows from 2,295 cfs to 1,115 cfs which is less than the pre-developed condition. Therefore, Poggi Canyon Channel will be able to handle the expected developed flows.

This project will be designed in accordance to water quality standards or waste discharge requirements. Storm water treatment design is further discussed in the *Water Quality Technical Report for Otay Ranch Village 2 North TM (November* 2013*)*.

Summary:

- Drainage facilities within Village 2 North will be designed in accordance with the requirements of the Chula Vista Subdivision Manual, the San Diego County Hydrology Manual and the requirements of the San Diego Regional Water Quality Control Board.

- Peak discharge flows produced by the development of the site will be attenuated to below pre-developed conditions via the existing Poggi Canyon Detention Basin as previously determined by the approved *Master Drainage Study for Otay Ranch Village 2, 3, & 4* (2005).

- Development of the project site will not degrade potential beneficial uses of downstream water bodies as designated by the Regional Water Quality Control Board, including water bodies listed on the Clean Water Section 303d list.

- Onsite and offsite drainage easements shall be provided to the satisfaction of the Director of Public Works.

References

City of Chula Vista Subdivision Manual; Engineering Department and Land Development; Section 3, 2011.

San Diego County Hydrology Manual; County of San Diego Department of Public Works Flood Control Division, June 2003

Master Drainage Study for Otay Ranch Village 2, 3, & 4 prepared by Hunsaker & Associates, July 14, 2005.

Hydromodification Management Plan prepared for County of San Diego, California, March 2011

"Order No. R9-2007-0001, NPDES No. CAS0108758 – Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, San Diego Unified Port District and the San Diego County Regional Airport Authority", California Regional Water Quality Control Board – San Diego Region; January 24, 2007.

Rough Grading Hydrology Study for Otay Ranch Village 2, Phase 1 prepared by Hunsaker & Associates, May 24, 2006.

Rough Grading Hydrology Study for Otay Ranch Village 2 North prepared by Hunsaker & Associates, March 2, 2007.

Water Quality Technical Report for Village 2 North TM prepared by Hunsaker & Associates, November 2013.

CHAPTER 2 - METHODOLOGY

2.1 - Rational Method Model Development Summary

Computer Software Package – AES-2010

Design Storm – 50-Year Return Interval

Land Use – Multi Family, Single Family, Community Purpose Facilities, a Park and Open Space

Soil Type - Hydrologic soil group D was assumed for all areas. Group D soils have very slow infiltration rates when thoroughly wetted. Consisting chiefly of clay soils with a high swelling potential, soils with a high permanent water table, soils with clay pan or clay layer at or near the surface, and shallow soils over nearly impervious materials, Group D soils have a very slow rate of water transmission.

Runoff Coefficient – In accordance with the City of Chula Vista Subdivision Manual, a runoff coefficient of 0.90 was used for fully paved areas, 0.85 for the Industrial/Commercial Sites, 0.75 for the Multi-Family Sites and dense residential, 0.65 for the Single-Family pads, 0.35 for proposed open space, and 0.30 for parks.

Method of Analysis – The Rational Method is the most widely used hydrologic model for estimating peak runoff rates. Applied to small urban and semi-urban areas with drainage areas less than 1.0 square mile, the Rational Method relates storm rainfall intensity, a runoff coefficient, and drainage area to peak runoff rate. This relationship is expressed by the equation:

Q = CIA, where:

Q = The peak runoff rate in cubic feet per second at the point of analysis.

C = A runoff coefficient representing the area - averaged ratio of runoff to rainfall intensity.

I = The time-averaged rainfall intensity in inches per hour corresponding to the time of concentration.

A = The drainage basin area in acres.

To perform a node-link study, the total watershed area is divided into subareas which discharge at designated nodes.

The procedure for the subarea summation model is as follows:

(1) Subdivide the watershed into an initial subarea (generally 1 lot) and subsequent subareas, which are generally less than 10 acres in size. Assign upstream and downstream node numbers to each subarea.

(2) Estimate an initial T_c by using the appropriate nomograph or overland flow velocity estimation.

(3) Using the initial T_c, determine the corresponding values of I. Then Q = C I A.

(4) Using Q, estimate the travel time between this node and the next by Manning's equation as applied to the particular channel or conduit linking the two nodes. Then, repeat the calculation for Q based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES-2010 computer subarea menu is as follows:

SUBAREA HYDROLOGIC PROCESS

1. Confluence analysis at node.
2. Initial subarea analysis (including time of concentration calculation).
3. Pipeflow travel time (computer estimated).
4. Pipeflow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through subarea.
7. User - specified information at node.
8. Addition of subarea runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

$$Q_p = Q_a + Q_b;\ T_p = T_a = T_b$$

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by the ratio of rainfall intensities.

$Q_p = Q_a + Q_b \ (I_a/I_b)$; $T_p = T_a$

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

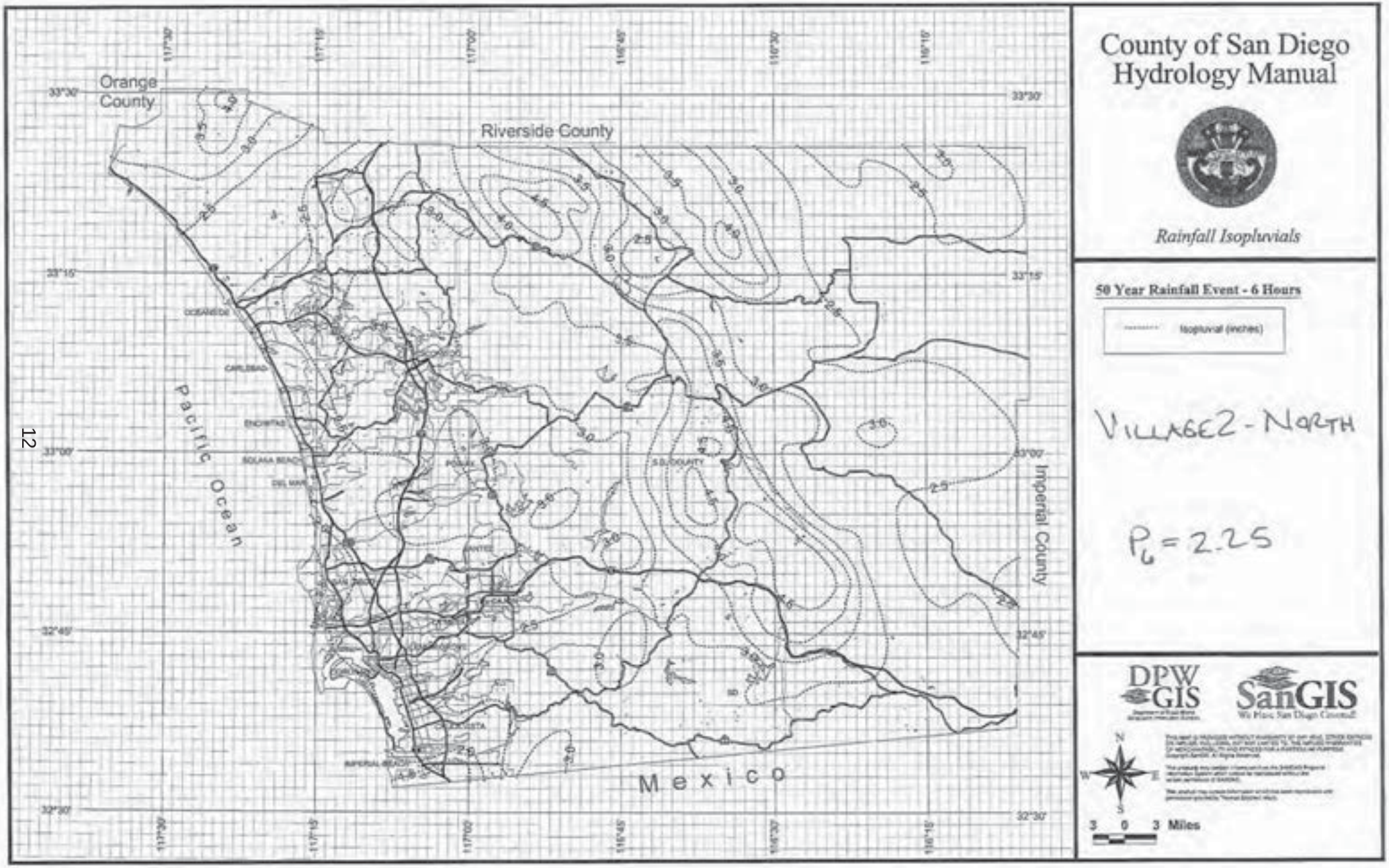
$Q_p = Q_b + Q_a \ (T_b/T_a)$; $T_p = T_b$

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.2 – Design Rainfall Determination

100-Year, 6-Hour and 50-Year, 6-Hour Rainfall Isopluvial Maps from San Diego County Hydrology Manual


County of San Diego
Hydrology Manual
Rainfall Isopluvials
50 Year Rainfall Event - 6 Hours
Isopluvial (inches)
VILLAGE2 - NORTH
$P_6 = 2.25$
Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico
DPW GIS
SanGIS
3 0 3 Miles

County of San Diego
Hydrology Manual
Rainfall Isopluvials
50 Year Rainfall Event - 24 Hours
Isopluvial (inches)
Village 2-NORTH
P_{24}=3.7
Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico
OCEANSIDE
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
33°30'
33°15'
33°00'
32°45'
32°30'
117°30'
117°15'
117°00'
116°45'
116°30'
116°15'
DPW GIS
SanGIS
We Have San Diego Covered!
N
S
E
W
3 0 3 Miles

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.3 – Runoff Coefficient Determination

3-203.1 **Previously Approved Reports** - Runoff quantities, as set forth or derived from the report prepared by Lawrence, Fogg, Florer and Smith titled "A Special Study of Storm Drain Facilities" on file in the office of the City Engineer may be used in the design of drainage facilities in Chula Vista. A hydrologic study prepared and approved at General Development Plan (GDP) or Specific Planning Area (SPA) plan may be used as determined by the City Engineer.

3-203.2 For local drainage basins, storm discharge flow may be estimated based on the Rational Method or the Modified Rational Method. For all lateral and major drainage basins the SCS method, U.S. Army Corps of Engineers HEC-1 computer method or other tabular or computer method may be used upon City Engineer approval.

3-203.3 **Rational and Modified Rational Methods**

(1) The rational method equation relates storm rainfall intensity (I), a selected runoff coefficient (C) and drainage area (A) to the peak runoff rate (Q):

$$Q = CIA \text{ (Empirical Units)}$$

where:

Q = Peak runoff in cubic feet per second
C = Runoff coefficient
I = Intensity, inches per hours
A = Drainage basin area in acres

Or

$$Q = 0.278CIA \text{ (Metric Units)}$$

where:

Q = Peak runoff in cubic meters per second
C = Runoff coefficient
I = Intensity in millimeters per second
A = Drainage area in square kilometers

(2) Coefficient of Runoff: Consider probable development. Use highest number of the following values:

a)	Paved Surface	0.90
b)	Commercial Area	0.85
c)	Dense Residential (R2, R3)	0.75
d)	Normal Residential (R1)	0.65
e)	Suburban Property (RE)	0.55
f)	Barren Slopes Steep	0.80
g)	Barren Slopes Hilly	0.75
h)	" " Rolling	0.70
i)	" " Flat	0.65
j)	Vegetated Slopes Steep	0.60
k)	" " Hilly	0.55
l)	" " Rolling	0.50
m)	" " Flat	0.45

n)	Farm Land	0.35
o)	Parks, Golf Courses	0.30

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

-Maximum Overland Flow Length & Initial Time of Concentration

-Urban Watershed Overland Time of Flow Nomograph

-Gutter & Roadway Discharge-Velocity Chart

- Manning's Equation Nomograph

-Intensity-Duration Design Chart

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.

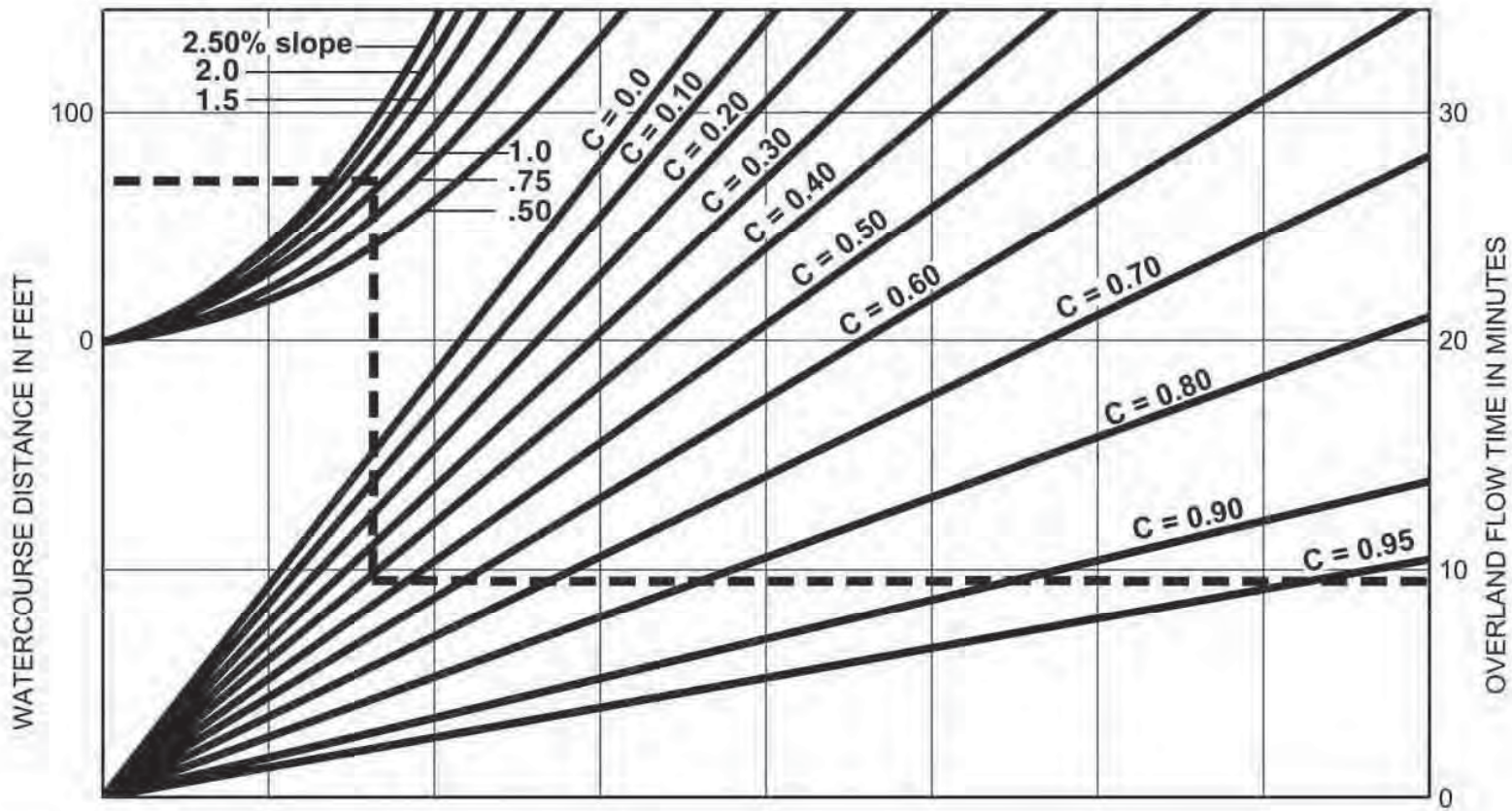
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved 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/	.5%		1%		2%		3%		5%		10%	
	Acre	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



EXAMPLE:

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

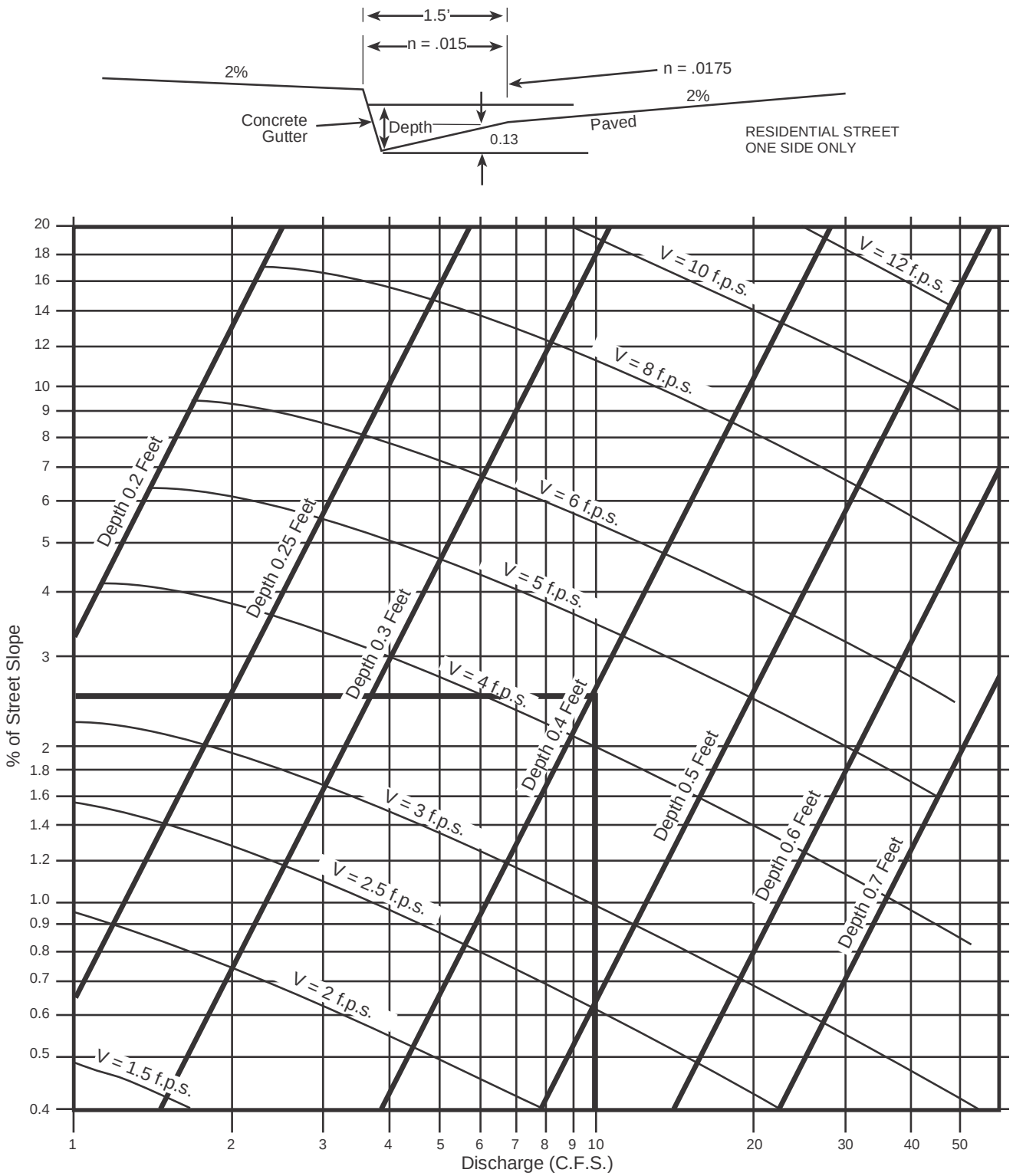
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

Rational Formula - Overland Time of Flow Nomograph

3-3



EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

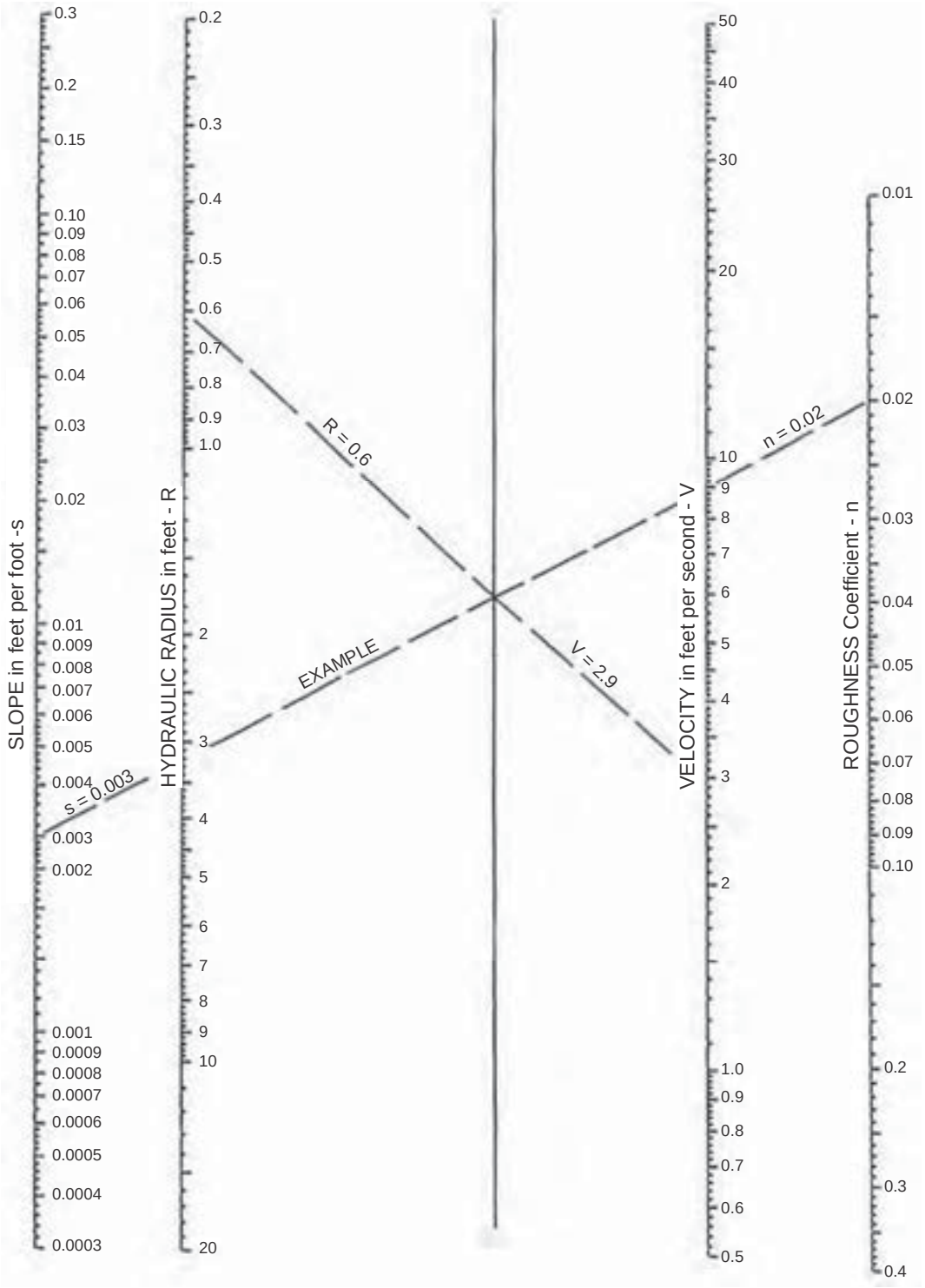
SOURCE: San Diego County Department of Special District Services Design Manual

FIGURE

Gutter and Roadway Discharge - Velocity Chart

3-6

EQUATION: $V = \frac{1.49}{n} R^{2/3} s^{1/2}$



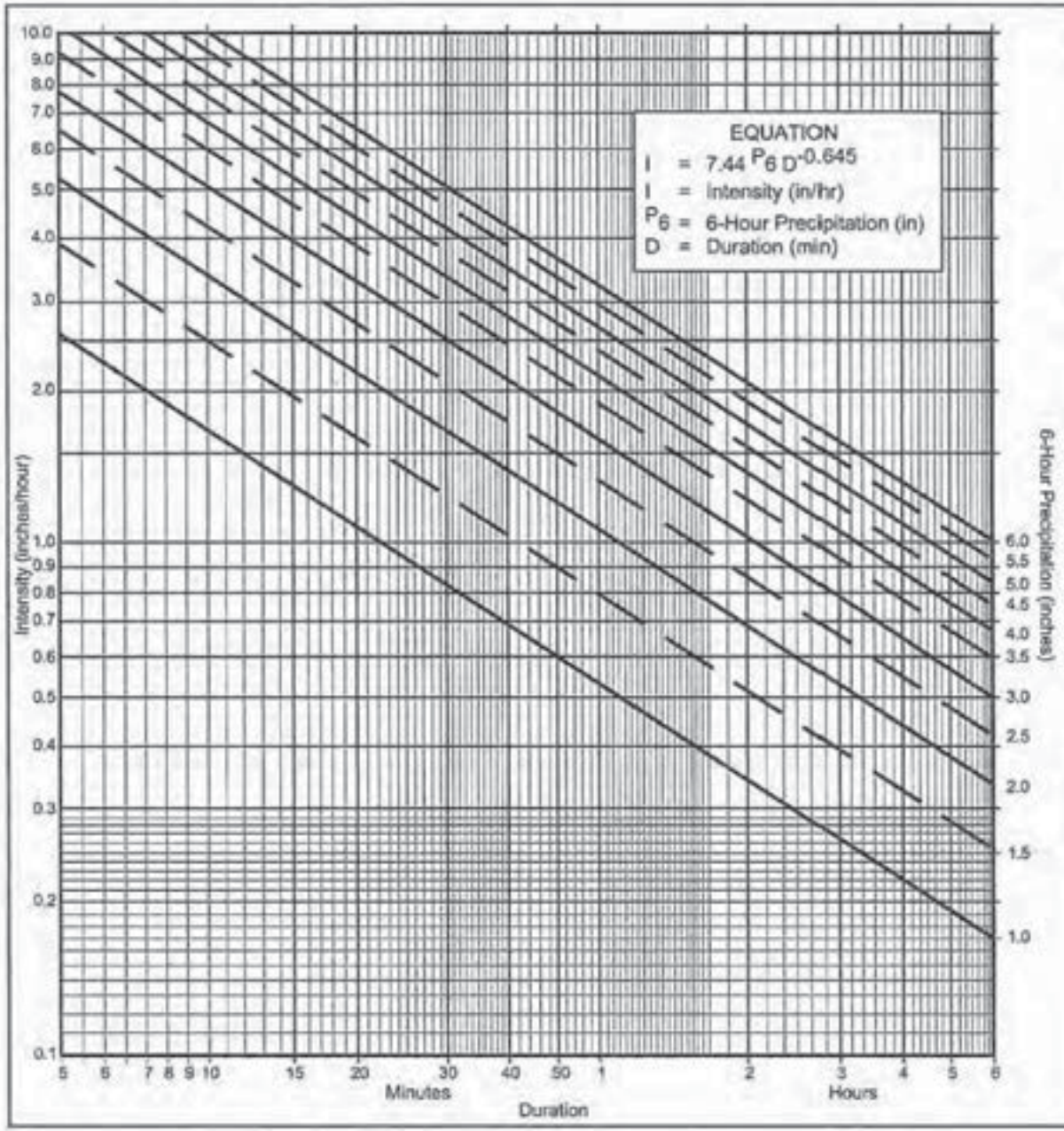
SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

Manning's Equation Nomograph

3-7

VILLAGE 2 - NORTH



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 50 year

(b) P_6 = 2.25 in., P_{24} = 3.7 , $\frac{P_6}{P_{24}}$ = 61 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.25 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

CHAPTER 3

HYDROLOGIC ANALYSIS

3.1 – 50-Year Pre-Developed Condition AES Model Output

Refer to Appendix A for Existing Condition hydrology for Residential Areas.

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                    Hunsaker & Associates San Diego, Inc.
                              9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch Village 2 North TM                                            *
* 50-year return interval hydrology model.  EXISTING CONDITION             *
* W.O. 2807-35   DLN: 1089                                                 *
 ****************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\N\EX50.DAT
  TIME/DATE OF STUDY: 09:04 02/21/2013
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  50.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   17.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  3   20.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  4   16.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  5   26.0     18.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  6   44.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    900.00 TO NODE    901.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .3000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    479.70
  DOWNSTREAM ELEVATION(FEET) =    478.00
  ELEVATION DIFFERENCE(FEET) =      1.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.223
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.821
  SUBAREA RUNOFF(CFS) =      0.34
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.34

****************************************************************************
  FLOW PROCESS FROM NODE    901.00 TO NODE    902.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   476.00  DOWNSTREAM(FEET) =   470.00
  FLOW LENGTH(FEET) =   590.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.67
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.34
  PIPE TRAVEL TIME(MIN.) =   3.68    Tc(MIN.) =   13.91
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    902.00 =     675.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    901.00 TO NODE    902.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.133
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .3000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =    6.35   SUBAREA RUNOFF(CFS) =    5.97
  TOTAL AREA(ACRES) =        6.7   TOTAL RUNOFF(CFS) =       6.25
  TC(MIN.) =   13.91

****************************************************************************
  FLOW PROCESS FROM NODE    902.00 TO NODE    908.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   465.00  DOWNSTREAM(FEET) =   440.00
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.25
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   13.96
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    908.00 =     750.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    908.00 TO NODE    908.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.96
  RAINFALL INTENSITY(INCH/HR) =   3.12
  TOTAL STREAM AREA(ACRES) =     6.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.25

****************************************************************************
  FLOW PROCESS FROM NODE    908.00 TO NODE    908.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  12.17   RAIN INTENSITY(INCH/HOUR) =  3.41
  TOTAL AREA(ACRES) =    57.50   TOTAL RUNOFF(CFS) =    138.61

****************************************************************************
  FLOW PROCESS FROM NODE    908.00 TO NODE    908.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.17
  RAINFALL INTENSITY(INCH/HR) =   3.41
  TOTAL STREAM AREA(ACRES) =    57.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    138.61
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.25    13.96        3.124          6.65
      2      138.61    12.17        3.414         57.50

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      144.06    12.17       3.414
      2      133.10    13.96       3.124

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     144.06   Tc(MIN.) =   12.17
  TOTAL AREA(ACRES) =       64.2
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    908.00 =     750.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    908.00 TO NODE    920.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   404.00
  FLOW LENGTH(FEET) =   864.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.81
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     144.06
  PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =   12.83
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    920.00 =    1614.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    917.00 TO NODE    917.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.83
  RAINFALL INTENSITY(INCH/HR) =   3.30
  TOTAL STREAM AREA(ACRES) =    64.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    144.06

****************************************************************************
  FLOW PROCESS FROM NODE    915.00 TO NODE    916.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    454.00
  DOWNSTREAM ELEVATION(FEET) =    444.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.51
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.51

****************************************************************************
  FLOW PROCESS FROM NODE    916.00 TO NODE    917.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   444.00  DOWNSTREAM(FEET) =   404.00
  FLOW LENGTH(FEET) =   864.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.9 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.08
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.51
  PIPE TRAVEL TIME(MIN.) =   2.84    Tc(MIN.) =    7.01
  LONGEST FLOWPATH FROM NODE    915.00 TO NODE    917.00 =     964.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    916.00 TO NODE    917.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.872
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    4.50   SUBAREA RUNOFF(CFS) =   13.15
  TOTAL AREA(ACRES) =        4.6   TOTAL RUNOFF(CFS) =      13.56
  TC(MIN.) =    7.01

****************************************************************************
  FLOW PROCESS FROM NODE    917.00 TO NODE    917.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.01
  RAINFALL INTENSITY(INCH/HR) =   4.87
  TOTAL STREAM AREA(ACRES) =     4.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.56

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      144.06    12.83        3.300         64.15
      2       13.56     7.01        4.872          4.64

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      111.14     7.01       4.872
      2      153.24    12.83       3.300

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     153.24   Tc(MIN.) =   12.83
  TOTAL AREA(ACRES) =       68.8
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    917.00 =    1614.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    917.00 TO NODE    918.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   404.00  DOWNSTREAM(FEET) =   386.00
  FLOW LENGTH(FEET) =   768.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.92
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     153.24
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =   13.54
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    918.00 =    2382.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    917.00 TO NODE    918.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.187
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6544
```

```
  SUBAREA AREA(ACRES) =    6.64   SUBAREA RUNOFF(CFS) =   12.70
  TOTAL AREA(ACRES) =       75.4   TOTAL RUNOFF(CFS) =     157.29
  TC(MIN.) =   13.54

****************************************************************************
  FLOW PROCESS FROM NODE    918.00 TO NODE    919.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   386.00  DOWNSTREAM(FEET) =   372.00
  FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.49
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     157.29
  PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =   14.05
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    919.00 =    2942.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    918.00 TO NODE    919.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.112
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6508
  SUBAREA AREA(ACRES) =    5.34   SUBAREA RUNOFF(CFS) =    9.97
  TOTAL AREA(ACRES) =       80.8   TOTAL RUNOFF(CFS) =     163.59
  TC(MIN.) =   14.05

****************************************************************************
  FLOW PROCESS FROM NODE    919.00 TO NODE    920.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   372.00  DOWNSTREAM(FEET) =   368.00
  FLOW LENGTH(FEET) =   238.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  36.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.96
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     163.59
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   14.30
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    920.00 =    3180.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    919.00 TO NODE    920.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.077
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6493
  SUBAREA AREA(ACRES) =    2.49   SUBAREA RUNOFF(CFS) =    4.60
  TOTAL AREA(ACRES) =       83.3   TOTAL RUNOFF(CFS) =     166.35
  TC(MIN.) =   14.30
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       83.3  TC(MIN.) =     14.30
  PEAK FLOW RATE(CFS)   =     166.35
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 3

HYDROLOGIC ANALYSIS

3.2 – 50-Year Developed Condition AES Model Output

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                    Hunsaker & Associates San Diego, Inc.
                              9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch Village 2 North TM                                            *
* 50 -year return interval hydrology model.                                *
* W.O. 2807-35   DLN: 1089                                                 *
 ****************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\N\RG50I.DAT
  TIME/DATE OF STUDY: 17:42 02/22/2013
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  50.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   17.0      8.5    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0160
  2   29.0     14.5    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    483.65
  DOWNSTREAM ELEVATION(FEET) =    483.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
```

```
============================================================================
  UPSTREAM ELEVATION(FEET) =  481.50  DOWNSTREAM ELEVATION(FEET) =  475.00
  STREET LENGTH(FEET) =   655.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.48
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.79
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.95
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.59
  STREET FLOW TRAVEL TIME(MIN.) =   5.59   Tc(MIN.) =   10.67
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.716
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.05      SUBAREA RUNOFF(CFS) =    5.71
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       6.05

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.14
  FLOW VELOCITY(FEET/SEC.) =  2.22   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.67
  RAINFALL INTENSITY(INCH/HR) =   3.72
  TOTAL STREAM AREA(ACRES) =     2.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.05

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   133.00
  UPSTREAM ELEVATION(FEET) =    477.00
  DOWNSTREAM ELEVATION(FEET) =    475.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.287
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.04
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.72
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
  FLOW PROCESS FROM NODE    606.00 TO NODE    603.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =    3.29
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =     0.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.72

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.05    10.67        3.716          2.17
      2        0.72     3.29        6.060          0.14

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        2.58     3.29       6.060
      2        6.49    10.67       3.716

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.49   Tc(MIN.) =   10.67
  TOTAL AREA(ACRES) =        2.3
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    603.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    607.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   470.00  DOWNSTREAM(FEET) =   468.00
  FLOW LENGTH(FEET) =   297.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.25
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.49
  PIPE TRAVEL TIME(MIN.) =   0.94    Tc(MIN.) =   11.62
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =    1017.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    607.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.62
  RAINFALL INTENSITY(INCH/HR) =   3.52
  TOTAL STREAM AREA(ACRES) =     2.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.49

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    609.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   197.00
  UPSTREAM ELEVATION(FEET) =    476.00
  DOWNSTREAM ELEVATION(FEET) =    473.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.338
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.84
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.82
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.82

****************************************************************************
  FLOW PROCESS FROM NODE    609.00 TO NODE    607.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.34
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =     0.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.82

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    611.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    482.70
  DOWNSTREAM ELEVATION(FEET) =    482.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.955
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.64
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.64

****************************************************************************
  FLOW PROCESS FROM NODE    611.00 TO NODE    612.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  480.50  DOWNSTREAM ELEVATION(FEET) =  473.00
  STREET LENGTH(FEET) =   577.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.11
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.25
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.69
  STREET FLOW TRAVEL TIME(MIN.) =   4.26   Tc(MIN.) =    9.22
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.084
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.22      SUBAREA RUNOFF(CFS) =    6.80
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       7.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.36
  FLOW VELOCITY(FEET/SEC.) =  2.57   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    610.00 TO NODE    612.00 =     642.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    612.00 TO NODE    607.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.22
```

```
  RAINFALL INTENSITY(INCH/HR) =   4.08
  TOTAL STREAM AREA(ACRES) =     2.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.23

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.49    11.62        3.519         2.31
      2        0.82     3.34        6.060         0.16
      3        7.23     9.22        4.084         2.36

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        7.21     3.34       6.060
      2       13.38     9.22       4.084
      3       13.20    11.62       3.519

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.38   Tc(MIN.) =    9.22
  TOTAL AREA(ACRES) =        4.8
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =    1017.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    613.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   468.00  DOWNSTREAM(FEET) =   467.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.88
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.38
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    9.33
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    613.00 =    1077.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    613.00 TO NODE    618.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   467.00  DOWNSTREAM(FEET) =   466.00
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.03
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.38
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    9.40
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    618.00 =    1119.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    618.00 TO NODE    623.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   467.00  DOWNSTREAM(FEET) =   464.00
  FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.61
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.38
  PIPE TRAVEL TIME(MIN.) =   0.93    Tc(MIN.) =   10.33
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    623.00 =    1486.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    623.00 TO NODE    623.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.33
  RAINFALL INTENSITY(INCH/HR) =   3.80
  TOTAL STREAM AREA(ACRES) =     4.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.38

****************************************************************************
  FLOW PROCESS FROM NODE    625.00 TO NODE    626.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    475.70
  DOWNSTREAM ELEVATION(FEET) =    475.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.21
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      1.21

****************************************************************************
  FLOW PROCESS FROM NODE    626.00 TO NODE    627.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  472.75  DOWNSTREAM ELEVATION(FEET) =  468.90
  STREET LENGTH(FEET) =   355.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.95
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.20
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.46
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.91
  STREET FLOW TRAVEL TIME(MIN.) =   2.40   Tc(MIN.) =    7.48
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.672
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.55      SUBAREA RUNOFF(CFS) =    5.43
  TOTAL AREA(ACRES) =        1.8        PEAK FLOW RATE(CFS) =       6.38

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.80
  FLOW VELOCITY(FEET/SEC.) =  2.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.17
  LONGEST FLOWPATH FROM NODE    625.00 TO NODE    627.00 =     425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    627.00 TO NODE    623.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.48
  RAINFALL INTENSITY(INCH/HR) =   4.67
```

```
  TOTAL STREAM AREA(ACRES) =     1.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.38

****************************************************************************
  FLOW PROCESS FROM NODE    630.00 TO NODE    631.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    473.00
  DOWNSTREAM ELEVATION(FEET) =    472.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
  FLOW PROCESS FROM NODE    631.00 TO NODE    632.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  472.00  DOWNSTREAM ELEVATION(FEET) =  469.00
  STREET LENGTH(FEET) =   343.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.75
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.04
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.87
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.57
  STREET FLOW TRAVEL TIME(MIN.) =   3.06   Tc(MIN.) =    8.14
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.426
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.72      SUBAREA RUNOFF(CFS) =    2.39
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       2.79

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.07
  FLOW VELOCITY(FEET/SEC.) =  2.07   DEPTH*VELOCITY(FT*FT/SEC.) =   0.72
  LONGEST FLOWPATH FROM NODE    630.00 TO NODE    632.00 =     408.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    632.00 TO NODE    623.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.14
  RAINFALL INTENSITY(INCH/HR) =   4.43
  TOTAL STREAM AREA(ACRES) =     0.84
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.79
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       13.38    10.33        3.795          4.83
      2        6.38     7.48        4.672          1.82
      3        2.79     8.14        4.426          0.84

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       19.81     7.48       4.672
      2       20.30     8.14       4.426
      3       20.95    10.33       3.795

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.95   Tc(MIN.) =   10.33
  TOTAL AREA(ACRES) =        7.5
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    623.00 =    1486.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    623.00 TO NODE    633.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   464.00  DOWNSTREAM(FEET) =   460.00
  FLOW LENGTH(FEET) =   371.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.26
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.95
  PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =   11.08
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    633.00 =    1857.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.08
  RAINFALL INTENSITY(INCH/HR) =   3.63
  TOTAL STREAM AREA(ACRES) =     7.49
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     20.95

****************************************************************************
  FLOW PROCESS FROM NODE    635.00 TO NODE    636.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    470.00
  DOWNSTREAM ELEVATION(FEET) =    469.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.63
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.63

****************************************************************************
  FLOW PROCESS FROM NODE    636.00 TO NODE    637.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
```

```
  UPSTREAM ELEVATION(FEET) =  469.00  DOWNSTREAM ELEVATION(FEET) =  464.80
  STREET LENGTH(FEET) =   375.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.32
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.67
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.20
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
  STREET FLOW TRAVEL TIME(MIN.) =   2.84   Tc(MIN.) =    7.92
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.506
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.99      SUBAREA RUNOFF(CFS) =    3.35
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       3.82

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.99
  FLOW VELOCITY(FEET/SEC.) =  2.46   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
  LONGEST FLOWPATH FROM NODE    635.00 TO NODE    637.00 =     445.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    637.00 TO NODE    633.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.92
  RAINFALL INTENSITY(INCH/HR) =   4.51
  TOTAL STREAM AREA(ACRES) =     1.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.82

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       20.95    11.08        3.628          7.49
      2        3.82     7.92        4.506          1.13

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       20.68     7.92       4.506
      2       24.02    11.08       3.628

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      24.02   Tc(MIN.) =   11.08
  TOTAL AREA(ACRES) =        8.6
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    633.00 =    1857.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    640.00 TO NODE    641.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    475.65
  DOWNSTREAM ELEVATION(FEET) =    475.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.85
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.85

******************************************************************************
  FLOW PROCESS FROM NODE    641.00 TO NODE    642.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  474.50  DOWNSTREAM ELEVATION(FEET) =  468.00
  STREET LENGTH(FEET) =   690.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.52
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.68
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.78
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.50
  STREET FLOW TRAVEL TIME(MIN.) =   6.47   Tc(MIN.) =   11.55
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.531
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.22      SUBAREA RUNOFF(CFS) =    3.23
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       3.73

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.18
  FLOW VELOCITY(FEET/SEC.) =  1.94   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    642.00 =     755.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    642.00 TO NODE    643.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   462.00  DOWNSTREAM(FEET) =   461.00
  FLOW LENGTH(FEET) =   148.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.62
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.73
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =   12.08
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    643.00 =     903.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    643.00 TO NODE    643.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.08
  RAINFALL INTENSITY(INCH/HR) =   3.43
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.73

******************************************************************************
  FLOW PROCESS FROM NODE    644.00 TO NODE    645.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    474.65
  DOWNSTREAM ELEVATION(FEET) =    474.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.94
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.94

******************************************************************************
  FLOW PROCESS FROM NODE    645.00 TO NODE    646.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  473.50  DOWNSTREAM ELEVATION(FEET) =  467.00
  STREET LENGTH(FEET) =   621.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.03
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.27
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
  STREET FLOW TRAVEL TIME(MIN.) =   4.57   Tc(MIN.) =    9.65
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.966
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.37      SUBAREA RUNOFF(CFS) =    4.08
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       4.70

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.22
  FLOW VELOCITY(FEET/SEC.) =  2.52   DEPTH*VELOCITY(FT*FT/SEC.) =   0.98
  LONGEST FLOWPATH FROM NODE    644.00 TO NODE    646.00 =     686.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    646.00 TO NODE    643.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =    9.65
  RAINFALL INTENSITY(INCH/HR) =   3.97
  TOTAL STREAM AREA(ACRES) =     1.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.70

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.73    12.08        3.430          1.41
      2        4.70     9.65        3.966          1.58

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        7.68     9.65       3.966
      2        7.80    12.08       3.430

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.80   Tc(MIN.) =   12.08
  TOTAL AREA(ACRES) =        3.0
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    643.00 =     903.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    643.00 TO NODE    647.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   462.00  DOWNSTREAM(FEET) =   461.00
  FLOW LENGTH(FEET) =    93.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.56
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.80
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =   12.32
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    647.00 =     996.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    647.00 TO NODE    647.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.32
  RAINFALL INTENSITY(INCH/HR) =   3.39
  TOTAL STREAM AREA(ACRES) =     2.99
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.80

****************************************************************************
  FLOW PROCESS FROM NODE    650.00 TO NODE    651.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    474.65
  DOWNSTREAM ELEVATION(FEET) =    474.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.72
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
  FLOW PROCESS FROM NODE    651.00 TO NODE    652.00 IS CODE =  61
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  474.00  DOWNSTREAM ELEVATION(FEET) =  466.00
  STREET LENGTH(FEET) =   760.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.59
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.20
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
  STREET FLOW TRAVEL TIME(MIN.) =   5.75   Tc(MIN.) =   10.83
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.682
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.32      SUBAREA RUNOFF(CFS) =    3.64
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       4.09

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.47
  FLOW VELOCITY(FEET/SEC.) =  2.44   DEPTH*VELOCITY(FT*FT/SEC.) =   0.92
  LONGEST FLOWPATH FROM NODE    650.00 TO NODE    652.00 =     825.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    652.00 TO NODE    647.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.83
  RAINFALL INTENSITY(INCH/HR) =   3.68
  TOTAL STREAM AREA(ACRES) =     1.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.09

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        7.80    12.32        3.387          2.99
      2        4.09    10.83        3.682          1.48

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       11.26    10.83       3.682
      2       11.56    12.32       3.387

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      11.56   Tc(MIN.) =   12.32
  TOTAL AREA(ACRES) =        4.5
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    647.00 =     996.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    647.00 TO NODE    653.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   462.00  DOWNSTREAM(FEET) =   461.00
```

```
  FLOW LENGTH(FEET) =   113.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.70
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.56
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   12.60
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    653.00 =    1109.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    653.00 TO NODE    653.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.60
  RAINFALL INTENSITY(INCH/HR) =   3.34
  TOTAL STREAM AREA(ACRES) =     4.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.56

****************************************************************************
  FLOW PROCESS FROM NODE    655.00 TO NODE    656.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    473.65
  DOWNSTREAM ELEVATION(FEET) =    473.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.81
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.81

****************************************************************************
  FLOW PROCESS FROM NODE    656.00 TO NODE    657.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  473.00  DOWNSTREAM ELEVATION(FEET) =  463.00
  STREET LENGTH(FEET) =   735.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 10.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.69
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.40
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.66
  STREET FLOW TRAVEL TIME(MIN.) =   5.46   Tc(MIN.) =   10.54
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.745
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.00      SUBAREA RUNOFF(CFS) =    5.62
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       6.12

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.00
  FLOW VELOCITY(FEET/SEC.) =  2.56   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    655.00 TO NODE    657.00 =     800.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    657.00 TO NODE    653.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.54
  RAINFALL INTENSITY(INCH/HR) =   3.75
  TOTAL STREAM AREA(ACRES) =     2.18
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.12

****************************************************************************
  FLOW PROCESS FROM NODE    660.00 TO NODE    661.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   192.00
  UPSTREAM ELEVATION(FEET) =    467.00
  DOWNSTREAM ELEVATION(FEET) =    463.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.068
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    75.83
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.88
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE    661.00 TO NODE    653.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.07
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =     0.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       11.56    12.60        3.338         4.47
      2        6.12    10.54        3.745         2.18
      3        0.88     3.07        6.060         0.17

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        9.02     3.07       6.060
      2       16.97    10.54       3.745
      3       17.50    12.60       3.338

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.50   Tc(MIN.) =   12.60
  TOTAL AREA(ACRES) =        6.8
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    653.00 =    1109.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    653.00 TO NODE    633.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   459.00  DOWNSTREAM(FEET) =   458.00
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.03
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.50
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   12.72
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    633.00 =    1174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       17.50    12.72       3.318        6.82
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    633.00 =    1174.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       24.02    11.08       3.628        8.62
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    633.00 =    1857.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      39.26      11.08        3.628
      2      39.47      12.72        3.318

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      39.47   Tc(MIN.) =   12.72
  TOTAL AREA(ACRES) =       15.4

****************************************************************************
  FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    633.00 TO NODE    664.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   458.00  DOWNSTREAM(FEET) =   453.00
  FLOW LENGTH(FEET) =   559.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.14
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      39.47
  PIPE TRAVEL TIME(MIN.) =   1.02    Tc(MIN.) =   13.74
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    664.00 =    2416.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    664.00 TO NODE    664.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    670.00 TO NODE    671.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
```

```
  UPSTREAM ELEVATION(FEET) =    468.65
  DOWNSTREAM ELEVATION(FEET) =    468.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.90
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.90

****************************************************************************
  FLOW PROCESS FROM NODE    671.00 TO NODE    672.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  467.50  DOWNSTREAM ELEVATION(FEET) =  461.00
  STREET LENGTH(FEET) =   475.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.17
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.51
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.01
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.51
  STREET FLOW TRAVEL TIME(MIN.) =   3.95   Tc(MIN.) =    9.03
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.140
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.81      SUBAREA RUNOFF(CFS) =    2.52
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       3.14

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.80
  FLOW VELOCITY(FEET/SEC.) =  2.16   DEPTH*VELOCITY(FT*FT/SEC.) =   0.61
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    672.00 =     540.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    672.00 TO NODE    673.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   456.00  DOWNSTREAM(FEET) =   455.00
  FLOW LENGTH(FEET) =   147.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.42
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.14
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =    9.58
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    673.00 =     687.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    673.00 TO NODE    673.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.58
  RAINFALL INTENSITY(INCH/HR) =   3.98
```

```
  TOTAL STREAM AREA(ACRES) =     1.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.14

****************************************************************************
  FLOW PROCESS FROM NODE    675.00 TO NODE    676.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    466.65
  DOWNSTREAM ELEVATION(FEET) =    466.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.17
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.17

****************************************************************************
  FLOW PROCESS FROM NODE    676.00 TO NODE    677.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  465.00  DOWNSTREAM ELEVATION(FEET) =  460.00
  STREET LENGTH(FEET) =   520.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.37
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.39
    HALFSTREET FLOOD WIDTH(FEET) =   13.04
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.40
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.93
  STREET FLOW TRAVEL TIME(MIN.) =   3.61   Tc(MIN.) =    8.69
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.244
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.98      SUBAREA RUNOFF(CFS) =    6.30
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       7.13

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  15.86
  FLOW VELOCITY(FEET/SEC.) =  2.71   DEPTH*VELOCITY(FT*FT/SEC.) =   1.20
  LONGEST FLOWPATH FROM NODE    675.00 TO NODE    677.00 =     585.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    677.00 TO NODE    673.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.69
  RAINFALL INTENSITY(INCH/HR) =   4.24
  TOTAL STREAM AREA(ACRES) =     2.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.13
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.14     9.58        3.984          1.01
      2        7.13     8.69        4.244          2.24

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        9.97     8.69       4.244
      2        9.83     9.58       3.984

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       9.97   Tc(MIN.) =    8.69
  TOTAL AREA(ACRES) =        3.2
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    673.00 =     687.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    673.00 TO NODE    678.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   455.00  DOWNSTREAM(FEET) =   453.00
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.45
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.97
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    8.91
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    678.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    678.00 TO NODE    678.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.91
  RAINFALL INTENSITY(INCH/HR) =   4.18
  TOTAL STREAM AREA(ACRES) =     3.25
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.97

****************************************************************************
  FLOW PROCESS FROM NODE    680.00 TO NODE    681.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    465.65
  DOWNSTREAM ELEVATION(FEET) =    465.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.08
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    681.00 TO NODE    682.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  464.50  DOWNSTREAM ELEVATION(FEET) =  458.00
  STREET LENGTH(FEET) =   498.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.26
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.13
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.68
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
  STREET FLOW TRAVEL TIME(MIN.) =   3.09   Tc(MIN.) =    8.17
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.414
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    6.29
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       7.08

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.43   HALFSTREET FLOOD WIDTH(FEET) =  14.94
  FLOW VELOCITY(FEET/SEC.) =  3.01   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
  LONGEST FLOWPATH FROM NODE    680.00 TO NODE    682.00 =     563.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    682.00 TO NODE    678.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.17
  RAINFALL INTENSITY(INCH/HR) =   4.41
  TOTAL STREAM AREA(ACRES) =     2.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.08

****************************************************************************
  FLOW PROCESS FROM NODE    685.00 TO NODE    686.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   200.00
  UPSTREAM ELEVATION(FEET) =    461.00
  DOWNSTREAM ELEVATION(FEET) =    458.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.686
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.50
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.91
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.91

****************************************************************************
  FLOW PROCESS FROM NODE    686.00 TO NODE    678.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.69
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =     0.20
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.91

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        9.97     8.91        4.175          3.25
      2        7.08     8.17        4.414          2.14
      3        0.91     4.69        6.060          0.20

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       11.84     4.69       6.060
      2       17.18     8.17       4.414
      3       17.30     8.91       4.175

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.30   Tc(MIN.) =    8.91
  TOTAL AREA(ACRES) =        5.6
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    678.00 =     799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    678.00 TO NODE    664.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   453.00  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =    63.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.14
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.30
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    9.02
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    664.00 =     862.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    664.00 TO NODE    664.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       17.30     9.02       4.141        5.59
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    664.00 =     862.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       39.47    13.74       3.157       15.44
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    664.00 =    2416.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      43.22       9.02        4.141
      2      52.66      13.74        3.157

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      52.66   Tc(MIN.) =   13.74
  TOTAL AREA(ACRES) =       21.0

****************************************************************************
  FLOW PROCESS FROM NODE    664.00 TO NODE    664.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    664.00 TO NODE    687.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   452.00  DOWNSTREAM(FEET) =   447.00
  FLOW LENGTH(FEET) =   562.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.75
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      52.66
  PIPE TRAVEL TIME(MIN.) =   0.96    Tc(MIN.) =   14.70
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    687.00 =    2978.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    687.00 TO NODE    687.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.70
  RAINFALL INTENSITY(INCH/HR) =   3.02
  TOTAL STREAM AREA(ACRES) =    21.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     52.66

****************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    458.65
  DOWNSTREAM ELEVATION(FEET) =    458.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.94
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.94

****************************************************************************
  FLOW PROCESS FROM NODE    701.00 TO NODE    702.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  457.00  DOWNSTREAM ELEVATION(FEET) =  452.00
  STREET LENGTH(FEET) =   441.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.02
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.26
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
  STREET FLOW TRAVEL TIME(MIN.) =   3.26   Tc(MIN.) =    8.34
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.358
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
```

```
  SUBAREA AREA(ACRES) =    0.96      SUBAREA RUNOFF(CFS) =    3.14
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       3.82

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.92
  FLOW VELOCITY(FEET/SEC.) =  2.49   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    702.00 =     506.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    702.00 TO NODE    687.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.34
  RAINFALL INTENSITY(INCH/HR) =   4.36
  TOTAL STREAM AREA(ACRES) =     1.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.82

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       52.66    14.70        3.022         21.03
      2        3.82     8.34        4.358          1.17

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       33.68     8.34       4.358
      2       55.31    14.70       3.022

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      55.31   Tc(MIN.) =   14.70
  TOTAL AREA(ACRES) =       22.2
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    687.00 =    2978.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    687.00 TO NODE    693.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   447.00  DOWNSTREAM(FEET) =   446.00
  FLOW LENGTH(FEET) =   108.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.99
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      55.31
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   14.88
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    693.00 =    3086.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    693.00 TO NODE    693.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.88
  RAINFALL INTENSITY(INCH/HR) =   3.00
  TOTAL STREAM AREA(ACRES) =    22.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     55.31

****************************************************************************
  FLOW PROCESS FROM NODE    690.00 TO NODE    691.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    459.65
  DOWNSTREAM ELEVATION(FEET) =    459.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.08
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    691.00 TO NODE    692.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  459.00  DOWNSTREAM ELEVATION(FEET) =  451.00
  STREET LENGTH(FEET) =   626.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 10.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.90
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.33   FLOOD WIDTH(FEET) =   10.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.38
    SPLIT DEPTH(FEET) =    0.16   SPLIT FLOOD WIDTH(FEET) =    1.53
    SPLIT FLOW(CFS) =    0.24   SPLIT VELOCITY(FEET/SEC.) =    1.71
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.38
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   4.39   Tc(MIN.) =    9.46
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.015
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.21      SUBAREA RUNOFF(CFS) =    3.64
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       4.37

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.00
  FLOW VELOCITY(FEET/SEC.) =  2.38   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
  LONGEST FLOWPATH FROM NODE    690.00 TO NODE    692.00 =     691.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    692.00 TO NODE    693.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.46
  RAINFALL INTENSITY(INCH/HR) =   4.02
  TOTAL STREAM AREA(ACRES) =     1.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.37

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       55.31    14.88        2.999         22.20
      2        4.37     9.46        4.015          1.45
```

```
  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       45.67     9.46       4.015
      2       58.57    14.88       2.999

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      58.57   Tc(MIN.) =   14.88
  TOTAL AREA(ACRES) =       23.7
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    693.00 =    3086.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    693.00 TO NODE    704.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   446.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.64
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      58.57
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   14.96
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    704.00 =    3146.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    704.00 TO NODE    704.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    710.00 TO NODE    711.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    460.65
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.90
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.90

****************************************************************************
  FLOW PROCESS FROM NODE    711.00 TO NODE    712.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  460.00  DOWNSTREAM ELEVATION(FEET) =  455.00
  STREET LENGTH(FEET) =   534.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.50
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.44
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.07
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.69
  STREET FLOW TRAVEL TIME(MIN.) =   4.30   Tc(MIN.) =    9.38
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.040
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.04      SUBAREA RUNOFF(CFS) =    3.15
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       3.76

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.34
  FLOW VELOCITY(FEET/SEC.) =  2.29   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    710.00 TO NODE    712.00 =     599.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    712.00 TO NODE    713.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.38
  RAINFALL INTENSITY(INCH/HR) =   4.04
  TOTAL STREAM AREA(ACRES) =     1.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.76

****************************************************************************
  FLOW PROCESS FROM NODE    715.00 TO NODE    716.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    460.65
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.12
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      1.12

****************************************************************************
  FLOW PROCESS FROM NODE    716.00 TO NODE    717.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  460.00  DOWNSTREAM ELEVATION(FEET) =  455.00
  STREET LENGTH(FEET) =   570.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.74
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.06
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.71
  STREET FLOW TRAVEL TIME(MIN.) =   4.60   Tc(MIN.) =    9.68
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.957
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.07      SUBAREA RUNOFF(CFS) =    3.18
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       3.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.69
  FLOW VELOCITY(FEET/SEC.) =  2.27   DEPTH*VELOCITY(FT*FT/SEC.) =   0.86
  LONGEST FLOWPATH FROM NODE    715.00 TO NODE    717.00 =     635.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    717.00 TO NODE    713.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.68
  RAINFALL INTENSITY(INCH/HR) =   3.96
  TOTAL STREAM AREA(ACRES) =     1.32
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.92

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.76     9.38        4.040          1.24
      2        3.92     9.68        3.957          1.32

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        7.55     9.38       4.040
      2        7.60     9.68       3.957

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.60   Tc(MIN.) =    9.68
  TOTAL AREA(ACRES) =        2.6
  LONGEST FLOWPATH FROM NODE    715.00 TO NODE    713.00 =     635.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    713.00 TO NODE    704.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =   388.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.42
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.60
  PIPE TRAVEL TIME(MIN.) =   1.01    Tc(MIN.) =   10.69
  LONGEST FLOWPATH FROM NODE    715.00 TO NODE    704.00 =    1023.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    704.00 TO NODE    704.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        7.60    10.69       3.712        2.56
  LONGEST FLOWPATH FROM NODE    715.00 TO NODE    704.00 =    1023.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
```

```
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       58.57    14.96       2.989       23.65
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    704.00 =    3146.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      49.44      10.69        3.712
      2      64.69      14.96        2.989

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      64.69   Tc(MIN.) =   14.96
  TOTAL AREA(ACRES) =       26.2

****************************************************************************
  FLOW PROCESS FROM NODE    704.00 TO NODE    704.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    704.00 TO NODE    718.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   444.00
  FLOW LENGTH(FEET) =    78.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.75
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      64.69
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   15.07
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    718.00 =    3224.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    718.00 TO NODE    718.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.07
  RAINFALL INTENSITY(INCH/HR) =   2.97
  TOTAL STREAM AREA(ACRES) =    26.21
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     64.69

****************************************************************************
  FLOW PROCESS FROM NODE    725.00 TO NODE    726.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    453.65
  DOWNSTREAM ELEVATION(FEET) =    453.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.62
  TOTAL AREA(ACRES) =      0.36   TOTAL RUNOFF(CFS) =      1.62

****************************************************************************
  FLOW PROCESS FROM NODE    726.00 TO NODE    727.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  453.00  DOWNSTREAM ELEVATION(FEET) =  448.00
```

```
  STREET LENGTH(FEET) =   326.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.28
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.51
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.68
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
  STREET FLOW TRAVEL TIME(MIN.) =   2.03   Tc(MIN.) =    7.11
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.830
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.91      SUBAREA RUNOFF(CFS) =    3.30
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       4.60

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.13
  FLOW VELOCITY(FEET/SEC.) =  2.89   DEPTH*VELOCITY(FT*FT/SEC.) =   1.07
  LONGEST FLOWPATH FROM NODE    725.00 TO NODE    727.00 =     391.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    727.00 TO NODE    718.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.11
  RAINFALL INTENSITY(INCH/HR) =   4.83
  TOTAL STREAM AREA(ACRES) =     1.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.60

****************************************************************************
  FLOW PROCESS FROM NODE    730.00 TO NODE    731.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    453.65
  DOWNSTREAM ELEVATION(FEET) =    453.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.44
  TOTAL AREA(ACRES) =      0.32   TOTAL RUNOFF(CFS) =      1.44

****************************************************************************
  FLOW PROCESS FROM NODE    731.00 TO NODE    732.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  453.00  DOWNSTREAM ELEVATION(FEET) =  448.00
  STREET LENGTH(FEET) =   286.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
```

```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.86
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.67
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.72
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.87
  STREET FLOW TRAVEL TIME(MIN.) =   1.76   Tc(MIN.) =    6.83
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.954
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.76      SUBAREA RUNOFF(CFS) =    2.82
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       4.01

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.14
  FLOW VELOCITY(FEET/SEC.) =  2.95   DEPTH*VELOCITY(FT*FT/SEC.) =   1.03
  LONGEST FLOWPATH FROM NODE    730.00 TO NODE    732.00 =     351.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    732.00 TO NODE    718.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.83
  RAINFALL INTENSITY(INCH/HR) =   4.95
  TOTAL STREAM AREA(ACRES) =     1.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.01

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       64.69    15.07        2.974         26.21
      2        4.60     7.11        4.830          1.27
      3        4.01     6.83        4.954          1.08

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       37.77     6.83       4.954
      2       39.02     7.11       4.830
      3       69.93    15.07       2.974

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      69.93   Tc(MIN.) =   15.07
  TOTAL AREA(ACRES) =       28.6
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    718.00 =    3224.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    718.00 TO NODE    733.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.00  DOWNSTREAM(FEET) =   431.00
  FLOW LENGTH(FEET) =   352.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.11
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      69.93
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =   15.41
```

```
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    733.00 =    3576.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    733.00 TO NODE    733.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.41
  RAINFALL INTENSITY(INCH/HR) =   2.93
  TOTAL STREAM AREA(ACRES) =    28.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     69.93

****************************************************************************
  FLOW PROCESS FROM NODE    735.00 TO NODE    736.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    445.65
  DOWNSTREAM ELEVATION(FEET) =    445.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.53
  TOTAL AREA(ACRES) =      0.34   TOTAL RUNOFF(CFS) =      1.53

****************************************************************************
  FLOW PROCESS FROM NODE    736.00 TO NODE    737.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  444.00  DOWNSTREAM ELEVATION(FEET) =  436.50
  STREET LENGTH(FEET) =   222.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.81
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.27
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.50
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.02
  STREET FLOW TRAVEL TIME(MIN.) =   1.06   Tc(MIN.) =    6.14
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.310
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.64      SUBAREA RUNOFF(CFS) =    2.55
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       3.90

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.60
  FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.20
  LONGEST FLOWPATH FROM NODE    735.00 TO NODE    737.00 =     287.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    737.00 TO NODE    733.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.14
  RAINFALL INTENSITY(INCH/HR) =   5.31
  TOTAL STREAM AREA(ACRES) =     0.98
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.90

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       69.93    15.41        2.931         28.56
      2        3.90     6.14        5.310          0.98

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       42.51     6.14       5.310
      2       72.08    15.41       2.931

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      72.08   Tc(MIN.) =   15.41
  TOTAL AREA(ACRES) =       29.5
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    733.00 =    3576.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    737.00 TO NODE    738.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   431.00  DOWNSTREAM(FEET) =   430.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.35
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      72.08
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   15.49
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    738.00 =    3636.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    738.00 TO NODE    738.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    750.00 TO NODE    751.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    469.00
  DOWNSTREAM ELEVATION(FEET) =    468.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
  FLOW PROCESS FROM NODE    751.00 TO NODE    752.00 IS CODE =  61
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  467.50  DOWNSTREAM ELEVATION(FEET) =  460.45
  STREET LENGTH(FEET) =   522.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.21
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.31
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
  STREET FLOW TRAVEL TIME(MIN.) =   3.77   Tc(MIN.) =    8.85
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.194
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.29      SUBAREA RUNOFF(CFS) =    7.20
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       7.58

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.47
  FLOW VELOCITY(FEET/SEC.) =  2.64   DEPTH*VELOCITY(FT*FT/SEC.) =   0.94
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    752.00 =     592.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    752.00 TO NODE    753.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   455.00  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =   290.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.43
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.58
  PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =    9.60
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    753.00 =     882.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    753.00 TO NODE    753.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.60
  RAINFALL INTENSITY(INCH/HR) =   3.98
  TOTAL STREAM AREA(ACRES) =     2.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.58

****************************************************************************
  FLOW PROCESS FROM NODE    760.00 TO NODE    761.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    471.00
  DOWNSTREAM ELEVATION(FEET) =    470.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
```

```
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.08
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    761.00 TO NODE    762.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.50  DOWNSTREAM ELEVATION(FEET) =  457.94
  STREET LENGTH(FEET) =   766.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.03
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.40
    HALFSTREET FLOOD WIDTH(FEET) =   13.84
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.96
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.20
  STREET FLOW TRAVEL TIME(MIN.) =   4.31   Tc(MIN.) =    9.39
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.037
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    3.20      SUBAREA RUNOFF(CFS) =    9.69
  TOTAL AREA(ACRES) =        3.4        PEAK FLOW RATE(CFS) =      10.42

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.00
  FLOW VELOCITY(FEET/SEC.) =  3.25   DEPTH*VELOCITY(FT*FT/SEC.) =   1.45
  LONGEST FLOWPATH FROM NODE    760.00 TO NODE    762.00 =     836.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    762.00 TO NODE    753.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.39
  RAINFALL INTENSITY(INCH/HR) =   4.04
  TOTAL STREAM AREA(ACRES) =     3.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.42

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        7.58     9.60        3.979         2.41
      2       10.42     9.39        4.037         3.44

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.83     9.39       4.037
      2       17.85     9.60       3.979

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      17.85   Tc(MIN.) =    9.60
  TOTAL AREA(ACRES) =        5.8
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    753.00 =     882.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    753.00 TO NODE    775.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   752.00  DOWNSTREAM(FEET) =   751.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.16
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.85
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    9.78
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    775.00 =     972.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    775.00 TO NODE    775.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.78
  RAINFALL INTENSITY(INCH/HR) =   3.93
  TOTAL STREAM AREA(ACRES) =     5.85
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.85

****************************************************************************
  FLOW PROCESS FROM NODE    780.00 TO NODE    781.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    462.70
  DOWNSTREAM ELEVATION(FEET) =    462.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.85
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.85

****************************************************************************
  FLOW PROCESS FROM NODE    781.00 TO NODE    782.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  460.25  DOWNSTREAM ELEVATION(FEET) =  457.00
  STREET LENGTH(FEET) =   208.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.60
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.62
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.29
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   1.51   Tc(MIN.) =    6.59
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.069
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.39      SUBAREA RUNOFF(CFS) =    1.48
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       2.21

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.84
  FLOW VELOCITY(FEET/SEC.) =  2.45   DEPTH*VELOCITY(FT*FT/SEC.) =   0.74
  LONGEST FLOWPATH FROM NODE    780.00 TO NODE    782.00 =     278.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    782.00 TO NODE    775.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.59
  RAINFALL INTENSITY(INCH/HR) =   5.07
  TOTAL STREAM AREA(ACRES) =     0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.21

****************************************************************************
  FLOW PROCESS FROM NODE    785.00 TO NODE    786.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    463.90
  DOWNSTREAM ELEVATION(FEET) =    463.20
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.21
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      1.21

****************************************************************************
  FLOW PROCESS FROM NODE    786.00 TO NODE    787.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  462.00  DOWNSTREAM ELEVATION(FEET) =  457.00
  STREET LENGTH(FEET) =   418.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.73
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.32
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.77
  STREET FLOW TRAVEL TIME(MIN.) =   3.00   Tc(MIN.) =    8.08
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.448
  *USER SPECIFIED(SUBAREA):
```

```
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    3.00
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       3.90

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.91
  FLOW VELOCITY(FEET/SEC.) =  2.54   DEPTH*VELOCITY(FT*FT/SEC.) =   0.93
  LONGEST FLOWPATH FROM NODE    785.00 TO NODE    787.00 =     488.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    787.00 TO NODE    775.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.08
  RAINFALL INTENSITY(INCH/HR) =   4.45
  TOTAL STREAM AREA(ACRES) =     1.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.90

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       17.85     9.78        3.931          5.85
      2        2.21     6.59        5.069          0.58
      3        3.90     8.08        4.448          1.17

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       19.23     6.59       5.069
      2       21.61     8.08       4.448
      3       23.01     9.78       3.931

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      23.01   Tc(MIN.) =    9.78
  TOTAL AREA(ACRES) =        7.6
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    775.00 =     972.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    775.00 TO NODE    788.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.00  DOWNSTREAM(FEET) =   448.00
  FLOW LENGTH(FEET) =   159.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.61
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.01
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   10.03
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    788.00 =    1131.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    788.00 TO NODE    788.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.03
  RAINFALL INTENSITY(INCH/HR) =   3.87
  TOTAL STREAM AREA(ACRES) =     7.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.01

****************************************************************************
  FLOW PROCESS FROM NODE    795.00 TO NODE    796.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =     0.65
  UPSTREAM ELEVATION(FEET) =    459.65
  DOWNSTREAM ELEVATION(FEET) =    459.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    0.236
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.91
  TOTAL AREA(ACRES) =      0.42   TOTAL RUNOFF(CFS) =      1.91

******************************************************************************
  FLOW PROCESS FROM NODE    796.00 TO NODE    797.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  459.00  DOWNSTREAM ELEVATION(FEET) =  454.00
  STREET LENGTH(FEET) =   323.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.23
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.86
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.03
  STREET FLOW TRAVEL TIME(MIN.) =   1.88   Tc(MIN.) =    2.12
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.02      SUBAREA RUNOFF(CFS) =    4.64
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       6.54

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  13.97
  FLOW VELOCITY(FEET/SEC.) =  3.16   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
  LONGEST FLOWPATH FROM NODE    795.00 TO NODE    797.00 =     323.65 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    797.00 TO NODE    788.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   448.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.40
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.54
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =    2.35
  LONGEST FLOWPATH FROM NODE    795.00 TO NODE    788.00 =     413.65 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    788.00 TO NODE    788.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    2.35
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =     1.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.54

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       23.01    10.03        3.867         7.60
      2        6.54     2.35        6.060         1.44

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       21.23     2.35       6.060
      2       27.18    10.03       3.867

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      27.18   Tc(MIN.) =   10.03
  TOTAL AREA(ACRES) =        9.0
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    788.00 =    1131.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    788.00 TO NODE    798.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   448.00  DOWNSTREAM(FEET) =   443.00
  FLOW LENGTH(FEET) =   262.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.96
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.18
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =   10.43
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    798.00 =    1393.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    798.00 TO NODE    798.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.43
  RAINFALL INTENSITY(INCH/HR) =   3.77
  TOTAL STREAM AREA(ACRES) =     9.04
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.18

****************************************************************************
  FLOW PROCESS FROM NODE    810.00 TO NODE    811.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    455.65
  DOWNSTREAM ELEVATION(FEET) =    455.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.17
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.17
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    811.00 TO NODE    812.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  455.00  DOWNSTREAM ELEVATION(FEET) =  448.00
  STREET LENGTH(FEET) =   355.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.67
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
  STREET FLOW TRAVEL TIME(MIN.) =   1.96   Tc(MIN.) =    7.04
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.860
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.36      SUBAREA RUNOFF(CFS) =    4.96
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       5.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.72
  FLOW VELOCITY(FEET/SEC.) =  3.40   DEPTH*VELOCITY(FT*FT/SEC.) =   1.29
  LONGEST FLOWPATH FROM NODE    810.00 TO NODE    812.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    812.00 TO NODE    798.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.04
  RAINFALL INTENSITY(INCH/HR) =   4.86
  TOTAL STREAM AREA(ACRES) =     1.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.91

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       27.18    10.43        3.771          9.04
      2        5.91     7.04        4.860          1.62

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       27.00     7.04       4.860
      2       31.77    10.43       3.771

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      31.77   Tc(MIN.) =   10.43
  TOTAL AREA(ACRES) =       10.7
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    798.00 =    1393.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    798.00 TO NODE    813.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.00  DOWNSTREAM(FEET) =   441.00
  FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.92
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      31.77
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   10.61
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    813.00 =    1513.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    813.00 TO NODE    813.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    815.00 TO NODE    816.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    460.00
  DOWNSTREAM ELEVATION(FEET) =    457.45
  ELEVATION DIFFERENCE(FEET) =      2.55
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.027
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    85.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.77
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.77

****************************************************************************
  FLOW PROCESS FROM NODE    816.00 TO NODE    817.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   453.00  DOWNSTREAM(FEET) =   449.00
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.27
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.77
  PIPE TRAVEL TIME(MIN.) =   0.82    Tc(MIN.) =    4.85
  LONGEST FLOWPATH FROM NODE    815.00 TO NODE    817.00 =     295.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    816.00 TO NODE    817.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8357
  SUBAREA AREA(ACRES) =    1.02   SUBAREA RUNOFF(CFS) =    5.25
  TOTAL AREA(ACRES) =        1.2   TOTAL RUNOFF(CFS) =       6.03
  TC(MIN.) =    4.85

****************************************************************************
  FLOW PROCESS FROM NODE    817.00 TO NODE    818.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   443.00
  FLOW LENGTH(FEET) =   356.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.33
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.03
  PIPE TRAVEL TIME(MIN.) =   0.81    Tc(MIN.) =    5.66
  LONGEST FLOWPATH FROM NODE    815.00 TO NODE    818.00 =     651.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    818.00 TO NODE    818.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.66
  RAINFALL INTENSITY(INCH/HR) =   5.60
  TOTAL STREAM AREA(ACRES) =     1.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.03

****************************************************************************
  FLOW PROCESS FROM NODE    820.00 TO NODE    821.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    456.00
  DOWNSTREAM ELEVATION(FEET) =    455.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.84
  TOTAL AREA(ACRES) =      0.41   TOTAL RUNOFF(CFS) =      1.84

****************************************************************************
  FLOW PROCESS FROM NODE    821.00 TO NODE    822.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  453.00  DOWNSTREAM ELEVATION(FEET) =  447.00
  STREET LENGTH(FEET) =   268.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.40
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.84
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.13
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
  STREET FLOW TRAVEL TIME(MIN.) =   1.43   Tc(MIN.) =    6.51
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.113
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.81      SUBAREA RUNOFF(CFS) =    3.11
```

```
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       4.68

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.28
  FLOW VELOCITY(FEET/SEC.) =  3.36   DEPTH*VELOCITY(FT*FT/SEC.) =   1.18
  LONGEST FLOWPATH FROM NODE    820.00 TO NODE    822.00 =     333.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    822.00 TO NODE    818.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.51
  RAINFALL INTENSITY(INCH/HR) =   5.11
  TOTAL STREAM AREA(ACRES) =     1.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.68

****************************************************************************
  FLOW PROCESS FROM NODE    825.00 TO NODE    826.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    457.65
  DOWNSTREAM ELEVATION(FEET) =    457.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.84
  TOTAL AREA(ACRES) =      0.41   TOTAL RUNOFF(CFS) =      1.84

****************************************************************************
  FLOW PROCESS FROM NODE    826.00 TO NODE    827.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  454.00  DOWNSTREAM ELEVATION(FEET) =  447.00
  STREET LENGTH(FEET) =   406.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.42
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.99
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.07
  STREET FLOW TRAVEL TIME(MIN.) =   2.26   Tc(MIN.) =    7.34
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.730
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.44      SUBAREA RUNOFF(CFS) =    5.11
  TOTAL AREA(ACRES) =        1.9        PEAK FLOW RATE(CFS) =       6.56

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.66
```

```
  FLOW VELOCITY(FEET/SEC.) =  3.31   DEPTH*VELOCITY(FT*FT/SEC.) =   1.32
  LONGEST FLOWPATH FROM NODE    825.00 TO NODE    827.00 =     471.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    827.00 TO NODE    818.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.34
  RAINFALL INTENSITY(INCH/HR) =   4.73
  TOTAL STREAM AREA(ACRES) =     1.85
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.56

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.03     5.66        5.597          1.19
      2        4.68     6.51        5.113          1.22
      3        6.56     7.34        4.730          1.85

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       15.15     5.66       5.597
      2       16.00     6.51       5.113
      3       15.98     7.34       4.730

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      16.00   Tc(MIN.) =    6.51
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE    815.00 TO NODE    818.00 =     651.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    818.00 TO NODE    813.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   442.00  DOWNSTREAM(FEET) =   441.00
  FLOW LENGTH(FEET) =    57.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.41
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.00
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    6.61
  LONGEST FLOWPATH FROM NODE    815.00 TO NODE    813.00 =     708.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    813.00 TO NODE    813.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       16.00     6.61       5.063        4.26
  LONGEST FLOWPATH FROM NODE    815.00 TO NODE    813.00 =     708.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       31.77    10.61       3.729       10.66
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    813.00 =    1513.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      35.78       6.61        5.063
      2      43.55      10.61        3.729
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      43.55   Tc(MIN.) =   10.61
  TOTAL AREA(ACRES) =       14.9

****************************************************************************
  FLOW PROCESS FROM NODE    813.00 TO NODE    813.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    813.00 TO NODE    828.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   441.00  DOWNSTREAM(FEET) =   439.00
  FLOW LENGTH(FEET) =   134.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.25
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      43.55
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   10.81
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    828.00 =    1647.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    828.00 TO NODE    828.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.81
  RAINFALL INTENSITY(INCH/HR) =   3.68
  TOTAL STREAM AREA(ACRES) =    14.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     43.55

****************************************************************************
  FLOW PROCESS FROM NODE    830.00 TO NODE    831.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    454.65
  DOWNSTREAM ELEVATION(FEET) =    454.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      2.43
  TOTAL AREA(ACRES) =      0.54   TOTAL RUNOFF(CFS) =      2.43

****************************************************************************
  FLOW PROCESS FROM NODE    831.00 TO NODE    832.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  452.00  DOWNSTREAM ELEVATION(FEET) =  443.00
  STREET LENGTH(FEET) =   406.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
```

```
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.06
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.10
  STREET FLOW TRAVEL TIME(MIN.) =   2.09   Tc(MIN.) =    7.17
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.803
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    3.24
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       5.19

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.78
  FLOW VELOCITY(FEET/SEC.) =  3.44   DEPTH*VELOCITY(FT*FT/SEC.) =   1.25
  LONGEST FLOWPATH FROM NODE    830.00 TO NODE    832.00 =     471.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    832.00 TO NODE    828.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.17
  RAINFALL INTENSITY(INCH/HR) =   4.80
  TOTAL STREAM AREA(ACRES) =     1.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.19

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       43.55    10.81        3.685         14.92
      2        5.19     7.17        4.803          1.44

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       34.07     7.17       4.803
      2       47.53    10.81       3.685

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      47.53   Tc(MIN.) =   10.81
  TOTAL AREA(ACRES) =       16.4
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    828.00 =    1647.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    828.00 TO NODE    833.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.00  DOWNSTREAM(FEET) =   435.00
  FLOW LENGTH(FEET) =   127.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.82
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      47.53
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   10.97
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    833.00 =    1774.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    833.00 TO NODE    833.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.97
  RAINFALL INTENSITY(INCH/HR) =   3.65
  TOTAL STREAM AREA(ACRES) =    16.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     47.53

****************************************************************************
  FLOW PROCESS FROM NODE    835.00 TO NODE    836.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    453.65
  DOWNSTREAM ELEVATION(FEET) =    453.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.80
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.80

****************************************************************************
  FLOW PROCESS FROM NODE    836.00 TO NODE    837.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  449.00  DOWNSTREAM ELEVATION(FEET) =  441.00
  STREET LENGTH(FEET) =   269.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.36
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.22
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.47
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.08
  STREET FLOW TRAVEL TIME(MIN.) =   1.29   Tc(MIN.) =    6.37
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.183
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    3.11
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       4.66

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.59
  FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.27
  LONGEST FLOWPATH FROM NODE    835.00 TO NODE    837.00 =     334.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    837.00 TO NODE    833.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.37
  RAINFALL INTENSITY(INCH/HR) =   5.18
```

```
  TOTAL STREAM AREA(ACRES) =     1.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.66

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       47.53    10.97        3.652        16.36
      2        4.66     6.37        5.183         1.20

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       38.15     6.37       5.183
      2       50.82    10.97       3.652

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      50.82   Tc(MIN.) =   10.97
  TOTAL AREA(ACRES) =       17.6
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    833.00 =    1774.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    833.00 TO NODE    838.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   435.00  DOWNSTREAM(FEET) =   433.00
  FLOW LENGTH(FEET) =   113.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.33
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      50.82
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =   11.12
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    838.00 =    1887.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    838.00 TO NODE    838.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.12
  RAINFALL INTENSITY(INCH/HR) =   3.62
  TOTAL STREAM AREA(ACRES) =    17.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     50.82

****************************************************************************
  FLOW PROCESS FROM NODE    840.00 TO NODE    841.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    449.65
  DOWNSTREAM ELEVATION(FEET) =    449.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.71
  TOTAL AREA(ACRES) =      0.38   TOTAL RUNOFF(CFS) =      1.71

****************************************************************************
  FLOW PROCESS FROM NODE    841.00 TO NODE    842.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
```

```
==============================================================================
  UPSTREAM ELEVATION(FEET) =  446.00  DOWNSTREAM ELEVATION(FEET) =  438.00
  STREET LENGTH(FEET) =   367.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.16
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.78
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.25
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.11
  STREET FLOW TRAVEL TIME(MIN.) =   1.88   Tc(MIN.) =    6.96
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.896
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.33      SUBAREA RUNOFF(CFS) =    4.88
  TOTAL AREA(ACRES) =        1.7        PEAK FLOW RATE(CFS) =       6.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.78
  FLOW VELOCITY(FEET/SEC.) =  3.58   DEPTH*VELOCITY(FT*FT/SEC.) =   1.37
  LONGEST FLOWPATH FROM NODE    840.00 TO NODE    842.00 =     432.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    842.00 TO NODE    838.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.96
  RAINFALL INTENSITY(INCH/HR) =   4.90
  TOTAL STREAM AREA(ACRES) =     1.71
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.28

****************************************************************************
  FLOW PROCESS FROM NODE    845.00 TO NODE    846.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    453.65
  DOWNSTREAM ELEVATION(FEET) =    453.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.80
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.80

****************************************************************************
  FLOW PROCESS FROM NODE    846.00 TO NODE    847.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  451.00  DOWNSTREAM ELEVATION(FEET) =  438.00
  STREET LENGTH(FEET) =   490.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.00
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.16
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.48
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.14
  STREET FLOW TRAVEL TIME(MIN.) =   2.35   Tc(MIN.) =    7.43
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.694
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.24      SUBAREA RUNOFF(CFS) =    4.37
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       5.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.91
  FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.37
  LONGEST FLOWPATH FROM NODE    845.00 TO NODE    847.00 =     555.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    847.00 TO NODE    838.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.43
  RAINFALL INTENSITY(INCH/HR) =   4.69
  TOTAL STREAM AREA(ACRES) =     1.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.77

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       50.82    11.12        3.619         17.56
      2        6.28     6.96        4.896          1.71
      3        5.77     7.43        4.694          1.64

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       49.26     6.96       4.896
      2       50.98     7.43       4.694
      3       59.91    11.12       3.619

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      59.91   Tc(MIN.) =   11.12
  TOTAL AREA(ACRES) =       20.9
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    838.00 =    1887.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    838.00 TO NODE    738.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   433.00  DOWNSTREAM(FEET) =   430.00
  FLOW LENGTH(FEET) =   153.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.59
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =      59.91
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   11.31
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    738.00 =    2040.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    738.00 TO NODE    738.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       59.91    11.31       3.580       20.91
  LONGEST FLOWPATH FROM NODE    750.00 TO NODE    738.00 =    2040.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       72.08    15.49       2.922       29.54
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    738.00 =    3636.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     112.52      11.31        3.580
      2     120.98      15.49        2.922

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     120.98   Tc(MIN.) =   15.49
  TOTAL AREA(ACRES) =       50.5

****************************************************************************
  FLOW PROCESS FROM NODE    738.00 TO NODE    738.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    738.00 TO NODE    848.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   430.00  DOWNSTREAM(FEET) =   424.00
  FLOW LENGTH(FEET) =   256.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.93
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     120.98
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   15.74
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    848.00 =    3892.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    848.00 TO NODE    848.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    860.00 TO NODE    861.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    451.65
  DOWNSTREAM ELEVATION(FEET) =    451.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
```

```
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      2.20
  TOTAL AREA(ACRES) =      0.49   TOTAL RUNOFF(CFS) =      2.20

****************************************************************************
  FLOW PROCESS FROM NODE    861.00 TO NODE    862.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  447.00  DOWNSTREAM ELEVATION(FEET) =  438.00
  STREET LENGTH(FEET) =   342.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.22
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.48
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.17
  STREET FLOW TRAVEL TIME(MIN.) =   1.64   Tc(MIN.) =    6.72
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.009
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.07      SUBAREA RUNOFF(CFS) =    4.02
  TOTAL AREA(ACRES) =        1.6        PEAK FLOW RATE(CFS) =       5.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.97
  FLOW VELOCITY(FEET/SEC.) =  3.78   DEPTH*VELOCITY(FT*FT/SEC.) =   1.38
  LONGEST FLOWPATH FROM NODE    860.00 TO NODE    862.00 =     407.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    862.00 TO NODE    863.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.72
  RAINFALL INTENSITY(INCH/HR) =   5.01
  TOTAL STREAM AREA(ACRES) =     1.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.86

****************************************************************************
  FLOW PROCESS FROM NODE    865.00 TO NODE    866.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    454.00
  DOWNSTREAM ELEVATION(FEET) =    453.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.63
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.63
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    866.00 TO NODE    867.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  452.00  DOWNSTREAM ELEVATION(FEET) =  438.00
  STREET LENGTH(FEET) =   565.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.01
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.34
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.38
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.13
  STREET FLOW TRAVEL TIME(MIN.) =   2.79   Tc(MIN.) =    7.87
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.524
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.97      SUBAREA RUNOFF(CFS) =    6.68
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       7.16

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.16
  FLOW VELOCITY(FEET/SEC.) =  3.87   DEPTH*VELOCITY(FT*FT/SEC.) =   1.51
  LONGEST FLOWPATH FROM NODE    865.00 TO NODE    867.00 =     630.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    867.00 TO NODE    863.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.87
  RAINFALL INTENSITY(INCH/HR) =   4.52
  TOTAL STREAM AREA(ACRES) =     2.11
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.16

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.86     6.72        5.009          1.56
      2        7.16     7.87        4.524          2.11

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       11.97     6.72       5.009
      2       12.45     7.87       4.524

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.45   Tc(MIN.) =    7.87
  TOTAL AREA(ACRES) =        3.7
  LONGEST FLOWPATH FROM NODE    865.00 TO NODE    863.00 =     630.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    863.00 TO NODE    868.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   433.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   384.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.45
  PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =    8.55
  LONGEST FLOWPATH FROM NODE    865.00 TO NODE    868.00 =    1014.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    868.00 TO NODE    868.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.55
  RAINFALL INTENSITY(INCH/HR) =   4.29
  TOTAL STREAM AREA(ACRES) =     3.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.45

****************************************************************************
  FLOW PROCESS FROM NODE    870.00 TO NODE    871.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    438.65
  DOWNSTREAM ELEVATION(FEET) =    438.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.89
  TOTAL AREA(ACRES) =      0.42   TOTAL RUNOFF(CFS) =      1.89

****************************************************************************
  FLOW PROCESS FROM NODE    871.00 TO NODE    872.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  435.00  DOWNSTREAM ELEVATION(FEET) =  430.00
  STREET LENGTH(FEET) =   224.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.21
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.06
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.97
  STREET FLOW TRAVEL TIME(MIN.) =   1.22   Tc(MIN.) =    6.30
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.221
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    8.61
```

```
  TOTAL AREA(ACRES) =        2.6        PEAK FLOW RATE(CFS) =      10.26

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.72
  FLOW VELOCITY(FEET/SEC.) =  3.44   DEPTH*VELOCITY(FT*FT/SEC.) =   1.24
  LONGEST FLOWPATH FROM NODE    870.00 TO NODE    872.00 =     289.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    872.00 TO NODE    868.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.30
  RAINFALL INTENSITY(INCH/HR) =   5.22
  TOTAL STREAM AREA(ACRES) =     2.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.26

****************************************************************************
  FLOW PROCESS FROM NODE    880.00 TO NODE    881.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    446.65
  DOWNSTREAM ELEVATION(FEET) =    446.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.62
  TOTAL AREA(ACRES) =      0.36   TOTAL RUNOFF(CFS) =      1.62

****************************************************************************
  FLOW PROCESS FROM NODE    881.00 TO NODE    882.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  444.00  DOWNSTREAM ELEVATION(FEET) =  430.00
  STREET LENGTH(FEET) =   535.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.52
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.18
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.95
  STREET FLOW TRAVEL TIME(MIN.) =   2.80   Tc(MIN.) =    7.88
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.519
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.28      SUBAREA RUNOFF(CFS) =    7.73
  TOTAL AREA(ACRES) =        2.6        PEAK FLOW RATE(CFS) =       8.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.72
```

```
  FLOW VELOCITY(FEET/SEC.) =  3.53   DEPTH*VELOCITY(FT*FT/SEC.) =   1.20
  LONGEST FLOWPATH FROM NODE    880.00 TO NODE    882.00 =     600.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    882.00 TO NODE    868.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.88
  RAINFALL INTENSITY(INCH/HR) =   4.52
  TOTAL STREAM AREA(ACRES) =     2.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.95

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.45     8.55        4.287          3.67
      2       10.26     6.30        5.221          2.62
      3        8.95     7.88        4.519          2.64

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       27.64     6.30       5.221
      2       29.64     7.88       4.519
      3       29.36     8.55       4.287

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.64   Tc(MIN.) =    7.88
  TOTAL AREA(ACRES) =        8.9
  LONGEST FLOWPATH FROM NODE    865.00 TO NODE    868.00 =    1014.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    868.00 TO NODE    848.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   424.00
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.44
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      29.64
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    7.98
  LONGEST FLOWPATH FROM NODE    865.00 TO NODE    848.00 =    1079.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    848.00 TO NODE    848.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       29.64     7.98       4.481        8.93
  LONGEST FLOWPATH FROM NODE    865.00 TO NODE    848.00 =    1079.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      120.98    15.74       2.892       50.45
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    848.00 =    3892.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      91.01       7.98        4.481
      2     140.12      15.74        2.892
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     140.12   Tc(MIN.) =   15.74
  TOTAL AREA(ACRES) =       59.4

****************************************************************************
  FLOW PROCESS FROM NODE    848.00 TO NODE    848.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

+--------------------------------------------------------------------------+
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    900.00 TO NODE    901.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  LAWNS, GOLF COURSES, ETC. FAIR COVER RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    482.20
  DOWNSTREAM ELEVATION(FEET) =    480.00
  ELEVATION DIFFERENCE(FEET) =      2.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.193
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.091
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.27

****************************************************************************
  FLOW PROCESS FROM NODE    901.00 TO NODE    902.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   480.00  DOWNSTREAM(FEET) =   470.00
  FLOW LENGTH(FEET) =   654.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.91
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.27
  PIPE TRAVEL TIME(MIN.) =   3.75    Tc(MIN.) =   12.94
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    902.00 =     734.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    901.00 TO NODE    902.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.281
  *USER SPECIFIED(SUBAREA):
  LAWNS, GOLF COURSES, ETC. FAIR COVER RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =    7.47   SUBAREA RUNOFF(CFS) =    7.35
  TOTAL AREA(ACRES) =        7.7   TOTAL RUNOFF(CFS) =       7.57
  TC(MIN.) =   12.94

****************************************************************************
  FLOW PROCESS FROM NODE    902.00 TO NODE    903.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   465.00  DOWNSTREAM(FEET) =   460.00
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.27
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.57
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   13.17
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    903.00 =     874.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    903.00 TO NODE    903.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.17
  RAINFALL INTENSITY(INCH/HR) =   3.24
  TOTAL STREAM AREA(ACRES) =     7.69
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.57

****************************************************************************
  FLOW PROCESS FROM NODE    905.00 TO NODE    906.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    472.25
  DOWNSTREAM ELEVATION(FEET) =    471.00
  ELEVATION DIFFERENCE(FEET) =      1.25
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.537
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    67.06
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.73
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.73

****************************************************************************
  FLOW PROCESS FROM NODE    906.00 TO NODE    907.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   466.00  DOWNSTREAM(FEET) =   462.00
  FLOW LENGTH(FEET) =   185.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.40
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.73
  PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =    5.24
  LONGEST FLOWPATH FROM NODE    905.00 TO NODE    907.00 =     270.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    906.00 TO NODE    907.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.881
  *USER SPECIFIED(SUBAREA):
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    0.84   SUBAREA RUNOFF(CFS) =    3.71
  TOTAL AREA(ACRES) =        1.0   TOTAL RUNOFF(CFS) =       4.41
  TC(MIN.) =    5.24

****************************************************************************
  FLOW PROCESS FROM NODE    907.00 TO NODE    903.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   462.00  DOWNSTREAM(FEET) =   460.00
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.19
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.41
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    5.38
  LONGEST FLOWPATH FROM NODE    905.00 TO NODE    903.00 =     340.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    903.00 TO NODE    903.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.38
  RAINFALL INTENSITY(INCH/HR) =   5.78
  TOTAL STREAM AREA(ACRES) =     1.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.41

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        7.57    13.17        3.245          7.69
      2        4.41     5.38        5.780          1.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        7.50     5.38       5.780
      2       10.05    13.17       3.245

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.05   Tc(MIN.) =   13.17
  TOTAL AREA(ACRES) =        8.7
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    903.00 =     874.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    903.00 TO NODE    908.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   460.00  DOWNSTREAM(FEET) =   440.00
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.01
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.05
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   13.22
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    908.00 =     949.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    908.00 TO NODE    908.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.22
  RAINFALL INTENSITY(INCH/HR) =   3.24
  TOTAL STREAM AREA(ACRES) =     8.69
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.05

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    908.00 TO NODE    908.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  12.17   RAIN INTENSITY(INCH/HOUR) =  3.41
  TOTAL AREA(ACRES) =    57.50   TOTAL RUNOFF(CFS) =    138.61

****************************************************************************
  FLOW PROCESS FROM NODE    908.00 TO NODE    908.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.17
  RAINFALL INTENSITY(INCH/HR) =   3.41
  TOTAL STREAM AREA(ACRES) =    57.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    138.61

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.05    13.22        3.236          8.69
      2      138.61    12.17        3.414         57.50

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      148.13    12.17       3.414
      2      141.43    13.22       3.236

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     148.13   Tc(MIN.) =   12.17
  TOTAL AREA(ACRES) =       66.2
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    908.00 =     949.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    908.00 TO NODE    919.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   380.00
  FLOW LENGTH(FEET) =  2263.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.85
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     148.13
  PIPE TRAVEL TIME(MIN.) =   2.00    Tc(MIN.) =   14.17
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    919.00 =    3212.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    918.00 TO NODE    918.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.17
  RAINFALL INTENSITY(INCH/HR) =   3.09
  TOTAL STREAM AREA(ACRES) =    66.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    148.13

****************************************************************************
  FLOW PROCESS FROM NODE    915.00 TO NODE    916.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  URBAN NEWLY GRADED AREAS RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    454.00
  DOWNSTREAM ELEVATION(FEET) =    444.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.51
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.51

****************************************************************************
  FLOW PROCESS FROM NODE    916.00 TO NODE    917.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   444.00  DOWNSTREAM(FEET) =   435.00
  FLOW LENGTH(FEET) =   818.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.10
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.51
  PIPE TRAVEL TIME(MIN.) =   4.39    Tc(MIN.) =    8.57
  LONGEST FLOWPATH FROM NODE    915.00 TO NODE    917.00 =     918.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    916.00 TO NODE    917.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.280
  *USER SPECIFIED(SUBAREA):
  URBAN NEWLY GRADED AREAS RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    1.52   SUBAREA RUNOFF(CFS) =    3.90
  TOTAL AREA(ACRES) =        1.7   TOTAL RUNOFF(CFS) =       4.26
  TC(MIN.) =    8.57

****************************************************************************
  FLOW PROCESS FROM NODE    917.00 TO NODE    918.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   435.00  DOWNSTREAM(FEET) =   405.00
  FLOW LENGTH(FEET) =   763.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.10
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.26
  PIPE TRAVEL TIME(MIN.) =   1.40    Tc(MIN.) =    9.97
  LONGEST FLOWPATH FROM NODE    915.00 TO NODE    918.00 =    1681.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    917.00 TO NODE    918.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.883
  *USER SPECIFIED(SUBAREA):
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    2.08   SUBAREA RUNOFF(CFS) =    4.85
  TOTAL AREA(ACRES) =        3.7   TOTAL RUNOFF(CFS) =       8.71
  TC(MIN.) =    9.97

****************************************************************************
  FLOW PROCESS FROM NODE    918.00 TO NODE    919.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   405.00  DOWNSTREAM(FEET) =   380.00
  FLOW LENGTH(FEET) =   683.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.76
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.71
  PIPE TRAVEL TIME(MIN.) =   1.06    Tc(MIN.) =   11.03
  LONGEST FLOWPATH FROM NODE    915.00 TO NODE    919.00 =    2364.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    918.00 TO NODE    919.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.638
  *USER SPECIFIED(SUBAREA):
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    1.85   SUBAREA RUNOFF(CFS) =    4.04
  TOTAL AREA(ACRES) =        5.6   TOTAL RUNOFF(CFS) =      12.20
  TC(MIN.) =   11.03

****************************************************************************
  FLOW PROCESS FROM NODE    919.00 TO NODE    919.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.03
  RAINFALL INTENSITY(INCH/HR) =   3.64
  TOTAL STREAM AREA(ACRES) =     5.59
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      148.13    14.17        3.095         66.19
      2       12.20    11.03        3.638          5.59

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      138.21    11.03       3.638
      2      158.51    14.17       3.095

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     158.51   Tc(MIN.) =   14.17
  TOTAL AREA(ACRES) =       71.8
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    919.00 =    3212.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    919.00 TO NODE    919.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    920.00 TO NODE    921.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    483.30
  DOWNSTREAM ELEVATION(FEET) =    482.60
  ELEVATION DIFFERENCE(FEET) =      0.70
```

```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.805
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.504
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
  FLOW PROCESS FROM NODE    921.00 TO NODE    922.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  480.60  DOWNSTREAM ELEVATION(FEET) =  451.18
  STREET LENGTH(FEET) =  1100.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.42
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.41
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.51
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.17
  STREET FLOW TRAVEL TIME(MIN.) =   5.23   Tc(MIN.) =   11.03
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.637
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
  SUBAREA AREA(ACRES) =    6.04      SUBAREA RUNOFF(CFS) =   15.38
  TOTAL AREA(ACRES) =        6.2        PEAK FLOW RATE(CFS) =      15.73

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.47
  FLOW VELOCITY(FEET/SEC.) =  4.07   DEPTH*VELOCITY(FT*FT/SEC.) =   1.61
  LONGEST FLOWPATH FROM NODE    920.00 TO NODE    922.00 =    1170.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    922.00 TO NODE    927.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   436.00
  FLOW LENGTH(FEET) =   674.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.38
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.73
  PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =   12.37
  LONGEST FLOWPATH FROM NODE    920.00 TO NODE    927.00 =    1844.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    927.00 TO NODE    927.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.37
  RAINFALL INTENSITY(INCH/HR) =   3.38
  TOTAL STREAM AREA(ACRES) =     6.18
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.73

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    925.00 TO NODE    926.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    450.50
  DOWNSTREAM ELEVATION(FEET) =    449.80
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.805
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.504
  SUBAREA RUNOFF(CFS) =      0.81
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.81

****************************************************************************
  FLOW PROCESS FROM NODE    926.00 TO NODE    927.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  448.00  DOWNSTREAM ELEVATION(FEET) =  441.80
  STREET LENGTH(FEET) =   604.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.66
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.22
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.38
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.88
  STREET FLOW TRAVEL TIME(MIN.) =   4.24   Tc(MIN.) =   10.04
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.865
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
  SUBAREA AREA(ACRES) =    4.96      SUBAREA RUNOFF(CFS) =   13.42
  TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =      13.99

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  15.53
  FLOW VELOCITY(FEET/SEC.) =  2.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.21
  LONGEST FLOWPATH FROM NODE    925.00 TO NODE    927.00 =     674.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    927.00 TO NODE    927.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.04
  RAINFALL INTENSITY(INCH/HR) =   3.87
  TOTAL STREAM AREA(ACRES) =     5.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.99

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       15.73    12.37        3.378          6.18
```

```
      2       13.99    10.04        3.865          5.17

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       26.76    10.04       3.865
      2       27.96    12.37       3.378

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      27.96   Tc(MIN.) =   12.37
  TOTAL AREA(ACRES) =       11.4
  LONGEST FLOWPATH FROM NODE    920.00 TO NODE    927.00 =    1844.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    927.00 TO NODE    928.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   436.00  DOWNSTREAM(FEET) =   375.00
  FLOW LENGTH(FEET) =   222.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  30.68
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.96
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   12.49
  LONGEST FLOWPATH FROM NODE    920.00 TO NODE    928.00 =    2066.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    927.00 TO NODE    928.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.357
  *USER SPECIFIED(SUBAREA):
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6952
  SUBAREA AREA(ACRES) =    1.20   SUBAREA RUNOFF(CFS) =    2.62
  TOTAL AREA(ACRES) =       12.6   TOTAL RUNOFF(CFS) =      29.29
  TC(MIN.) =   12.49

****************************************************************************
  FLOW PROCESS FROM NODE    928.00 TO NODE    919.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       29.29    12.49       3.357       12.55
  LONGEST FLOWPATH FROM NODE    920.00 TO NODE    919.00 =    2066.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      158.51    14.17       3.095       71.78
  LONGEST FLOWPATH FROM NODE    900.00 TO NODE    919.00 =    3212.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     169.04      12.49        3.357
      2     185.52      14.17        3.095

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     185.52   Tc(MIN.) =   14.17
  TOTAL AREA(ACRES) =       84.3

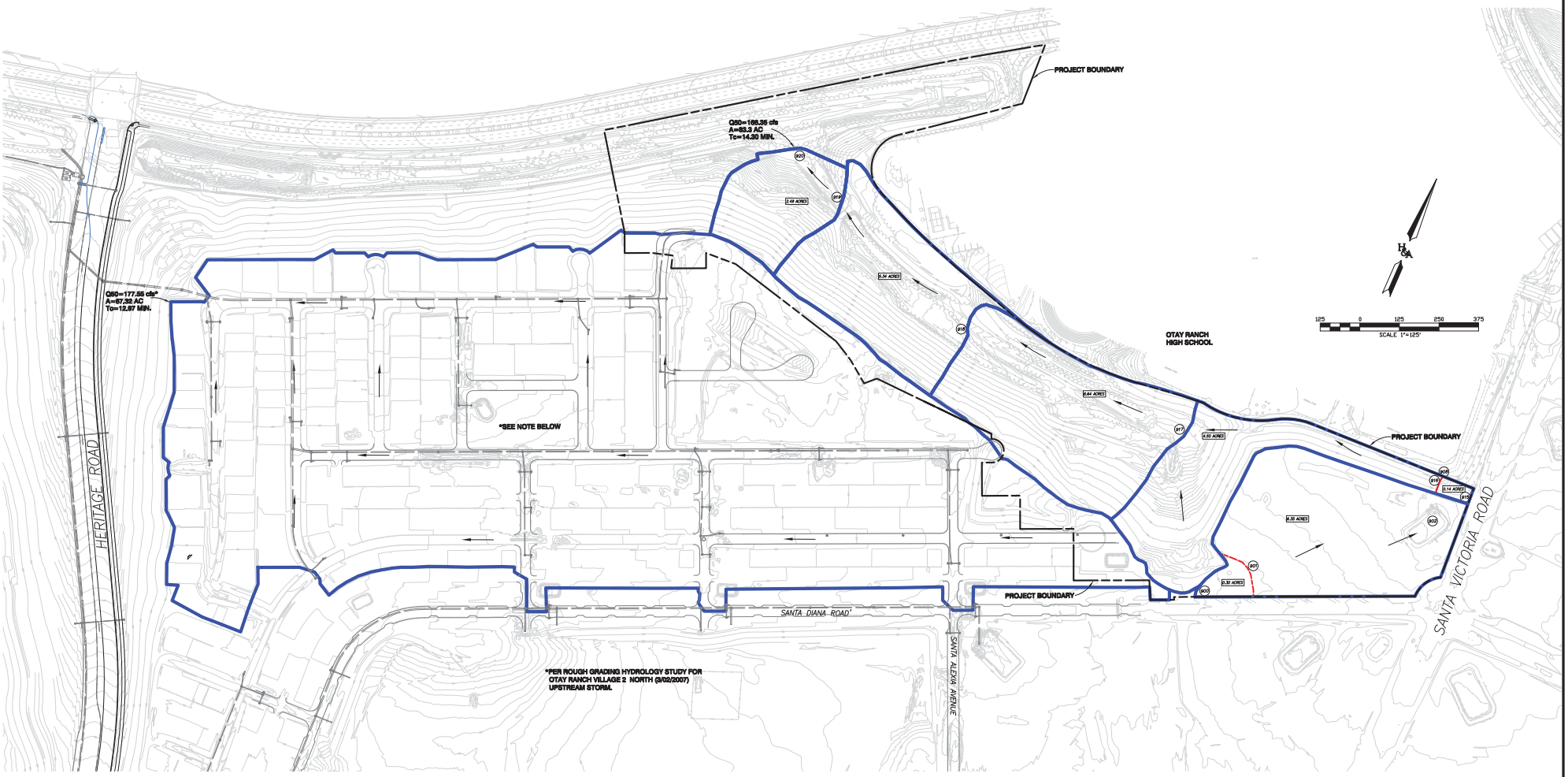
****************************************************************************
  FLOW PROCESS FROM NODE    919.00 TO NODE    919.00 IS CODE =  12
```

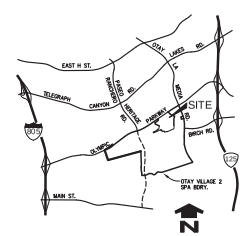
```
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       84.3  TC(MIN.) =     14.17
  PEAK FLOW RATE(CFS)   =     185.52
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 4

EXHIBIT 1.1
PRE-DEVELOPED CONDITION
HYDROLOGY MAP

EXHIBIT 1.2
DEVELOPED CONDITION
HYDROLOGY MAP





VICINITY MAP
NOT TO SCALE

LEGEND:

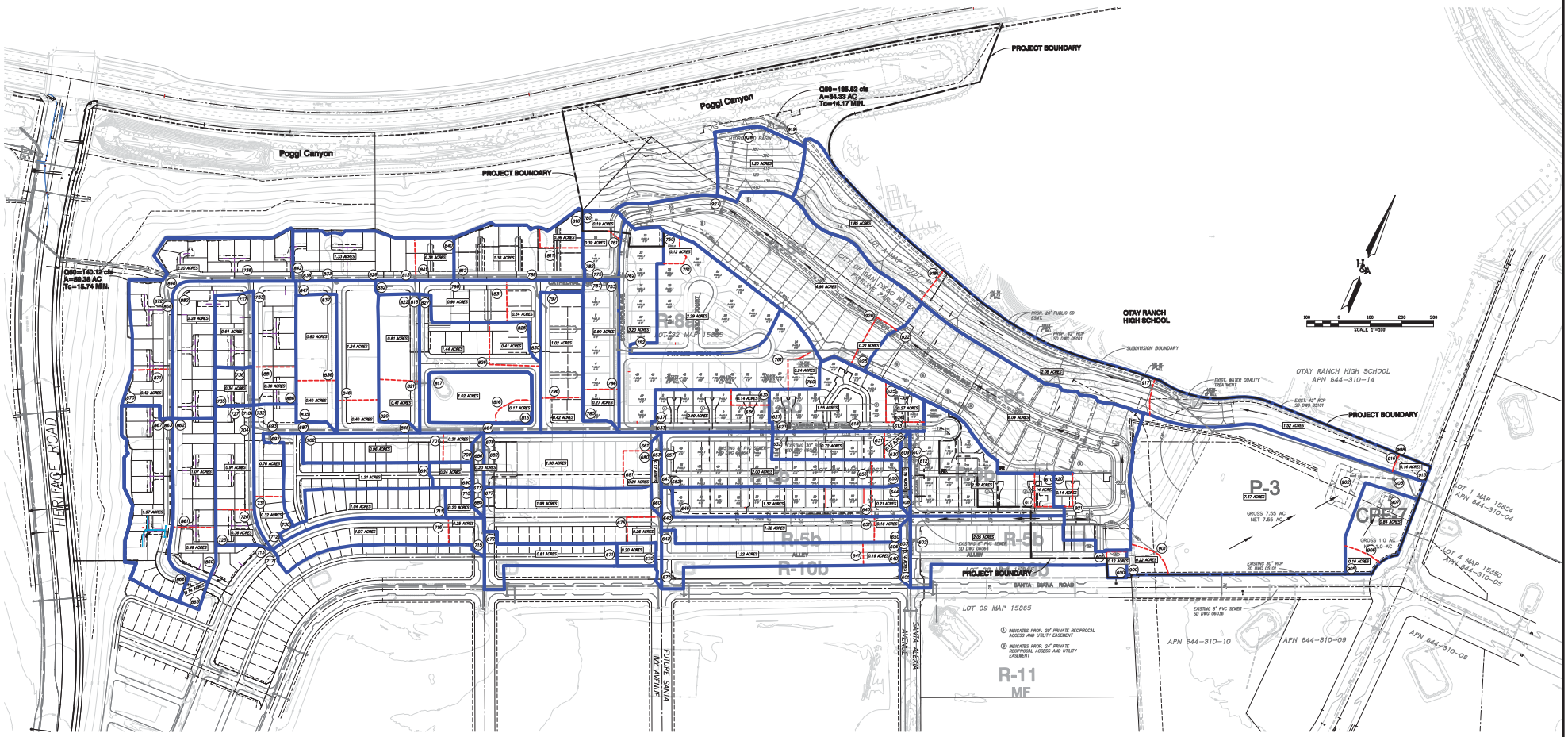
1639	HYDROLOGY NODE
7.26 ACRES	WATERSHED AREA
	SUBAREA BOUNDARY
	WATERSHED BOUNDARY

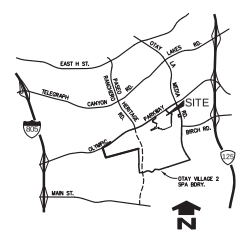
PREPARED BY:
HUNSAKER & ASSOCIATES
SAN DIEGO, INC.

EXHIBIT 1.1
EXISTING CONDITION HYDROLOGY MAP
OTAY RANCH VILLAGE 2 NORTH
CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 2

R:\1089\Hyd\ACAD\HYDRO\NORTH\1089$H01- Hydro EXIST - V2 North TM Exhibit 1.1.dwg[]Feb-21-2013:10:51





VICINITY MAP

NOT TO SCALE

LEGEND:

- HYDROLOGY NODE
- 7.26 ACRES — WATERSHED AREA
- SUBAREA BOUNDARY
- WATERSHED BOUNDARY

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC.

EXHIBIT 1.2
DEVELOPED CONDITION HYDROLOGY MAP

OTAY RANCH VILLAGE 2 NORTH

CITY OF CHULA VISTA, CALIFORNIA

SHEET 2 OF 2

R:\1089\Hyd\ACAD\HYDRO\NORTH\1089#H01- Hydro PROP - V2 North TM Exhibit 1.2.dwg[]Feb-22-2013:18:07

APPENDIX A

Excerpt from Rough Grading Hydrology Study for Otay Ranch Village 2, North March 2, 2007

HUNSAKER & ASSOCIATES
SAN DIEGO INC

PLANNING
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IRVINE
LOS ANGELES
RIVERSIDE
SAN DIEGO
ARIZONA

ROUGH GRADING HYDROLOGY STUDY For OTAY RANCH VILLAGE 2,NORTH

City of Chula Vista, California

Prepared for
Otay Ranch Company
610 West Ash Street
Suite 1500
San Diego, CA 92101

w.o. 0025-363

March 2, 2007

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RE:kc H:\REPORTS\0025\363\NORTH\ao6- RG.doc
w.o. 0025-363 3/2/2007 11:38 AM

'ULTIMATE CONDITION'

LEGEND SCALE 1"= 100'

WATERSHED BOUNDARY

SUBAREA BOUNDARY

NODES

PREPARED FOR:

HUNSAKER & ASSOCIATES

ROUGH GRADING HYDROLOGY MAP FOR

OTAY RANCH VILLAGE 2 - NORTH

CITY OF CHULA VISTA, CALIFORNIA

MAP 2

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                       2003,1985,1981 HYDROLOGY MANUAL
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 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch, Village 2, Phase 2 NORTH - ULTIMATE Rough Grade Hydrology    *
* 50-Year Return Interval                                                  *
* W.O. 25-343                                                              *
 ****************************************************************************

  FILE NAME: H:\AES2003\0025\361\NORTH\RG50.DAT
  TIME/DATE OF STUDY: 14:42 01/29/2007
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  50.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.300
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)   (FT)  (FT)  (FT)    (n)
***  ***** ********* ***************** ****** ***** ****** ***** *******
  1   17.0      8.5   0.020/0.020/0.020   0.50   1.50 0.0313 0.125 0.0160
  2   29.0     14.5   0.020/0.020/0.020   0.50   1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    455.40
  DOWNSTREAM ELEVATION(FEET) =    454.75
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.959
  SUBAREA RUNOFF(CFS) =      1.08
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  453.00  DOWNSTREAM ELEVATION(FEET) =  451.00
  STREET LENGTH(FEET) =   228.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.50
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DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.67
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.34
  HALFSTREET FLOOD WIDTH(FEET) =   10.84
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.06
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.71
STREET FLOW TRAVEL TIME(MIN.) =   1.85   Tc(MIN.) =   8.93
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.910
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     0.86      SUBAREA RUNOFF(CFS) =     3.17
TOTAL AREA(ACRES) =      1.10        PEAK FLOW RATE(CFS) =       4.05

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.91
FLOW VELOCITY(FEET/SEC.) =  2.27   DEPTH*VELOCITY(FT*FT/SEC.) =   0.87
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =   394.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   444.00
FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.63
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       4.05
PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   7.02
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =   334.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    310.00 TO NODE    311.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    462.00
DOWNSTREAM ELEVATION(FEET) =    461.35
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.078
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =       0.90
TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.90

****************************************************************************
FLOW PROCESS FROM NODE    311.00 TO NODE    312.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  461.00  DOWNSTREAM ELEVATION(FEET) =  449.00
STREET LENGTH(FEET) =   881.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00
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DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =    8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.64
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.31
  HALFSTREET FLOOD WIDTH(FEET) =    9.28
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.87
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
STREET FLOW TRAVEL TIME(MIN.) =   6.07   Tc(MIN.) =  11.15
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.612
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    2.67      SUBAREA RUNOFF(CFS) =    7.23
TOTAL AREA(ACRES) =      2.87        PEAK FLOW RATE(CFS) =       7.78

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.53
FLOW VELOCITY(FEET/SEC.) =  2.69   DEPTH*VELOCITY(FT*FT/SEC.) =   0.96
LONGEST FLOWPATH FROM NODE    310.00 TO NODE    312.00 =   928.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    312.00 TO NODE    313.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  11.15
RAINFALL INTENSITY(INCH/HR) =   3.61
TOTAL STREAM AREA(ACRES) =      2.87
PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.78

****************************************************************************
FLOW PROCESS FROM NODE    320.00 TO NODE    321.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    451.00
DOWNSTREAM ELEVATION(FEET) =    450.35
ELEVATION DIFFERENCE(FEET) =       0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.902
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1A of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.049
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =       0.44
TOTAL AREA(ACRES) =       0.08   TOTAL RUNOFF(CFS) =       0.44

****************************************************************************
FLOW PROCESS FROM NODE    321.00 TO NODE    313.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   2.90
RAINFALL INTENSITY(INCH/HR) =   6.05
TOTAL STREAM AREA(ACRES) =      0.08
PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.44

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
   1        7.78     11.15       3.612         2.87
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    2        0.44     2.90        6.060          0.08

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc       INTENSITY
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
    1         2.46     2.90        6.060
    2         8.04    11.15        1.612

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      8.04   Tc(MIN.) =   11.15
  TOTAL AREA(ACRES) =      2.95
  LONGEST FLOWPATH FROM NODE    310.00 TO NODE    311.00 =   928.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   444.00
  FLOW LENGTH(FEET) =    73.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.27
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.04
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =  11.32
  LONGEST FLOWPATH FROM NODE    310.00 TO NODE    303.00 =  1001.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
****************************************************************************

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc       INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
    1         8.04    11.32        3.578         2.99
  LONGEST FLOWPATH FROM NODE    310.00 TO NODE    303.00 =  1001.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc       INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
    1         4.05     7.02        4.871         1.10
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =   334.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc       INTENSITY
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
    1         9.03     7.02        4.871
    2        11.01    11.32        3.578

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     11.01   Tc(MIN.) =   11.32
  TOTAL AREA(ACRES) =      4.05

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    322.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   444.00  DOWNSTREAM(FEET) =   441.90
  FLOW LENGTH(FEET) =   321.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.79
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   2
  PIPE-FLOW(CFS) =     11.01
  PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =  12.11
  LONGEST FLOWPATH FROM NODE    310.00 TO NODE    322.00 =  1322.00 FEET.

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  FLOW PROCESS FROM NODE    322.00 TO NODE    322.00 IS CODE =  1
----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
**********************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  12.11
  RAINFALL INTENSITY(INCH/HR) =   3.43
  TOTAL STREAM AREA(ACRES) =     4.05
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.01

**********************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    331.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
**********************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =  0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    451.00
  DOWNSTREAM ELEVATION(FEET) =    450.38
  ELEVATION DIFFERENCE(FEET) =      0.62
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.63
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.63

**********************************************************************
  FLOW PROCESS FROM NODE    331.00 TO NODE    332.00 IS CODE =  61
----------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
**********************************************************************
  UPSTREAM ELEVATION(FEET) =  449.00  DOWNSTREAM ELEVATION(FEET) =  445.50
  STREET LENGTH(FEET) =   347.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.50

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.63
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.71
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.65
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.47
  STREET FLOW TRAVEL TIME(MIN.) =   3.13   Tc(MIN.) =   8.21
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.403
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =  0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.20      SUBAREA RUNOFF(CFS) =    3.96
  TOTAL AREA(ACRES) =      1.34        PEAK FLOW RATE(CFS) =       4.42

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.72
  FLOW VELOCITY(FEET/SEC.) =  2.08   DEPTH*VELOCITY(FT*FT/SEC.) =   0.67
  LONGEST FLOWPATH FROM NODE    330.00 TO NODE    332.00 =   412.00 FEET.

**********************************************************************
  FLOW PROCESS FROM NODE    332.00 TO NODE    322.00 IS CODE =  1
----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
**********************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.21
  RAINFALL INTENSITY(INCH/HR) =   4.40
  TOTAL STREAM AREA(ACRES) =     1.34
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PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.42

****************************************************************************
FLOW PROCESS FROM NODE    340.00 TO NODE    341.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    454.60
DOWNSTREAM ELEVATION(FEET) =    453.95
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      0.99
TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.99

****************************************************************************
FLOW PROCESS FROM NODE    341.00 TO NODE    342.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  452.50  DOWNSTREAM ELEVATION(FEET) =  445.50
STREET LENGTH(FEET) =   551.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.50

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.22
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.32
  HALFSTREET FLOOD WIDTH(FEET) =    5.91
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.37
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.77
STREET FLOW TRAVEL TIME(MIN.) =   3.87   Tc(MIN.) =   8.95
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.163
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    2.66      SUBAREA RUNOFF(CFS) =    8.30
TOTAL AREA(ACRES) =      2.88        PEAK FLOW RATE(CFS) =       8.99

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.47
FLOW VELOCITY(FEET/SEC.) =  2.69   DEPTH*VELOCITY(FT*FT/SEC.) =   1.01
LONGEST FLOWPATH FROM NODE    340.00 TO NODE    342.00 =   616.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    342.00 TO NODE    322.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =   8.95
RAINFALL INTENSITY(INCH/HR) =   4.16
TOTAL STREAM AREA(ACRES) =     2.88
PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.95

** CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
    1       11.01     12.11        3.426          4.05
    2        4.42      8.21        4.403          1.34
    3        8.98      8.95        4.163          2.88
```

6

```
RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
   1        20.13     8.21       4.403
   2        21.31     8.95       4.161
   3        21.85    12.11       3.426

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     21.85   Tc(MIN.) =   12.11
TOTAL AREA(ACRES) =      8.27
LONGEST FLOWPATH FROM NODE    310.00 TO NODE    322.00 =  1322.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    322.00 TO NODE    343.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   438.00
FLOW LENGTH(FEET) =   171.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.56
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     21.85
PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =  12.44
LONGEST FLOWPATH FROM NODE    310.00 TO NODE    343.00 =  1495.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    343.00 TO NODE    343.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  12.44
RAINFALL INTENSITY(INCH/HR) =   3.37
TOTAL STREAM AREA(ACRES) =      8.27
PEAK FLOW RATE(CFS) AT CONFLUENCE =     21.85

****************************************************************************
FLOW PROCESS FROM NODE    350.00 TO NODE    351.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
GENERAL COMMERCIAL RUNOFF COEFFICIENT =  .8500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
UPSTREAM ELEVATION(FEET) =    453.00
DOWNSTREAM ELEVATION(FEET) =    451.50
ELEVATION DIFFERENCE(FEET) =      1.50
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.093
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      2.63
TOTAL AREA(ACRES) =      0.51   TOTAL RUNOFF(CFS) =      2.63

****************************************************************************
FLOW PROCESS FROM NODE    351.00 TO NODE    352.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  445.00  DOWNSTREAM ELEVATION(FEET) =  439.00
STREET LENGTH(FEET) =   410.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 36.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  18.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.90
```

```
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.31
  HALFSTREET FLOOD WIDTH(FEET) =    9.27
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.99
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.24
STREET FLOW TRAVEL TIME(MIN.) =   1.71   Tc(MIN.) =   4.80
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
GENERAL COMMERCIAL RUNOFF COEFFICIENT = .7000
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.760
SUBAREA AREA(ACRES) =     0.60      SUBAREA RUNOFF(CFS) =     2.55
TOTAL AREA(ACRES) =       1.11        PEAK FLOW RATE(CFS) =       5.17

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.49
FLOW VELOCITY(FEET/SEC.) =  4.24   DEPTH*VELOCITY(FT*FT/SEC.) =   1.43
LONGEST FLOWPATH FROM NODE    350.00 TO NODE    352.00 =   485.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    353.00 TO NODE    352.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
****************************************************************************
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7645
SUBAREA AREA(ACRES) =     0.34   SUBAREA RUNOFF(CFS) =     1.59
TOTAL AREA(ACRES) =       1.45   TOTAL RUNOFF(CFS) =     6.72
TC(MIN.) =   4.80

****************************************************************************
FLOW PROCESS FROM NODE    352.00 TO NODE    343.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   4.80
RAINFALL INTENSITY(INCH/HR) =   6.06
TOTAL STREAM AREA(ACRES) =      1.45
PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.72

****************************************************************************
FLOW PROCESS FROM NODE    355.00 TO NODE    356.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
GENERAL COMMERCIAL RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
UPSTREAM ELEVATION(FEET) =    446.00
DOWNSTREAM ELEVATION(FEET) =    445.40
ELEVATION DIFFERENCE(FEET) =      0.60
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.880
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =       1.36
TOTAL AREA(ACRES) =       0.30   TOTAL RUNOFF(CFS) =       1.36

****************************************************************************
FLOW PROCESS FROM NODE    356.00 TO NODE    357.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  445.00  DOWNSTREAM ELEVATION(FEET) =  429.00
STREET LENGTH(FEET) =   371.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 36.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  18.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
```

```
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.10
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.29
  HALFSTREET FLOOD WIDTH(FEET) =    8.43
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.39
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.18
STREET FLOW TRAVEL TIME(MIN.) =   1.55   Tc(MIN.) =   8.43
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.152
*USER SPECIFIED(SUBAREA):
GENERAL COMMERCIAL RUNOFF COEFFICIENT = .7000
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.711
SUBAREA AREA(ACRES) =    1.07      SUBAREA RUNOFF(CFS) =    3.86
TOTAL AREA(ACRES) =      1.37        PEAK FLOW RATE(CFS) =       5.02

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.10
FLOW VELOCITY(FEET/SEC.) =  4.41   DEPTH*VELOCITY(FT*FT/SEC.) =   1.45
LONGEST FLOWPATH FROM NODE    355.00 TO NODE    357.00 =   431.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    357.00 TO NODE    343.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   6.43
RAINFALL INTENSITY(INCH/HR) =   5.15
TOTAL STREAM AREA(ACRES) =     1.37
PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.02

** CONFLUENCE DATA **
STREAM      RUNOFF       Tc       INTENSITY       AREA
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1        21.85     12.44        3.366          8.27
    2         6.72      4.80        6.060          1.45
    3         5.02      6.43        5.152          1.37

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS:

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF       Tc       INTENSITY
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        22.60      4.80        6.060
    2        25.01      6.43        5.152
    3        28.86     12.44        3.366

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     28.86   Tc(MIN.) =   12.44
TOTAL AREA(ACRES) =     11.09
LONGEST FLOWPATH FROM NODE    310.00 TO NODE    343.00 =  1495.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (4). DU/AC OR LESS) RUNOFF COEFFICIENT =  .7800
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    481.65
DOWNSTREAM ELEVATION(FEET) =    481.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
```

```
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
 SUBAREA RUNOFF(CFS) =      0.76
 TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.76

****************************************************************************
 FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
 UPSTREAM ELEVATION(FEET) =  480.50  DOWNSTREAM ELEVATION(FEET) =  475.00
 STREET LENGTH(FEET) =   505.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.00
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.31
   HALFSTREET FLOOD WIDTH(FEET) =    9.18
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.09
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
 STREET FLOW TRAVEL TIME(MIN.) =   4.04   Tc(MIN.) =   9.11
   50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.114
 *USER SPECIFIED(SUBAREA):
 RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT =  .5500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.760
 SUBAREA AREA(ACRES) =    2.06      SUBAREA RUNOFF(CFS) =    6.36
 TOTAL AREA(ACRES) =      2.23        PEAK FLOW RATE(CFS) =       6.88

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.57
 FLOW VELOCITY(FEET/SEC.) =  2.36   DEPTH*VELOCITY(FT*FT/SEC.) =   0.84
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =   570.00 FEET

****************************************************************************
 FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   9.11
 RAINFALL INTENSITY(INCH/HR) =   4.11
 TOTAL STREAM AREA(ACRES) =      2.23
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.88

****************************************************************************
 FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
 *USER SPECIFIED(SUBAREA):
 RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT =  .8500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   133.00
 UPSTREAM ELEVATION(FEET) =    477.00
 DOWNSTREAM ELEVATION(FEET) =    475.00
 ELEVATION DIFFERENCE(FEET) =      2.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.287
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    70.04
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.969
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.72
 TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
 FLOW PROCESS FROM NODE    606.00 TO NODE    603.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 3.29
RAINFALL INTENSITY(INCH/HR) = 6.06
TOTAL STREAM AREA(ACRES) = 0.14
PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.72

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
   1         6.88     9.11       4.114         2.23
   2         0.72     3.29       6.066         0.14

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
   1         3.20     3.29       6.060
   2         7.37     9.11       4.114

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 7.37  Tc(MIN.) = 9.11
TOTAL AREA(ACRES) = 2.37
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 603.00 = 570.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE 603.00 TO NODE 607.00 IS CODE = 31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) = 470.00 DOWNSTREAM(FEET) = 468.00
FLOW LENGTH(FEET) = 297.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.36
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 7.37
PIPE TRAVEL TIME(MIN.) = 0.92 Tc(MIN.) = 10.04
LONGEST FLOWPATH FROM NODE 600.00 TO NODE 607.00 = 867.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE 607.00 TO NODE 607.00 IS CODE = 1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 10.04
RAINFALL INTENSITY(INCH/HR) = 3.87
TOTAL STREAM AREA(ACRES) = 2.37
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.37

****************************************************************************
FLOW PROCESS FROM NODE 608.00 TO NODE 609.00 IS CODE = 21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .8500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 197.00
UPSTREAM ELEVATION(FEET) = 476.00
DOWNSTREAM ELEVATION(FEET) = 473.00
ELEVATION DIFFERENCE(FEET) = 3.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 3.338
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH = 72.84
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE
SUBAREA RUNOFF(CFS) = 0.82
TOTAL AREA(ACRES) = 0.16  TOTAL RUNOFF(CFS) = 0.82

****************************************************************************
FLOW PROCESS FROM NODE 609.00 TO NODE 607.00 IS CODE = 1
----------------------------------------------------------------------------
```

```
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   3.34
RAINFALL INTENSITY(INCH/HR) =   6.06
TOTAL STREAM AREA(ACRES) =     0.16
PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.92

****************************************************************************
FLOW PROCESS FROM NODE    610.00 TO NODE    611.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    479.65
DOWNSTREAM ELEVATION(FEET) =    479.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.075
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.26
TOTAL AREA(ACRES) =      0.28   TOTAL RUNOFF(CFS) =      1.26

****************************************************************************
FLOW PROCESS FROM NODE    611.00 TO NODE    612.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  479.00  DOWNSTREAM ELEVATION(FEET) =  473.00
STREET LENGTH(FEET) =   463.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.88
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.32
  HALFSTREET FLOOD WIDTH(FEET) =    9.60
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.35
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.75
STREET FLOW TRAVEL TIME(MIN.) =   3.29   Tc(MIN.) =   6.37
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.347
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     2.19      SUBAREA RUNOFF(CFS) =     7.14
TOTAL AREA(ACRES) =      2.47        PEAK FLOW RATE(CFS) =       8.05

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.85
FLOW VELOCITY(FEET/SEC.) =  2.65   DEPTH*VELOCITY(FT*FT/SEC.) =   0.96
LONGEST FLOWPATH FROM NODE    610.00 TO NODE    612.00 =   528.00 FEET

****************************************************************************
FLOW PROCESS FROM NODE    612.00 TO NODE    607.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =   6.37
RAINFALL INTENSITY(INCH/HR) =   4.35
TOTAL STREAM AREA(ACRES) =     2.47
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.51
```

```
** CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
   1         7.37     10.04        3.866         2.37
   2         0.82      3.34        6.060         0.16
   3         8.05      8.37        4.347         2.47

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF      Tc       INTENSITY
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
   1         8.74      3.34        6.060
   2        15.20      8.37        4.347
   3        15.05     10.04        3.866

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     15.20   Tc(MIN.) =     8.37
TOTAL AREA(ACRES) =      5.00
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =   867.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    607.00 TO NODE    613.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   469.00  DOWNSTREAM(FEET) =   467.00
FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  11.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.13
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     15.20
PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   8.48
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    613.00 =   927.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    613.00 TO NODE    613.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   8.48
RAINFALL INTENSITY(INCH/HR) =   4.31
TOTAL STREAM AREA(ACRES) =     5.00
PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.20

****************************************************************************
FLOW PROCESS FROM NODE    615.00 TO NODE    616.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    482.00
DOWNSTREAM ELEVATION(FEET) =    481.35
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.93
TOTAL AREA(ACRES) =      0.43   TOTAL RUNOFF(CFS) =      1.93

****************************************************************************
FLOW PROCESS FROM NODE    616.00 TO NODE    617.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  481.00  DOWNSTREAM ELEVATION(FEET) =  473.00
STREET LENGTH(FEET) =   527.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00
```

```
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        4.85
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.37
  HALFSTREET FLOOD WIDTH(FEET) =   12.41
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.92
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.09
STREET FLOW TRAVEL TIME(MIN.) =   3.01   Tc(MIN.) =   8.08
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.445
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     1.73      SUBAREA RUNOFF(CFS) =     5.77
TOTAL AREA(ACRES) =      2.16        PEAK FLOW RATE(CFS) =       7.20

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.59
FLOW VELOCITY(FEET/SEC.) =  3.20   DEPTH*VELOCITY(FT*FT/SEC.) =   1.34
LONGEST FLOWPATH FROM NODE    615.00 TO NODE    617.00 =   592.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    617.00 TO NODE    613.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   470.00  DOWNSTREAM(FEET) =   467.00
FLOW LENGTH(FEET) =   172.00   MANNING'S N =  0.011
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.77
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       7.20
PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =   8.45
LONGEST FLOWPATH FROM NODE    615.00 TO NODE    613.00 =   784.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    613.00 TO NODE    613.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   8.45
RAINFALL INTENSITY(INCH/HR) =   4.32
TOTAL STREAM AREA(ACRES) =     2.16
PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.20

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
    1       15.20     8.48        4.311          5.00
    2        7.20     8.45        4.319          2.16

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
    1       22.37     8.45        4.319
    2       22.38     8.48        4.311

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     22.38   Tc(MIN.) =    8.48
TOTAL AREA(ACRES) =      7.16
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    613.00 =   827.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    613.00 TO NODE    618.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   467.00  DOWNSTREAM(FEET) =   466.00
FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  11.26
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =     22.38
PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   8.54
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    618.00 =   969.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    618.00 TO NODE    623.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   467.00  DOWNSTREAM(FEET) =   464.00
FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.56
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =     22.38
PIPE TRAVEL TIME(MIN.) =   0.80    Tc(MIN.) =   9.34
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    623.00 =  1336.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    623.00 TO NODE    623.00 IS CODE =  1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   9.34
RAINFALL INTENSITY(INCH/HR) =   4.05
TOTAL STREAM AREA(ACRES) =      7.16
PEAK FLOW RATE(CFS) AT CONFLUENCE =     22.38

****************************************************************************
FLOW PROCESS FROM NODE    625.00 TO NODE    626.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    472.65
DOWNSTREAM ELEVATION(FEET) =    472.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    55.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.53
TOTAL AREA(ACRES) =      0.34   TOTAL RUNOFF(CFS) =      1.53

****************************************************************************
FLOW PROCESS FROM NODE    626.00 TO NODE    627.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  471.00  DOWNSTREAM ELEVATION(FEET) =  469.00
STREET LENGTH(FEET) =   277.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.91
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
  STREET FLOW DEPTH(FEET) =  0.36
  HALFSTREET FLOOD WIDTH(FEET) =   11.71
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.95
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
STREET FLOW TRAVEL TIME(MIN.) =   3.36   Tc(MIN.) =   7.44
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.698
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.78      SUBAREA RUNOFF(CFS) =    2.74
TOTAL AREA(ACRES) =      1.12        PEAK FLOW RATE(CFS) =       3.94

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.35
FLOW VELOCITY(FEET/SEC.) =  2.10   DEPTH*VELOCITY(FT*FT/SEC.) =   0.82
LONGEST FLOWPATH FROM NODE    625.00 TO NODE    627.00 =   342.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    627.00 TO NODE    623.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   7.44
RAINFALL INTENSITY(INCH/HR) =   4.69
TOTAL STREAM AREA(ACRES) =      1.12
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.94

****************************************************************************
FLOW PROCESS FROM NODE    630.00 TO NODE    631.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    472.65
DOWNSTREAM ELEVATION(FEET) =    472.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      0.54
TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
FLOW PROCESS FROM NODE    631.00 TO NODE    632.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  472.00  DOWNSTREAM ELEVATION(FEET) =  469.00
STREET LENGTH(FEET) =   342.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.75
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.31
  HALFSTREET FLOOD WIDTH(FEET) =    9.94
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.87
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.57
STREET FLOW TRAVEL TIME(MIN.) =   3.06   Tc(MIN.) =   8.14
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.426
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
```

```
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     0.72      SUBAREA RUNOFF(CFS) =     2.39
TOTAL AREA(ACRES) =       0.84        PEAK FLOW RATE(CFS) =       2.79

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.15   HALFSTREET FLOOD WIDTH(FEET) =  11.07
FLOW VELOCITY(FEET/SEC.) =  2.07   DEPTH*VELOCITY(FT*FT/SEC.) =   0.32
LONGEST FLOWPATH FROM NODE    630.00 TO NODE    632.00 =   408.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    632.00 TO NODE    633.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =   8.14
RAINFALL INTENSITY(INCH/HR) =   4.43
TOTAL STREAM AREA(ACRES) =      0.84
PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.79

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
    1       22.38     9.34        4.050         7.16
    2        3.94     7.44        4.688         1.12
    3        2.79     8.14        4.426         0.84

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
    1       25.83     7.44        4.688
    2       26.99     8.14        4.426
    3       28.34     9.34        4.050

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     28.34   Tc(MIN.) =    9.34
TOTAL AREA(ACRES) =      9.12
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    621.00 =  1336.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   464.00  DOWNSTREAM(FEET) =   460.00
FLOW LENGTH(FEET) =   371.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.93
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     28.34
PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =  10.03
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    633.00 =  1707.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  10.03
RAINFALL INTENSITY(INCH/HR) =   3.87
TOTAL STREAM AREA(ACRES) =      9.12
PEAK FLOW RATE(CFS) AT CONFLUENCE =     28.34

****************************************************************************
FLOW PROCESS FROM NODE    635.00 TO NODE    636.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    95.00
UPSTREAM ELEVATION(FEET) =    469.00
```

```
DOWNSTREAM ELEVATION(FEET) =    466.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =       1.35
TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.35

****************************************************************************
FLOW PROCESS FROM NODE    616.00 TO NODE    617.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  467.00  DOWNSTREAM ELEVATION(FEET) =  465.00
STREET LENGTH(FEET) =   260.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.75
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.35
  HALFSTREET FLOOD WIDTH(FEET) =   11.29
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.98
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
STREET FLOW TRAVEL TIME(MIN.) =   2.19   Tc(MIN.) =   7.27
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.759
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.78       SUBAREA RUNOFF(CFS) =    2.78
TOTAL AREA(ACRES) =      1.08        PEAK FLOW RATE(CFS) =       3.85

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.97
FLOW VELOCITY(FEET/SEC.) =  2.14   DEPTH*VELOCITY(FT*FT/SEC.) =   0.83
LONGEST FLOWPATH FROM NODE    635.00 TO NODE    637.00 =   325.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    637.00 TO NODE    633.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   7.27
RAINFALL INTENSITY(INCH/HR) =   4.75
TOTAL STREAM AREA(ACRES) =      1.08
PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.85

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       28.34    10.03       3.867         9.12
    2        3.85     7.27       4.759         1.08

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    2       28.89     7.27       4.759
    1       31.47    10.03       3.867

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     31.47   Tc(MIN.) =   10.03
TOTAL AREA(ACRES) =     10.20
```

```
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    633.00 =  1707.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    640.00 TO NODE    641.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (4). DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    475.65
DOWNSTREAM ELEVATION(FEET) =    475.09
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.979
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      0.85
TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.85

****************************************************************************
FLOW PROCESS FROM NODE    641.00 TO NODE    642.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  474.50  DOWNSTREAM ELEVATION(FEET) =  468.00
STREET LENGTH(FEET) =   690.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.52
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.28
  HALFSTREET FLOOD WIDTH(FEET) =    7.48
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.78
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.50
STREET FLOW TRAVEL TIME(MIN.) =   6.47   Tc(MIN.) =  11.55
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.531
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (4). DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.760
SUBAREA AREA(ACRES) =     1.22      SUBAREA RUNOFF(CFS) =     3.23
TOTAL AREA(ACRES) =      1.41        PEAK FLOW RATE(CFS) =       3.71

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.18
FLOW VELOCITY(FEET/SEC.) =  1.94   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
LONGEST FLOWPATH FROM NODE    640.00 TO NODE    642.00 =   755.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    642.00 TO NODE    643.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   462.00  DOWNSTREAM(FEET) =   461.00
FLOW LENGTH(FEET) =   148.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.62
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      3.73
```

```
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =  12.08
  LONGEST FLOWPATH FROM NODE    640.00 TO NODE    643.00 =   903.00 FEET

****************************************************************************
  FLOW PROCESS FROM NODE    643.00 TO NODE    643.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  12.08
  RAINFALL INTENSITY(INCH/HR) =   3.43
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.73

****************************************************************************
  FLOW PROCESS FROM NODE    644.00 TO NODE    645.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =  0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    474.65
  DOWNSTREAM ELEVATION(FEET) =    474.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.078
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.94
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.94

****************************************************************************
  FLOW PROCESS FROM NODE    645.00 TO NODE    646.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  473.50  DOWNSTREAM ELEVATION(FEET) =  467.00
  STREET LENGTH(FEET) =   621.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.03
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.27
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
  STREET FLOW TRAVEL TIME(MIN.) =   4.57   Tc(MIN.) =   9.65
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.966
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT =  .7500
  S.C.S. CURVE NUMBER (AMC II) =  0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.37      SUBAREA RUNOFF(CFS) =    4.09
  TOTAL AREA(ACRES) =      1.58        PEAK FLOW RATE(CFS) =       4.70

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.22
  FLOW VELOCITY(FEET/SEC.) =  2.52   DEPTH*VELOCITY(FT*FT/SEC.) =   0.98
  LONGEST FLOWPATH FROM NODE    644.00 TO NODE    646.00 =   686.00 FEET

****************************************************************************
  FLOW PROCESS FROM NODE    646.00 TO NODE    641.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
```

```
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   9.65
RAINFALL INTENSITY(INCH/HR) =   3.97
TOTAL STREAM AREA(ACRES) =      1.58
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.70

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1        3.73    12.08       3.430         1.41
    2        4.70     9.65       3.966         1.58

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1        7.50     9.65       3.966
    2        7.80    12.08       3.430

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      7.80   Tc(MIN.) =   12.08
TOTAL AREA(ACRES) =      2.99
LONGEST FLOWPATH FROM NODE    640.00 TO NODE    643.00 =   903.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    643.00 TO NODE    647.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   462.00  DOWNSTREAM(FEET) =   461.00
FLOW LENGTH(FEET) =    93.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.55
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =  1
PIPE-FLOW(CFS) =      7.80
PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =  12.32
LONGEST FLOWPATH FROM NODE    640.00 TO NODE    647.00 =   996.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    647.00 TO NODE    647.00 IS CODE =  1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  12.32
RAINFALL INTENSITY(INCH/HR) =   3.39
TOTAL STREAM AREA(ACRES) =      2.99
PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.80

****************************************************************************
FLOW PROCESS FROM NODE    650.00 TO NODE    651.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT =  .7500
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    474.65
DOWNSTREAM ELEVATION(FEET) =    474.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.979
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    68.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      0.72
TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.72

****************************************************************************
FLOW PROCESS FROM NODE    651.00 TO NODE    652.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
```

```
UPSTREAM ELEVATION(FEET) =  474.00  DOWNSTREAM ELEVATION(FEET) =  460.00
STREET LENGTH(FEET) =   769.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.59
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.33
  HALFSTREET FLOOD WIDTH(FEET) =   10.28
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.20
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
STREET FLOW TRAVEL TIME(MIN.) =   5.75   Tc(MIN.) =  10.83
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.682
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    1.32       SUBAREA RUNOFF(CFS) =    3.64
TOTAL AREA(ACRES) =      1.48         PEAK FLOW RATE(CFS) =       4.09

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.47
FLOW VELOCITY(FEET/SEC.) =  2.44   DEPTH*VELOCITY(FT*FT/SEC.) =   0.92
LONGEST FLOWPATH FROM NODE    650.00 TO NODE    652.00 =   825.00 FEET

****************************************************************************
FLOW PROCESS FROM NODE    652.00 TO NODE    647.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  10.83
RAINFALL INTENSITY(INCH/HR) =   3.68
TOTAL STREAM AREA(ACRES) =     1.48
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.09

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
    1        7.80    12.32        3.397         2.99
    2        4.09    10.83        3.682         1.48

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
    1       11.24    10.83       3.682
    2       11.56    12.32       3.397

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     11.56   Tc(MIN.) =   12.32
TOTAL AREA(ACRES) =      4.47
LONGEST FLOWPATH FROM NODE    640.00 TO NODE    647.00 =   986.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    647.00 TO NODE    653.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   462.00  DOWNSTREAM(FEET) =   461.00
FLOW LENGTH(FEET) =   111.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.70
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     11.56
PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =  12.60
LONGEST FLOWPATH FROM NODE    640.00 TO NODE    653.00 =  1109.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     653.00 TO NODE     653.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  12.60
  RAINFALL INTENSITY(INCH/HR) =   3.34
  TOTAL STREAM AREA(ACRES) =      4.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      11.56

****************************************************************************
  FLOW PROCESS FROM NODE     655.00 TO NODE     656.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =     65.00
  UPSTREAM ELEVATION(FEET) =     473.65
  DOWNSTREAM ELEVATION(FEET) =     473.00
  ELEVATION DIFFERENCE(FEET) =       0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =     5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =     65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =       0.81
  TOTAL AREA(ACRES) =       0.18   TOTAL RUNOFF(CFS) =       0.81

****************************************************************************
  FLOW PROCESS FROM NODE     656.00 TO NODE     657.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  473.00  DOWNSTREAM ELEVATION(FEET) =  461.00
  STREET LENGTH(FEET) =   735.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 10.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.69
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.40
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.24
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   5.46   Tc(MIN.) =  10.54
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.745
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.00      SUBAREA RUNOFF(CFS) =    5.62
  TOTAL AREA(ACRES) =      2.18        PEAK FLOW RATE(CFS) =       6.12

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.00
  FLOW VELOCITY(FEET/SEC.) =  2.56   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE    655.00 TO NODE    657.00 =   800.00 FEET

****************************************************************************
  FLOW PROCESS FROM NODE     657.00 TO NODE     657.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  10.54
  RAINFALL INTENSITY(INCH/HR) =   3.75
```

```
  TOTAL STREAM AREA(ACRES) =      2.18
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.12

****************************************************************************
  FLOW PROCESS FROM NODE     660.00 TO NODE     661.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   192.00
  UPSTREAM ELEVATION(FEET) =    467.00
  DOWNSTREAM ELEVATION(FEET) =    463.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.068
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    75.83
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =       0.88
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE     661.00 TO NODE     653.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   3.07
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =      0.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc       INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
     1        11.56    12.60        3.338         4.47
     2         6.12    10.54        3.745         2.18
     3         0.88     3.07        6.060         0.17

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc       INTENSITY
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
     1         9.02     3.07        6.060
     2        16.37    10.54        3.745
     3        17.50    12.60        3.338

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     17.50   Tc(MIN.) =   12.60
  TOTAL AREA(ACRES) =      6.82
  LONGEST FLOWPATH FROM NODE     640.00 TO NODE     653.00 =  1109.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     653.00 TO NODE     633.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   459.00  DOWNSTREAM(FEET) =   458.00
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.03
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     17.50
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =  12.72
  LONGEST FLOWPATH FROM NODE     640.00 TO NODE     633.00 =  1174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     633.00 TO NODE     633.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
****************************************************************************
```

```
** MAIN STREAM CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
   1         17.50     12.72       3.318         6.82
LONGEST FLOWPATH FROM NODE    640.00 TO NODE    633.00 =  1174.00 FEET.

** MEMORY BANK #  1 CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
   1         31.47     10.03       3.867        10.20
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    633.00 =  1707.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF       Tc       INTENSITY
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
   1        45.27      10.03       3.867
   2        44.50      12.72       3.318

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     45.27   Tc(MIN.) =   10.03
TOTAL AREA(ACRES) =     17.02

****************************************************************************
FLOW PROCESS FROM NODE    633.00 TO NODE    633.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    633.00 TO NODE    664.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   458.00  DOWNSTREAM(FEET) =   453.00
FLOW LENGTH(FEET) =   559.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.32
ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     45.27
PIPE TRAVEL TIME(MIN.) =   1.00    Tc(MIN.) =  11.03
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    664.00 =  2266.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    664.00 TO NODE    664.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    670.00 TO NODE    671.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (43. DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    468.65
DOWNSTREAM ELEVATION(FEET) =    468.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION:
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      0.90
TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.90

****************************************************************************
FLOW PROCESS FROM NODE    671.00 TO NODE    672.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  467.50  DOWNSTREAM ELEVATION(FEET) =  461.00
STREET LENGTH(FEET) =   475.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
```

```
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.17
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.26
  HALFSTREET FLOOD WIDTH(FEET) =    6.51
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.01
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.51
STREET FLOW TRAVEL TIME(MIN.) =   3.95   Tc(MIN.) =   9.03
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.140
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (4.1 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.81       SUBAREA RUNOFF(CFS) =    2.52
TOTAL AREA(ACRES) =      1.01        PEAK FLOW RATE(CFS) =       3.14

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   7.80
FLOW VELOCITY(FEET/SEC.) =  2.16   DEPTH*VELOCITY(FT*FT/SEC.) =   0.61
LONGEST FLOWPATH FROM NODE    670.00 TO NODE    672.00 =   540.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    672.00 TO NODE    673.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   456.00  DOWNSTREAM(FEET) =   455.00
FLOW LENGTH(FEET) =   147.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.6 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.42
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       3.14
PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =   9.58
LONGEST FLOWPATH FROM NODE    670.00 TO NODE    673.00 =   687.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    673.00 TO NODE    673.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   9.58
RAINFALL INTENSITY(INCH/HR) =   3.98
TOTAL STREAM AREA(ACRES) =     1.01
PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.14

****************************************************************************
FLOW PROCESS FROM NODE    675.00 TO NODE    676.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    466.65
DOWNSTREAM ELEVATION(FEET) =    466.00
ELEVATION DIFFERENCE(FEET) =       0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.078
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-19 of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =       1.17
TOTAL AREA(ACRES) =       0.26   TOTAL RUNOFF(CFS) =       1.17

****************************************************************************
FLOW PROCESS FROM NODE    676.00 TO NODE    677.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  465.00  DOWNSTREAM ELEVATION(FEET) =  460.00
  STREET LENGTH(FEET) =   520.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.37
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.39
    HALFSTREET FLOOD WIDTH(FEET) =   13.04
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.40
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.93
  STREET FLOW TRAVEL TIME(MIN.) =   3.61   Tc(MIN.) =   8.69
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.244
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =     1.98      SUBAREA RUNOFF(CFS) =     6.10
  TOTAL AREA(ACRES) =       2.24        PEAK FLOW RATE(CFS) =       7.13

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  15.86
  FLOW VELOCITY(FEET/SEC.) =  2.71   DEPTH*VELOCITY(FT*FT/SEC.) =   1.20
  LONGEST FLOWPATH FROM NODE    676.00 TO NODE    677.00 =   585.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    677.00 TO NODE    673.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.69
  RAINFALL INTENSITY(INCH/HR) =   4.24
  TOTAL STREAM AREA(ACRES) =     2.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.13

  ** CONFLUENCE DATA **
  STREAM      RUNOFF       Tc       INTENSITY       AREA
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
      1         3.14      9.58        3.984          1.01
      2         7.13      8.69        4.244          2.24

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM      RUNOFF       Tc       INTENSITY
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
      1         9.97      8.69        4.244
      2         9.83      9.58        3.984

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      9.97   Tc(MIN.) =    8.69
  TOTAL AREA(ACRES) =      3.25
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    673.00 =   687.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    673.00 TO NODE    678.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   463.00  DOWNSTREAM(FEET) =   453.00
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.45
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      9.97
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =   8.91
```

```
 LONGEST FLOWPATH FROM NODE    670.00 TO NODE    678.00 =   789.00 FEET.
****************************************************************************
 FLOW PROCESS FROM NODE    678.00 TO NODE    678.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.91
 RAINFALL INTENSITY(INCH/HR) =    4.18
 TOTAL STREAM AREA(ACRES) =      1.25
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       9.97

****************************************************************************
 FLOW PROCESS FROM NODE    680.00 TO NODE    681.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
 *USER SPECIFIED(SUBAREA):
 RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =    465.65
 DOWNSTREAM ELEVATION(FEET) =    465.00
 ELEVATION DIFFERENCE(FEET) =       0.65
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
 SUBAREA RUNOFF(CFS) =       1.08
 TOTAL AREA(ACRES) =       0.24   TOTAL RUNOFF(CFS) =       1.08

****************************************************************************
 FLOW PROCESS FROM NODE    681.00 TO NODE    682.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
 UPSTREAM ELEVATION(FEET) =  464.50  DOWNSTREAM ELEVATION(FEET) =  458.00
 STREET LENGTH(FEET) =   498.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0260

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.28
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.37
   HALFSTREET FLOOD WIDTH(FEET) =   12.13
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.68
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
 STREET FLOW TRAVEL TIME(MIN.) =   3.09   Tc(MIN.) =   8.17
   50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.414
 *USER SPECIFIED(SUBAREA):
 RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
 SUBAREA AREA(ACRES) =    1.90       SUBAREA RUNOFF(CFS) =    6.29
 TOTAL AREA(ACRES) =      2.14         PEAK FLOW RATE(CFS) =       7.08

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.94
 FLOW VELOCITY(FEET/SEC.) =  3.01   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
 LONGEST FLOWPATH FROM NODE    680.00 TO NODE    682.00 =   563.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    682.00 TO NODE    678.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =   8.17
  RAINFALL INTENSITY(INCH/HR) =   4.41
  TOTAL STREAM AREA(ACRES) =     2.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.08

****************************************************************************
  FLOW PROCESS FROM NODE    685.00 TO NODE    686.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   200.00
  UPSTREAM ELEVATION(FEET) =    461.00
  DOWNSTREAM ELEVATION(FEET) =    458.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.686
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.50
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.91
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.91

****************************************************************************
  FLOW PROCESS FROM NODE    686.00 TO NODE    676.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   4.69
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =     0.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.91

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1        9.97     8.91        4.175         3.25
     2        7.08     8.17        4.414         2.14
     3        0.91     4.69        6.060         0.20

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       11.84     4.69       6.060
     2       17.18     8.17       4.414
     3       17.30     8.91       4.175

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     17.30   Tc(MIN.) =    8.91
  TOTAL AREA(ACRES) =      5.59
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    678.00 =   789.00 FEET

****************************************************************************
  FLOW PROCESS FROM NODE    678.00 TO NODE    664.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   453.00  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =    63.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.14
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     17.30
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    9.02
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    664.00 =   852.00 FEET

****************************************************************************
  FLOW PROCESS FROM NODE    664.00 TO NODE    664.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
```

```
****************************************************************************

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM      RUNOFF      Tc       INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
     1        17.30      9.02        4.141         5.59
  LONGEST FLOWPATH FROM NODE    670.00 TO NODE    664.00 =   862.00 FEET.

  ** MEMORY BANK # 1 CONFLUENCE DATA **
  STREAM      RUNOFF      Tc       INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
     1        45.27     11.03        3.637        17.02
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    664.00 =  2266.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF       Tc       INTENSITY
  NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
     1        54.33      9.02        4.141
     2        60.47     11.03        3.637

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     60.47   Tc(MIN.) =   11.03
  TOTAL AREA(ACRES) =     22.61

****************************************************************************
  FLOW PROCESS FROM NODE    664.00 TO NODE    664.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
  FLOW PROCESS FROM NODE    664.00 TO NODE    687.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   452.00  DOWNSTREAM(FEET) =   447.00
  FLOW LENGTH(FEET) =   562.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.89
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     60.47
  PIPE TRAVEL TIME(MIN.) =   0.95    Tc(MIN.) =  11.98
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    687.00 =  2628.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    687.00 TO NODE    687.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  11.98
  RAINFALL INTENSITY(INCH/HR) =   3.45
  TOTAL STREAM AREA(ACRES) =    22.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     60.47

****************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    458.65
  DOWNSTREAM ELEVATION(FEET) =    458.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      0.94
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.94

****************************************************************************
  FLOW PROCESS FROM NODE    701.00 TO NODE    702.00 IS CODE =  61
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  457.00  DOWNSTREAM ELEVATION(FEET) =  452.00
STREET LENGTH(FEET) =   441.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.53
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.33
  HALFSTREET FLOOD WIDTH(FEET) =   10.02
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.26
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
STREET FLOW TRAVEL TIME(MIN.) =   3.26   Tc(MIN.) =   8.34
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.358
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.96      SUBAREA RUNOFF(CFS) =    3.14
TOTAL AREA(ACRES) =      1.17        PEAK FLOW RATE(CFS) =       3.82

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.92
FLOW VELOCITY(FEET/SEC.) =  2.49   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
LONGEST FLOWPATH FROM NODE    700.00 TO NODE    702.00 =   506.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    702.00 TO NODE    687.00 IS CODE =  1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   8.34
RAINFALL INTENSITY(INCH/HR) =   4.36
TOTAL STREAM AREA(ACRES) =      1.17
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.82

** CONFLUENCE DATA **
STREAM      RUNOFF       Tc       INTENSITY      AREA
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
    1        60.47     11.98        3.449        22.61
    2         3.82      8.34        4.358         1.17

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF       Tc       INTENSITY
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        45.91      8.34        4.358
    2        63.49     11.98        3.449

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     63.49   Tc(MIN.) =   11.98
TOTAL AREA(ACRES) =      23.78
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    687.00 =  1824.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    687.00 TO NODE    693.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   447.00  DOWNSTREAM(FEET) =   446.00
FLOW LENGTH(FEET) =   108.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  39.0 INCH PIPE IS  26.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  10.42
ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     63.49
```

```
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =  12.15
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    693.00 =  2936.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    693.00 TO NODE    693.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  12.15
  RAINFALL INTENSITY(INCH/HR) =   3.42
  TOTAL STREAM AREA(ACRES) =    23.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     63.49

****************************************************************************
  FLOW PROCESS FROM NODE    690.00 TO NODE    691.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    459.65
  DOWNSTREAM ELEVATION(FEET) =    459.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.08
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    691.00 TO NODE    692.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  459.00  DOWNSTREAM ELEVATION(FEET) =  451.00
  STREET LENGTH(FEET) =   626.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 10.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.90
    ***STREET FLOW SPLITS OVER STREET-CROWN***
    FULL DEPTH(FEET) =    0.33   FLOOD WIDTH(FEET) =   10.00
    FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.38
    SPLIT DEPTH(FEET) =    0.16   SPLIT FLOOD WIDTH(FEET) =    1.53
    SPLIT FLOW(CFS) =    0.24   SPLIT VELOCITY(FEET/SEC.) =    1.71
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.38
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   4.39   Tc(MIN.) =   9.46
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.015
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.759
  SUBAREA AREA(ACRES) =    1.21      SUBAREA RUNOFF(CFS) =    3.64
  TOTAL AREA(ACRES) =      1.45        PEAK FLOW RATE(CFS) =       4.37

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.00
  FLOW VELOCITY(FEET/SEC.) =  2.38   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
  LONGEST FLOWPATH FROM NODE    690.00 TO NODE    692.00 =   691.00 FEET.

****************************************************************************
```

```
FLOW PROCESS FROM NODE    692.00 TO NODE    693.00 IS CODE =  1
----------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
**********************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   9.46
RAINFALL INTENSITY(INCH/HR) =   4.02
TOTAL STREAM AREA(ACRES) =      1.45
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.37

** CONFLUENCE DATA **
STREAM      RUNOFF      Tc      INTENSITY      AREA
NUMBER       (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1        63.49    12.15       3.418        23.78
    2         4.37     9.46       4.015         1.45

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF      Tc      INTENSITY
NUMBER       (CFS)    (MIN.)   (INCH/HOUR)
    1        58.41     9.46       4.015
    2        67.21    12.15       3.418

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     67.21   Tc(MIN.) =   12.15
TOTAL AREA(ACRES) =     25.23
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    693.00 =  2936.00 FEET

**********************************************************************
FLOW PROCESS FROM NODE    693.00 TO NODE    704.00 IS CODE =  31
----------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
**********************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   446.00  DOWNSTREAM(FEET) =   445.00
FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.19
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     67.21
PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  12.23
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    704.00 =  2996.00 FEET.

**********************************************************************
FLOW PROCESS FROM NODE    704.00 TO NODE    704.00 IS CODE =  10
----------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
**********************************************************************

**********************************************************************
FLOW PROCESS FROM NODE    710.00 TO NODE    711.00 IS CODE =  21
----------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
**********************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    460.65
DOWNSTREAM ELEVATION(FEET) =    460.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    69.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.990
SUBAREA RUNOFF(CFS) =      0.90
TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.90

**********************************************************************
FLOW PROCESS FROM NODE    711.00 TO NODE    712.00 IS CODE =  61
----------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
**********************************************************************
UPSTREAM ELEVATION(FEET) =  460.00  DOWNSTREAM ELEVATION(FEET) =  455.00
```

```
STREET LENGTH(FEET) =   534.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.50
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.34
  HALFSTREET FLOOD WIDTH(FEET) =   10.44
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.07
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.69
STREET FLOW TRAVEL TIME(MIN.) =   4.30   Tc(MIN.) =   9.38
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.040
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    1.04      SUBAREA RUNOFF(CFS) =    3.15
TOTAL AREA(ACRES) =      1.24        PEAK FLOW RATE(CFS) =       3.76

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.34
FLOW VELOCITY(FEET/SEC.) =  2.29   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
LONGEST FLOWPATH FROM NODE    710.00 TO NODE    712.00 =   599.00 FEET

****************************************************************************
FLOW PROCESS FROM NODE    712.00 TO NODE    713.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   9.38
RAINFALL INTENSITY(INCH/HR) =   4.04
TOTAL STREAM AREA(ACRES) =     1.24
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.76

****************************************************************************
FLOW PROCESS FROM NODE    715.00 TO NODE    716.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    460.65
DOWNSTREAM ELEVATION(FEET) =    460.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION:
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.12
TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      1.12

****************************************************************************
FLOW PROCESS FROM NODE    716.00 TO NODE    717.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  460.00  DOWNSTREAM ELEVATION(FEET) =  455.00
STREET LENGTH(FEET) =   370.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
```

```
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.74
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.35
  HALFSTREET FLOOD WIDTH(FEET) =   11.00
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.06
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =   0.71
STREET FLOW TRAVEL TIME(MIN.) =   4.60   Tc(MIN.) =   9.68
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.957
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    1.07      SUBAREA RUNOFF(CFS) =    3.18
TOTAL AREA(ACRES) =      1.32        PEAK FLOW RATE(CFS) =       3.92

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.49
FLOW VELOCITY(FEET/SEC.) =  2.27   DEPTH*VELOCITY(FT*FT/SEC.) =   0.86
LONGEST FLOWPATH FROM NODE    715.00 TO NODE    717.00 =   635.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    717.00 TO NODE    711.00 IS CODE =  1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   9.68
RAINFALL INTENSITY(INCH/HR) =   3.96
TOTAL STREAM AREA(ACRES) =     1.32
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.92

** CONFLUENCE DATA **
STREAM      RUNOFF      Tc      INTENSITY      AREA
NUMBER       (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1         3.76     9.38       4.040         1.24
    2         3.92     9.68       3.957         1.32

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF      Tc      INTENSITY
NUMBER       (CFS)    (MIN.)   (INCH/HOUR)
    1         7.55     9.38       4.040
    2         7.60     9.68       3.957

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      7.60   Tc(MIN.) =    9.68
TOTAL AREA(ACRES) =      2.56
LONGEST FLOWPATH FROM NODE    715.00 TO NODE    713.00 =   635.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    713.00 TO NODE    704.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   445.00
FLOW LENGTH(FEET) =   388.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.42
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      7.60
PIPE TRAVEL TIME(MIN.) =   1.01    Tc(MIN.) =  10.69
LONGEST FLOWPATH FROM NODE    715.00 TO NODE    704.00 =  1023.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    704.00 TO NODE    704.00 IS CODE =  11
----------------------------------------------------------------------------
>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
****************************************************************************

** MAIN STREAM CONFLUENCE DATA **
STREAM      RUNOFF      Tc      INTENSITY      AREA
NUMBER       (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1         7.60    10.69       3.712         2.56
```

```
LONGEST FLOWPATH FROM NODE    715.00 TO NODE    704.00 =  1023.00 FEET

** MEMORY BANK # 1 CONFLUENCE DATA **
STREAM      RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
   1        67.21    12.23       3.404        25.23
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    704.00 =  2996.00 FEET

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF       Tc       INTENSITY
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
   1       64.35      10.69        3.712
   2       74.18      12.23        3.404

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     74.18   Tc(MIN.) =   12.23
TOTAL AREA(ACRES) =     27.79

****************************************************************************
FLOW PROCESS FROM NODE    704.00 TO NODE    704.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    704.00 TO NODE    718.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   444.00
FLOW LENGTH(FEET) =    78.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  39.0 INCH PIPE IS  26.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  12.24
ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     74.18
PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  12.33
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    718.00 =  3074.00 FEET

****************************************************************************
FLOW PROCESS FROM NODE    718.00 TO NODE    718.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  12.33
RAINFALL INTENSITY(INCH/HR) =   3.38
TOTAL STREAM AREA(ACRES) =    27.79
PEAK FLOW RATE(CFS) AT CONFLUENCE =     74.18

****************************************************************************
FLOW PROCESS FROM NODE    725.00 TO NODE    726.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (9.3 DU/AC OR LESS) RUNOFF COEFFICIENT =  .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    453.65
DOWNSTREAM ELEVATION(FEET) =    453.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.959
SUBAREA RUNOFF(CFS) =      1.62
TOTAL AREA(ACRES) =      0.36   TOTAL RUNOFF(CFS) =      1.62

****************************************************************************
FLOW PROCESS FROM NODE    726.00 TO NODE    727.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  453.00  DOWNSTREAM ELEVATION(FEET) =  449.20
STREET LENGTH(FEET) =   324.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00
```

```
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.18
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.34
  HALFSTREET FLOOD WIDTH(FEET) =   10.51
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.68
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
STREET FLOW TRAVEL TIME(MIN.) =   2.03   Tc(MIN.) =   7.11
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.830
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     0.91      SUBAREA RUNOFF(CFS) =     3.30
TOTAL AREA(ACRES) =      1.27        PEAK FLOW RATE(CFS) =       4.60

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.13
FLOW VELOCITY(FEET/SEC.) =  2.89   DEPTH*VELOCITY(FT*FT/SEC.) =   1.07
LONGEST FLOWPATH FROM NODE    725.00 TO NODE    727.00 =   591.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    727.00 TO NODE    718.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   7.11
RAINFALL INTENSITY(INCH/HR) =   4.83
TOTAL STREAM AREA(ACRES) =     1.27
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.60

****************************************************************************
FLOW PROCESS FROM NODE    730.00 TO NODE    731.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    453.65
DOWNSTREAM ELEVATION(FEET) =    453.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.078
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.44
TOTAL AREA(ACRES) =      0.32   TOTAL RUNOFF(CFS) =      1.44

****************************************************************************
FLOW PROCESS FROM NODE    731.00 TO NODE    719.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  453.00  DOWNSTREAM ELEVATION(FEET) =  448.00
STREET LENGTH(FEET) =   386.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.85
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.32
  HALFSTREET FLOOD WIDTH(FEET) =    9.67
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.72
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.87
STREET FLOW TRAVEL TIME(MIN.) =   1.76   Tc(MIN.) =   6.83
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.954
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     0.76       SUBAREA RUNOFF(CFS) =    2.82
TOTAL AREA(ACRES) =       1.08        PEAK FLOW RATE(CFS) =       4.01

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.14
FLOW VELOCITY(FEET/SEC.) =  2.95   DEPTH*VELOCITY(FT*FT/SEC.) =   1.03
LONGEST FLOWPATH FROM NODE    730.00 TO NODE    732.00 =   351.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    732.00 TO NODE    718.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =   6.83
RAINFALL INTENSITY(INCH/HR) =   4.95
TOTAL STREAM AREA(ACRES) =     1.08
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.01

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       74.18    12.33        3.385        27.79
    2        4.60     7.11        4.830         1.27
    3        4.01     6.83        4.954         1.08

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       49.54     6.83        4.954
    2       51.26     7.11        4.830
    3       80.14    12.33        3.385

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     80.14   Tc(MIN.) =   12.33
TOTAL AREA(ACRES) =     30.14
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    718.00 =  3074.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    718.00 TO NODE    733.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   443.00  DOWNSTREAM(FEET) =   431.00
FLOW LENGTH(FEET) =   352.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  17.96
ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     80.14
PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =  12.66
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    733.00 =  3426.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    733.00 TO NODE    733.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  12.66
RAINFALL INTENSITY(INCH/HR) =   3.33
TOTAL STREAM AREA(ACRES) =    30.14
```

```
PEAK FLOW RATE(CFS) AT CONFLUENCE =      80.14

****************************************************************************
FLOW PROCESS FROM NODE    735.00 TO NODE    736.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    445.65
DOWNSTREAM ELEVATION(FEET) =    445.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.53
TOTAL AREA(ACRES) =      0.34   TOTAL RUNOFF(CFS) =      1.53

****************************************************************************
FLOW PROCESS FROM NODE    736.00 TO NODE    737.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  444.00  DOWNSTREAM ELEVATION(FEET) =  436.50
STREET LENGTH(FEET) =   222.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.81
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.29
  HALFSTREET FLOOD WIDTH(FEET) =    8.27
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.50
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.02
STREET FLOW TRAVEL TIME(MIN.) =   1.06   Tc(MIN.) =   6.14
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.310
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.64      SUBAREA RUNOFF(CFS) =    2.55
TOTAL AREA(ACRES) =      0.98        PEAK FLOW RATE(CFS) =      3.90

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.60
FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.20
LONGEST FLOWPATH FROM NODE    735.00 TO NODE    737.00 =   287.00 FEET

****************************************************************************
FLOW PROCESS FROM NODE    737.00 TO NODE    733.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   6.14
RAINFALL INTENSITY(INCH/HR) =   5.31
TOTAL STREAM AREA(ACRES) =     0.98
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.90

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       80.14    12.66        3.328        30.14
    2        3.90     6.14        5.310         0.98
```

```
RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
   1        54.13     6.14       5.310
   2        82.59    12.66       3.828

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     82.59   Tc(MIN.) =   12.66
TOTAL AREA(ACRES) =     31.12
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    733.00 =  3426.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    737.00 TO NODE    738.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   431.00  DOWNSTREAM(FEET) =   430.00
FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.53
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     82.59
PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =  12.73
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    738.00 =  3486.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    738.00 TO NODE    738.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    750.00 TO NODE    751.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    467.00
DOWNSTREAM ELEVATION(FEET) =    466.35
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.35
TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.35

****************************************************************************
FLOW PROCESS FROM NODE    751.00 TO NODE    752.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  466.00  DOWNSTREAM ELEVATION(FEET) =  461.50
STREET LENGTH(FEET) =   489.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.29
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.43
  HALFSTREET FLOOD WIDTH(FEET) =   15.22
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.44
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.11
```

```
STREET FLOW TRAVEL TIME(MIN.) =   3.15   Tc(MIN.) =   8.23
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.393
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     2.96      SUBAREA RUNOFF(CFS) =     9.75
TOTAL AREA(ACRES) =       3.26        PEAK FLOW RATE(CFS) =      10.74

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  18.00
FLOW VELOCITY(FEET/SEC.) =  2.85   DEPTH*VELOCITY(FT*FT/SEC.) =   1.39
LONGEST FLOWPATH FROM NODE    750.00 TO NODE    752.00 =   594.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    752.00 TO NODE    754.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   456.00  DOWNSTREAM(FEET) =   454.00
FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.9 INCH PIPE IS  12.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     10.74
PIPE TRAVEL TIME(MIN.) =   0.48    Tc(MIN.) =   8.71
LONGEST FLOWPATH FROM NODE    750.00 TO NODE    754.00 =   754.00 FEET

****************************************************************************
FLOW PROCESS FROM NODE    754.00 TO NODE    754.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   8.71
RAINFALL INTENSITY(INCH/HR) =   4.24
TOTAL STREAM AREA(ACRES) =     3.26
PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.74

****************************************************************************
FLOW PROCESS FROM NODE    760.00 TO NODE    761.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    462.65
DOWNSTREAM ELEVATION(FEET) =    462.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.998
SUBAREA RUNOFF(CFS) =      1.53
TOTAL AREA(ACRES) =      0.34   TOTAL RUNOFF(CFS) =      1.53

****************************************************************************
FLOW PROCESS FROM NODE    761.00 TO NODE    762.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  461.00  DOWNSTREAM ELEVATION(FEET) =  459.00
STREET LENGTH(FEET) =   281.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.98
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.36
  HALFSTREET FLOOD WIDTH(FEET) =   11.85
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.96
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.71
STREET FLOW TRAVEL TIME(MIN.) =   2.39   Tc(MIN.) =   7.47
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.676
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    2.88
TOTAL AREA(ACRES) =      1.16        PEAK FLOW RATE(CFS) =       4.07

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.46
FLOW VELOCITY(FEET/SEC.) =  2.11   DEPTH*VELOCITY(FT*FT/SEC.) =   0.83
LONGEST FLOWPATH FROM NODE    760.00 TO NODE    762.00 =   346.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    762.00 TO NODE    754.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   7.47
RAINFALL INTENSITY(INCH/HR) =   4.68
TOTAL STREAM AREA(ACRES) =     1.16
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.07

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       10.74     8.71       4.235         3.26
    2        4.07     7.47       4.676         1.16

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       13.28     7.47       4.676
    2       14.43     8.71       4.235

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     14.43   Tc(MIN.) =    8.71
TOTAL AREA(ACRES) =      4.42
LONGEST FLOWPATH FROM NODE    750.00 TO NODE    754.00 =   754.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    754.00 TO NODE    761.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    770.00 TO NODE    771.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    471.65
DOWNSTREAM ELEVATION(FEET) =    471.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.80
TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.80

****************************************************************************
```

```
FLOW PROCESS FROM NODE    771.00 TO NODE    772.00 IS CODE =  31
----------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
**********************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   466.00  DOWNSTREAM(FEET) =   460.00
FLOW LENGTH(FEET) =   682.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.16
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       1.80
PIPE TRAVEL TIME(MIN.) =   2.73    Tc(MIN.) =   7.81
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    772.00 =   747.00 FEET.

**********************************************************************
FLOW PROCESS FROM NODE    771.00 TO NODE    772.00 IS CODE =  81
----------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
**********************************************************************
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.944
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
SUBAREA AREA(ACRES) =     3.03   SUBAREA RUNOFF(CFS) =   10.33
TOTAL AREA(ACRES) =       3.43   TOTAL RUNOFF(CFS) =   11.69
TC(MIN.) =   7.81

**********************************************************************
FLOW PROCESS FROM NODE    772.00 TO NODE    773.00 IS CODE =  31
----------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
**********************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   460.00  DOWNSTREAM(FEET) =   456.00
FLOW LENGTH(FEET) =   370.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.28
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      11.69
PIPE TRAVEL TIME(MIN.) =   0.85    Tc(MIN.) =   8.66
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    773.00 =  1117.00 FEET.

**********************************************************************
FLOW PROCESS FROM NODE    772.00 TO NODE    773.00 IS CODE =  81
----------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
**********************************************************************
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.252
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
SUBAREA AREA(ACRES) =     3.79   SUBAREA RUNOFF(CFS) =   12.08
TOTAL AREA(ACRES) =       7.22   TOTAL RUNOFF(CFS) =   23.02
TC(MIN.) =   8.66

**********************************************************************
FLOW PROCESS FROM NODE    773.00 TO NODE    763.00 IS CODE =  31
----------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
**********************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   456.00  DOWNSTREAM(FEET) =   454.00
FLOW LENGTH(FEET) =   174.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.58
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      23.02
PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =   9.00
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    763.00 =  1291.00 FEET.

**********************************************************************
FLOW PROCESS FROM NODE    763.00 TO NODE    763.00 IS CODE =  11
----------------------------------------------------------------------
>>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN STREAM MEMORY<<<<<
**********************************************************************

** MAIN STREAM CONFLUENCE DATA **
STREAM     RUNOFF     Tc      INTENSITY     AREA
```

```
NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
    1       23.02     9.00       4.148         7.22
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    763.00 =  1291.00 FEET

** MEMORY BANK # 2 CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY     AREA
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)   (ACRE)
    1       14.43      8.71       4.235        4.42
LONGEST FLOWPATH FROM NODE    750.00 TO NODE    763.00 =   754.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF       Tc       INTENSITY
NUMBER     (CFS)      (MIN.)    (INCH/HOUR)
    1      36.72       8.71       4.235
    2      37.15       9.00       4.148

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     37.15   Tc(MIN.) =    9.00
TOTAL AREA(ACRES) =     11.64

****************************************************************************
FLOW PROCESS FROM NODE    763.00 TO NODE    763.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 2 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    763.00 TO NODE    775.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   451.00  DOWNSTREAM(FEET) =   450.00
FLOW LENGTH(FEET) =    95.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.46
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     37.15
PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   9.17
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    775.00 =  1386.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    775.00 TO NODE    775.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   9.17
RAINFALL INTENSITY(INCH/HR) =   4.10
TOTAL STREAM AREA(ACRES) =    11.64
PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.15

****************************************************************************
FLOW PROCESS FROM NODE    780.00 TO NODE    781.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    459.65
DOWNSTREAM ELEVATION(FEET) =    459.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      0.94
TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.94

****************************************************************************
FLOW PROCESS FROM NODE    781.00 TO NODE    782.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  459.00  DOWNSTREAM ELEVATION(FEET) =  457.00
```

```
STREET LENGTH(FEET) =   283.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.98
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.36
  HALFSTREET FLOOD WIDTH(FEET) =   11.59
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.04
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
STREET FLOW TRAVEL TIME(MIN.) =   2.07   Tc(MIN.) =   7.15
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.812
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     1.12      SUBAREA RUNOFF(CFS) =     4.04
TOTAL AREA(ACRES) =       1.33        PEAK FLOW RATE(CFS) =       4.80

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.09
FLOW VELOCITY(FEET/SEC.) =  2.28   DEPTH*VELOCITY(FT*FT/SEC.) =   0.93
LONGEST FLOWPATH FROM NODE    785.00 TO NODE    782.00 =   318.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    782.00 TO NODE    775.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   7.15
RAINFALL INTENSITY(INCH/HR) =   4.81
TOTAL STREAM AREA(ACRES) =     1.33
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.80

****************************************************************************
FLOW PROCESS FROM NODE    785.00 TO NODE    786.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    462.65
DOWNSTREAM ELEVATION(FEET) =    462.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION:
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.30
TOTAL AREA(ACRES) =      0.29   TOTAL RUNOFF(CFS) =      1.30

****************************************************************************
FLOW PROCESS FROM NODE    786.00 TO NODE    787.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  462.00  DOWNSTREAM ELEVATION(FEET) =  457.00
STREET LENGTH(FEET) =   438.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
```

```
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.46
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.32
  HALFSTREET FLOOD WIDTH(FEET) =    9.91
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.24
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
STREET FLOW TRAVEL TIME(MIN.) =   3.26   Tc(MIN.) =   8.34
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.355
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    2.29
TOTAL AREA(ACRES) =      0.99        PEAK FLOW RATE(CFS) =       3.23

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.16
FLOW VELOCITY(FEET/SEC.) =  2.37   DEPTH*VELOCITY(FT*FT/SEC.) =   0.83
LONGEST FLOWPATH FROM NODE    785.00 TO NODE    787.00 =   503.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    787.00 TO NODE    775.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =   8.34
RAINFALL INTENSITY(INCH/HR) =   4.36
TOTAL STREAM AREA(ACRES) =     0.99
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.23

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       37.15     9.17       4.099        11.64
    2        4.80     7.15       4.812         1.33
    3        3.23     8.34       4.355         0.99

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       36.55     7.15       4.812
    2       41.40     8.34       4.355
    3       44.29     9.17       4.099

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     44.29   Tc(MIN.) =    9.17
TOTAL AREA(ACRES) =     13.96
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    775.00 =  1386.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    775.00 TO NODE    788.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   451.00  DOWNSTREAM(FEET) =   448.00
FLOW LENGTH(FEET) =   159.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  12.45
ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     44.29
PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   9.38
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    788.00 =  1545.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    788.00 TO NODE    788.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   9.38
```

```
RAINFALL INTENSITY(INCH/HR) =   4.04
TOTAL STREAM AREA(ACRES) =    13.96
PEAK FLOW RATE(CFS) AT CONFLUENCE =     44.29

****************************************************************************
FLOW PROCESS FROM NODE    795.00 TO NODE    796.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =     0.65
UPSTREAM ELEVATION(FEET) =    459.85
DOWNSTREAM ELEVATION(FEET) =    459.00
ELEVATION DIFFERENCE(FEET) =      0.85
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    0.236
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      1.91
TOTAL AREA(ACRES) =      0.42   TOTAL RUNOFF(CFS) =      1.91

****************************************************************************
FLOW PROCESS FROM NODE    796.00 TO NODE    797.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  459.00  DOWNSTREAM ELEVATION(FEET) =  454.00
STREET LENGTH(FEET) =   321.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.23
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.36
  HALFSTREET FLOOD WIDTH(FEET) =   11.46
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.86
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.03
STREET FLOW TRAVEL TIME(MIN.) =   1.88   Tc(MIN.) =   3.52
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     1.02      SUBAREA RUNOFF(CFS) =     4.84
TOTAL AREA(ACRES) =      1.44        PEAK FLOW RATE(CFS) =       6.54

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  13.97
FLOW VELOCITY(FEET/SEC.) =  3.16   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
LONGEST FLOWPATH FROM NODE    795.00 TO NODE    797.00 =   323.65 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    797.00 TO NODE    798.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   448.00
FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.40
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       6.54
PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   3.35
LONGEST FLOWPATH FROM NODE    795.00 TO NODE    798.00 =   413.65 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    798.00 TO NODE    768.00 IS CODE =   1
```

```
----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
**********************************************************************
  TOTAL NUMBER OF STREAMS = 2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
  TIME OF CONCENTRATION(MIN.) =   2.35
  RAINFALL INTENSITY(INCH/HR) =   6.06
  TOTAL STREAM AREA(ACRES) =     1.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.54

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       44.29     9.38        4.039        13.96
     2        6.54     2.35        6.060         1.44

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR 2 STREAMS

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       36.06     2.35        6.060
     2       48.65     9.38        4.039

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     48.65   Tc(MIN.) =    9.38
  TOTAL AREA(ACRES) =     15.40
  LONGEST FLOWPATH FROM NODE    770.00 TO NODE    786.00 =  1545.00 FEET.

**********************************************************************
  FLOW PROCESS FROM NODE    788.00 TO NODE    798.00 IS CODE =  31
----------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
**********************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   448.00  DOWNSTREAM(FEET) =   443.00
  FLOW LENGTH(FEET) =   262.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.70
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      48.65
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =   9.72
  LONGEST FLOWPATH FROM NODE    770.00 TO NODE    798.00 =  1807.00 FEET.

**********************************************************************
  FLOW PROCESS FROM NODE    798.00 TO NODE    798.00 IS CODE =   1
----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
**********************************************************************
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   9.72
  RAINFALL INTENSITY(INCH/HR) =   3.93
  TOTAL STREAM AREA(ACRES) =    15.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     48.65

**********************************************************************
  FLOW PROCESS FROM NODE    810.00 TO NODE    811.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
**********************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    455.65
  DOWNSTREAM ELEVATION(FEET) =    455.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  30 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.17
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.17

**********************************************************************
  FLOW PROCESS FROM NODE    811.00 TO NODE    812.00 IS CODE =  61
```

```
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
**********************************************************************
UPSTREAM ELEVATION(FEET) =  455.00  DOWNSTREAM ELEVATION(FEET) =  448.00
STREET LENGTH(FEET) =   155.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.67
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.34
  HALFSTREET FLOOD WIDTH(FEET) =   10.47
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.02
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
STREET FLOW TRAVEL TIME(MIN.) =   1.86   Tc(MIN.) =   7.04
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.860
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    1.36      SUBAREA RUNOFF(CFS) =    4.95
TOTAL AREA(ACRES) =      1.62        PEAK FLOW RATE(CFS) =       5.91

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  12.72
FLOW VELOCITY(FEET/SEC.) =  3.40   DEPTH*VELOCITY(FT*FT/SEC.) =   1.29
LONGEST FLOWPATH FROM NODE    810.00 TO NODE    812.00 =   420.00 FEET.

**********************************************************************
FLOW PROCESS FROM NODE    812.00 TO NODE    798.00 IS CODE =   1
----------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
**********************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   7.04
RAINFALL INTENSITY(INCH/HR) =   4.86
TOTAL STREAM AREA(ACRES) =     1.62
PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.91

** CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY       AREA
NUMBER       (CFS)    (MIN.)    (INCH/HOUR)     (ACRE)
    1        48.65     9.72        3.946         19.40
    2         5.91     7.04        4.860          1.62

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF      Tc       INTENSITY
NUMBER       (CFS)    (MIN.)    (INCH/HOUR)
    1        45.41     7.04        4.860
    2        53.44     9.72        3.946

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     53.44   Tc(MIN.) =    9.72
TOTAL AREA(ACRES) =     17.02
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    798.00 =  1807.00 FEET.

**********************************************************************
FLOW PROCESS FROM NODE    798.00 TO NODE    813.00 IS CODE =  31
----------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
**********************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   441.00  DOWNSTREAM(FEET) =   441.00
FLOW LENGTH(FEET) =   120.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  12.45
ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
```

```
PIPE-FLOW(CFS) =      53.44
PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =   9.86
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    813.00 =  1927.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    813.00 TO NODE    813.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    815.00 TO NODE    816.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
GENERAL COMMERCIAL RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
UPSTREAM ELEVATION(FEET) =    460.00
DOWNSTREAM ELEVATION(FEET) =    457.45
ELEVATION DIFFERENCE(FEET) =      2.55
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.027
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    85.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      0.77
TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.77

****************************************************************************
FLOW PROCESS FROM NODE    816.00 TO NODE    817.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   453.00  DOWNSTREAM(FEET) =   449.00
FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.27
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      0.77
PIPE TRAVEL TIME(MIN.) =   0.82    Tc(MIN.) =   4.85
LONGEST FLOWPATH FROM NODE    815.00 TO NODE    817.00 =   395.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    818.00 TO NODE    817.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
****************************************************************************
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.060
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8500
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.8357
SUBAREA AREA(ACRES) =     1.02   SUBAREA RUNOFF(CFS) =     5.25
TOTAL AREA(ACRES) =      1.19   TOTAL RUNOFF(CFS) =     6.03
TC(MIN.) =   4.85

****************************************************************************
FLOW PROCESS FROM NODE    817.00 TO NODE    819.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   442.00
FLOW LENGTH(FEET) =   356.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.33
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      6.03
PIPE TRAVEL TIME(MIN.) =   0.81    Tc(MIN.) =   5.66
LONGEST FLOWPATH FROM NODE    818.00 TO NODE    819.00 =   681.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    819.00 TO NODE    818.00 IS CODE =   1
```

```
----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
**********************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.66
  RAINFALL INTENSITY(INCH/HR) =    5.60
  TOTAL STREAM AREA(ACRES) =      1.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.03

**********************************************************************
  FLOW PROCESS FROM NODE     820.00 TO NODE     821.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
**********************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =     65.00
  UPSTREAM ELEVATION(FEET) =     456.00
  DOWNSTREAM ELEVATION(FEET) =     455.35
  ELEVATION DIFFERENCE(FEET) =       0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =     69.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =       1.84
  TOTAL AREA(ACRES) =       0.41   TOTAL RUNOFF(CFS) =       1.84

**********************************************************************
  FLOW PROCESS FROM NODE     821.00 TO NODE     822.00 IS CODE =  61
----------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
**********************************************************************
  UPSTREAM ELEVATION(FEET) =  453.00  DOWNSTREAM ELEVATION(FEET) =  447.00
  STREET LENGTH(FEET) =   268.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.40
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.84
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.13
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
  STREET FLOW TRAVEL TIME(MIN.) =   1.43   Tc(MIN.) =   6.51
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.113
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =     0.81      SUBAREA RUNOFF(CFS) =     3.11
  TOTAL AREA(ACRES) =       1.22        PEAK FLOW RATE(CFS) =       4.68

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.24
  FLOW VELOCITY(FEET/SEC.) =  3.36   DEPTH*VELOCITY(FT*FT/SEC.) =   1.16
  LONGEST FLOWPATH FROM NODE     820.00 TO NODE     822.00 =   333.00 FEET.

**********************************************************************
  FLOW PROCESS FROM NODE     822.00 TO NODE     812.00 IS CODE =   1
----------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
**********************************************************************
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.51
  RAINFALL INTENSITY(INCH/HR) =    5.11
  TOTAL STREAM AREA(ACRES) =      1.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.68
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    825.00 TO NODE    826.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    457.65
  DOWNSTREAM ELEVATION(FEET) =    457.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.075
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION)
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =      1.84
  TOTAL AREA(ACRES) =      0.41   TOTAL RUNOFF(CFS) =      1.84

****************************************************************************
  FLOW PROCESS FROM NODE    826.00 TO NODE    827.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  454.00  DOWNSTREAM ELEVATION(FEET) =  447.00
  STREET LENGTH(FEET) =   406.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.42
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.99
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.07
  STREET FLOW TRAVEL TIME(MIN.) =   2.26   Tc(MIN.) =   7.34
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.730
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.44      SUBAREA RUNOFF(CFS) =    5.11
  TOTAL AREA(ACRES) =      1.85        PEAK FLOW RATE(CFS) =       6.58

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.66
  FLOW VELOCITY(FEET/SEC.) =  3.31   DEPTH*VELOCITY(FT*FT/SEC.) =   1.32
  LONGEST FLOWPATH FROM NODE    825.00 TO NODE    827.00 =   471.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    827.00 TO NODE    818.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   7.34
  RAINFALL INTENSITY(INCH/HR) =   4.73
  TOTAL STREAM AREA(ACRES) =     1.85
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.54

  ** CONFLUENCE DATA **
  STREAM      RUNOFF       Tc       INTENSITY       AREA
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
      1         6.03      5.66        5.597          1.18
      2         4.48      6.51        5.113          1.22
      3         6.56      7.34        4.730          1.85
```

```
RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
   1        15.15     5.66       5.597
   2        16.00     6.51       5.113
   3        15.98     7.34       4.730

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     16.00   Tc(MIN.) =    6.51
TOTAL AREA(ACRES) =      4.26
LONGEST FLOWPATH FROM NODE    815.00 TO NODE    818.00 =   651.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    818.00 TO NODE    813.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   442.00  DOWNSTREAM(FEET) =   441.00
FLOW LENGTH(FEET) =    57.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.41
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     16.00
PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   6.61
LONGEST FLOWPATH FROM NODE    815.00 TO NODE    813.00 =   708.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    813.00 TO NODE    813.00 IS CODE =  11
----------------------------------------------------------------------------
>>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
****************************************************************************

** MAIN STREAM CONFLUENCE DATA **
STREAM     RUNOFF      Tc       INTENSITY     AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
   1        16.00     6.61       5.063        4.26
LONGEST FLOWPATH FROM NODE    815.00 TO NODE    813.00 =   708.00 FEET.

** MEMORY BANK #  2 CONFLUENCE DATA **
STREAM     RUNOFF      Tc       INTENSITY     AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
   1        53.44     9.88       3.905       17.02
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    813.00 =  1927.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
   1        51.73     6.61       5.063
   2        65.79     9.88       3.905

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     65.79   Tc(MIN.) =    9.88
TOTAL AREA(ACRES) =     21.28

****************************************************************************
FLOW PROCESS FROM NODE    811.00 TO NODE    813.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 2 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    813.00 TO NODE    828.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   441.00  DOWNSTREAM(FEET) =   439.00
FLOW LENGTH(FEET) =   134.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  12.56
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     65.79
PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =  10.06
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    828.00 =  2061.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    828.00 TO NODE    828.00 IS CODE =   1
```

```
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 10.06
RAINFALL INTENSITY(INCH/HR) = 3.86
TOTAL STREAM AREA(ACRES) = 21.28
PEAK FLOW RATE(CFS) AT CONFLUENCE = 65.79

FLOW PROCESS FROM NODE 830.00 TO NODE 831.00 IS CODE = 21
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
UPSTREAM ELEVATION(FEET) = 454.65
DOWNSTREAM ELEVATION(FEET) = 454.00
ELEVATION DIFFERENCE(FEET) = 0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 55.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION:
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.999
SUBAREA RUNOFF(CFS) = 2.43
TOTAL AREA(ACRES) = 0.54 TOTAL RUNOFF(CFS) = 2.43

FLOW PROCESS FROM NODE 831.00 TO NODE 832.00 IS CODE = 61
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
UPSTREAM ELEVATION(FEET) = 452.00 DOWNSTREAM ELEVATION(FEET) = 443.00
STREET LENGTH(FEET) = 406.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.06
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 10.65
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.24
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.10
STREET FLOW TRAVEL TIME(MIN.) = 2.09 Tc(MIN.) = 7.17
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.801
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.750
SUBAREA AREA(ACRES) = 0.90 SUBAREA RUNOFF(CFS) = 3.24
TOTAL AREA(ACRES) = 1.44 PEAK FLOW RATE(CFS) = 5.19

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36 HALFSTREET FLOOD WIDTH(FEET) = 11.78
FLOW VELOCITY(FEET/SEC.) = 3.44 DEPTH*VELOCITY(FT*FT/SEC.) = 1.25
LONGEST FLOWPATH FROM NODE 830.00 TO NODE 832.00 = 471.00 FEET.

FLOW PROCESS FROM NODE 832.00 TO NODE 826.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 7.17
RAINFALL INTENSITY(INCH/HR) = 4.80
TOTAL STREAM AREA(ACRES) = 1.44
```

```
PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.19

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
   1        69.79    10.06       3.860        21.28
   2         5.19     7.17       4.803         1.44

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
   1        52.07     7.17       4.803
   2        69.95    10.06       3.860

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     69.95   Tc(MIN.) =   10.06
TOTAL AREA(ACRES) =     22.72
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    828.00 =  2061.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    828.00 TO NODE    833.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   438.00  DOWNSTREAM(FEET) =   435.00
FLOW LENGTH(FEET) =   127.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  15.06
ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     69.95
PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =  10.20
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    833.00 =  2188.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    833.00 TO NODE    833.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  10.20
RAINFALL INTENSITY(INCH/HR) =   3.83
TOTAL STREAM AREA(ACRES) =    22.72
PEAK FLOW RATE(CFS) AT CONFLUENCE =     69.95

****************************************************************************
FLOW PROCESS FROM NODE    835.00 TO NODE    836.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT =  .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    453.65
DOWNSTREAM ELEVATION(FEET) =    453.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.078
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.80
TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.80

****************************************************************************
FLOW PROCESS FROM NODE    836.00 TO NODE    837.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  449.60  DOWNSTREAM ELEVATION(FEET) =  441.00
STREET LENGTH(FEET) =   269.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
```

```
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.36
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.31
  HALFSTREET FLOOD WIDTH(FEET) =    9.22
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.47
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.08
STREET FLOW TRAVEL TIME(MIN.) =   1.20   Tc(MIN.) =   6.37
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.183
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    3.11
TOTAL AREA(ACRES) =      1.20        PEAK FLOW RATE(CFS) =       4.66

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.59
FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.27
LONGEST FLOWPATH FROM NODE    835.00 TO NODE    837.00 =   334.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    837.00 TO NODE    833.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   6.37
RAINFALL INTENSITY(INCH/HR) =   5.18
TOTAL STREAM AREA(ACRES) =     1.20
PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.66

** CONFLUENCE DATA **
STREAM      RUNOFF       Tc       INTENSITY       AREA
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1        69.95     10.20        1.826         22.72
    2         4.66      6.17        5.183          1.20

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF       Tc       INTENSITY
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        56.30      6.17        5.183
    2        73.40     10.20        1.826

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     73.40   Tc(MIN.) =   10.20
TOTAL AREA(ACRES) =     23.92
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    833.00 =  2168.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    833.00 TO NODE    838.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   435.80  DOWNSTREAM(FEET) =   433.00
FLOW LENGTH(FEET) =   113.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.73
ESTIMATED PIPE DIAMETER(INCH) =  36.00     NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     73.40
PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =  10.34
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    838.00 =  2281.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    838.00 TO NODE    838.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
```

```
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 10.34
RAINFALL INTENSITY(INCH/HR) = 3.79
TOTAL STREAM AREA(ACRES) = 23.92
PEAK FLOW RATE(CFS) AT CONFLUENCE = 72.40

****************************************************************************
FLOW PROCESS FROM NODE 840.00 TO NODE 841.00 IS CODE = 21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) = 0
INITIAL SUBAREA FLOW-LENGTH(FEET) = 65.00
UPSTREAM ELEVATION(FEET) = 449.65
DOWNSTREAM ELEVATION(FEET) = 449.00
ELEVATION DIFFERENCE(FEET) = 0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.079
WARNING: (INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 65.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION)
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.599
SUBAREA RUNOFF(CFS) = 1.71
TOTAL AREA(ACRES) = 0.38 TOTAL RUNOFF(CFS) = 1.71

****************************************************************************
FLOW PROCESS FROM NODE 841.00 TO NODE 842.00 IS CODE = 61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) = 446.00 DOWNSTREAM ELEVATION(FEET) = 438.00
STREET LENGTH(FEET) = 367.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 8.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.020
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.16
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.34
HALFSTREET FLOOD WIDTH(FEET) = 10.78
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.25
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 1.11
STREET FLOW TRAVEL TIME(MIN.) = 1.88 Tc(MIN.) = 6.96
50 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.896
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) = 0
AREA-AVERAGE RUNOFF COEFFICIENT = 0.750
SUBAREA AREA(ACRES) = 1.33 SUBAREA RUNOFF(CFS) = 4.89
TOTAL AREA(ACRES) = 1.71 PEAK FLOW RATE(CFS) = 6.28

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.38 HALFSTREET FLOOD WIDTH(FEET) = 12.78
FLOW VELOCITY(FEET/SEC.) = 3.58 DEPTH*VELOCITY(FT*FT/SEC.) = 1.37
LONGEST FLOWPATH FROM NODE 840.00 TO NODE 842.00 = 432.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE 842.00 TO NODE 838.00 IS CODE = 1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.96
RAINFALL INTENSITY(INCH/HR) = 4.90
TOTAL STREAM AREA(ACRES) = 1.71
PEAK FLOW RATE(CFS) AT CONFLUENCE = 6.28

****************************************************************************
FLOW PROCESS FROM NODE 849.00 TO NODE 846.00 IS CODE = 21
```

```
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    453.65
DOWNSTREAM ELEVATION(FEET) =    453.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION:
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.80
TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      2.80

FLOW PROCESS FROM NODE    846.00 TO NODE    847.00 IS CODE =  51
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
UPSTREAM ELEVATION(FEET) =  451.00  DOWNSTREAM ELEVATION(FEET) =  438.00
STREET LENGTH(FEET) =   490.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.00
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.33
  HALFSTREET FLOOD WIDTH(FEET) =   10.16
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.48
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.14
STREET FLOW TRAVEL TIME(MIN.) =   2.35   Tc(MIN.) =   7.43
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.694
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     1.24      SUBAREA RUNOFF(CFS) =     4.37
TOTAL AREA(ACRES) =      1.64        PEAK FLOW RATE(CFS) =      5.77

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.91
FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.37
LONGEST FLOWPATH FROM NODE    845.00 TO NODE    847.00 =   555.00 FEET.

FLOW PROCESS FROM NODE    847.00 TO NODE    838.00 IS CODE =   1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   7.43
RAINFALL INTENSITY(INCH/HR) =   4.69
TOTAL STREAM AREA(ACRES) =     1.64
PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.77

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       71.40    10.24        3.793        23.92
    2        6.28     6.96        4.898         1.71
    3        5.77     7.43        4.694         1.64

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS
```

```
** PEAK FLOW RATE TABLE **
STREAM      RUNOFF      Tc       INTENSITY
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
   1        68.55      6.96       4.896
   2        71.10      7.43       4.694
   3        82.93     10.34       3.793

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     82.93   Tc(MIN.) =   10.34
TOTAL AREA(ACRES) =     27.27
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    838.00 =  2301.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    838.00 TO NODE    738.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   433.00  DOWNSTREAM(FEET) =   430.00
FLOW LENGTH(FEET) =   153.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  14.59
ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     82.93
PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =  10.51
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    738.00 =  2454.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    738.00 TO NODE    738.00 IS CODE =  11
----------------------------------------------------------------------------
>>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
****************************************************************************

** MAIN STREAM CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
   1        82.93     10.51       3.752        27.27
LONGEST FLOWPATH FROM NODE    770.00 TO NODE    738.00 =  2454.00 FEET.

** MEMORY BANK #  1 CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
   1        82.59     12.73       3.316        31.12
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    738.00 =  3486.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF      Tc       INTENSITY
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
   1       151.11     10.51       3.752
   2       155.87     12.73       3.316

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =    155.87   Tc(MIN.) =   12.73
TOTAL AREA(ACRES) =     58.39

****************************************************************************
FLOW PROCESS FROM NODE    738.00 TO NODE    738.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 1 <<<<<
****************************************************************************

****************************************************************************
FLOW PROCESS FROM NODE    738.00 TO NODE    848.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
ELEVATION DATA: UPSTREAM(FEET) =   430.00  DOWNSTREAM(FEET) =   424.00
FLOW LENGTH(FEET) =   266.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  13.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  18.38
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =    155.87
PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =  12.97
LONGEST FLOWPATH FROM NODE    600.00 TO NODE    848.00 =  3742.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    848.00 TO NODE    848.00 IS CODE =  10
----------------------------------------------------------------------------
>>>>>MAIN-STREAM MEMORY COPIED INTO MEMORY BANK # 1 <<<<<
****************************************************************************
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     860.00 TO NODE     861.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =  0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =     65.00
  UPSTREAM ELEVATION(FEET) =     451.65
  DOWNSTREAM ELEVATION(FEET) =     451.00
  ELEVATION DIFFERENCE(FEET) =       0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =     5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =     65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
  SUBAREA RUNOFF(CFS) =       2.20
  TOTAL AREA(ACRES) =       0.49   TOTAL RUNOFF(CFS) =       2.20

****************************************************************************
  FLOW PROCESS FROM NODE     861.00 TO NODE     862.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  447.00  DOWNSTREAM ELEVATION(FEET) =  438.00
  STREET LENGTH(FEET) =   342.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.22
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.48
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.17
  STREET FLOW TRAVEL TIME(MIN.) =   1.64   Tc(MIN.) =   6.72
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.009
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =  0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =     1.07      SUBAREA RUNOFF(CFS) =     4.02
  TOTAL AREA(ACRES) =       1.56        PEAK FLOW RATE(CFS) =       5.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.97
  FLOW VELOCITY(FEET/SEC.) =  3.78   DEPTH*VELOCITY(FT*FT/SEC.) =   1.38
  LONGEST FLOWPATH FROM NODE     860.00 TO NODE     862.00 =   407.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     862.00 TO NODE     863.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   6.72
  RAINFALL INTENSITY(INCH/HR) =   5.01
  TOTAL STREAM AREA(ACRES) =      1.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.86

****************************************************************************
  FLOW PROCESS FROM NODE     865.00 TO NODE     866.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =  0
```

```
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    454.00
DOWNSTREAM ELEVATION(FEET) =    453.39
ELEVATION DIFFERENCE(FEET) =      0.60
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.078
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      0.63
TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.63

****************************************************************************
FLOW PROCESS FROM NODE    866.00 TO NODE    867.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  452.00  DOWNSTREAM ELEVATION(FEET) =  439.30
STREET LENGTH(FEET) =   565.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.01
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.33
  HALFSTREET FLOOD WIDTH(FEET) =   10.34
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.38
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.13
STREET FLOW TRAVEL TIME(MIN.) =   2.79   Tc(MIN.) =   7.87
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.524
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    1.97      SUBAREA RUNOFF(CFS) =    6.68
TOTAL AREA(ACRES) =      2.11        PEAK FLOW RATE(CFS) =       7.16

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  11.16
FLOW VELOCITY(FEET/SEC.) =  3.87   DEPTH*VELOCITY(FT*FT/SEC.) =   1.51
LONGEST FLOWPATH FROM NODE    865.00 TO NODE    867.00 =   630.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    867.00 TO NODE    861.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   7.87
RAINFALL INTENSITY(INCH/HR) =   4.52
TOTAL STREAM AREA(ACRES) =     2.11
PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.16

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1        5.86     6.72        5.009         1.86
    2        7.16     7.87        4.524         2.11

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       11.97     6.72       5.009
    2       12.45     7.87       4.524

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =     12.45   Tc(MIN.) =     7.87
  TOTAL AREA(ACRES) =       1.87
  LONGEST FLOWPATH FROM NODE     865.00 TO NODE     861.00 =   630.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     863.00 TO NODE     866.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   433.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   384.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     12.45
  PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =   8.55
  LONGEST FLOWPATH FROM NODE     865.00 TO NODE     868.00 =  1014.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     868.00 TO NODE     868.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.55
  RAINFALL INTENSITY(INCH/HR) =   4.29
  TOTAL STREAM AREA(ACRES) =      3.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.45

****************************************************************************
  FLOW PROCESS FROM NODE     870.00 TO NODE     871.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =     65.00
  UPSTREAM ELEVATION(FEET) =    438.65
  DOWNSTREAM ELEVATION(FEET) =    438.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION:
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.989
  SUBAREA RUNOFF(CFS) =      1.89
  TOTAL AREA(ACRES) =      0.42   TOTAL RUNOFF(CFS) =      1.89

****************************************************************************
  FLOW PROCESS FROM NODE     871.00 TO NODE     872.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
  UPSTREAM ELEVATION(FEET) =  435.00  DOWNSTREAM ELEVATION(FEET) =  430.00
  STREET LENGTH(FEET) =   224.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.21
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.06
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.97
  STREET FLOW TRAVEL TIME(MIN.) =   1.22   Tc(MIN.) =   6.30
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.211
  *USER SPECIFIED(SUBAREA):
  RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
```

```
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     2.20      SUBAREA RUNOFF(CFS) =     8.61
TOTAL AREA(ACRES) =       2.62        PEAK FLOW RATE(CFS) =      10.26

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.72
FLOW VELOCITY(FEET/SEC.) =  3.44   DEPTH*VELOCITY(FT*FT/SEC.) =   1.24
LONGEST FLOWPATH FROM NODE    870.00 TO NODE    872.00 =   289.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    872.00 TO NODE    866.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
****************************************************************************
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   6.30
RAINFALL INTENSITY(INCH/HR) =   5.22
TOTAL STREAM AREA(ACRES) =     2.62
PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.26

****************************************************************************
FLOW PROCESS FROM NODE    880.00 TO NODE    881.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
****************************************************************************
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
UPSTREAM ELEVATION(FEET) =    446.65
DOWNSTREAM ELEVATION(FEET) =    446.00
ELEVATION DIFFERENCE(FEET) =      0.65
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
         (Reference: Table 5-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.999
SUBAREA RUNOFF(CFS) =      1.62
TOTAL AREA(ACRES) =      0.36   TOTAL RUNOFF(CFS) =      1.62

****************************************************************************
FLOW PROCESS FROM NODE    881.00 TO NODE    882.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
****************************************************************************
UPSTREAM ELEVATION(FEET) =  444.00  DOWNSTREAM ELEVATION(FEET) =  430.00
STREET LENGTH(FEET) =   535.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 16.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   7.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.62
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.30
  HALFSTREET FLOOD WIDTH(FEET) =    8.66
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.18
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
STREET FLOW TRAVEL TIME(MIN.) =   2.80   Tc(MIN.) =   7.88
  50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.519
*USER SPECIFIED(SUBAREA):
RESIDENTAIL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =  0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =     2.28      SUBAREA RUNOFF(CFS) =     7.71
TOTAL AREA(ACRES) =       2.64        PEAK FLOW RATE(CFS) =      8.95

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.72
FLOW VELOCITY(FEET/SEC.) =  3.51   DEPTH*VELOCITY(FT*FT/SEC.) =   1.20
LONGEST FLOWPATH FROM NODE    880.00 TO NODE    882.00 =   600.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     882.00 TO NODE     868.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
****************************************************************************
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.88
  RAINFALL INTENSITY(INCH/HR) =    4.52
  TOTAL STREAM AREA(ACRES) =      2.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.95

  ** CONFLUENCE DATA **
  STREAM      RUNOFF       Tc       INTENSITY       AREA
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1         12.45      8.55        4.287          3.87
     2         10.26      6.30        5.221          2.62
     3          8.95      7.88        4.519          2.64

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM      RUNOFF       Tc       INTENSITY
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1         27.64      6.30        5.221
     2         29.64      7.88        4.519
     3         29.36      8.55        4.287

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.64   Tc(MIN.) =     7.88
  TOTAL AREA(ACRES) =       8.93
  LONGEST FLOWPATH FROM NODE     865.00 TO NODE     868.00 =  1014.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     868.00 TO NODE     948.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
****************************************************************************
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   424.00
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.44
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      29.64
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    7.98
  LONGEST FLOWPATH FROM NODE     865.00 TO NODE     948.00 =  1079.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     948.00 TO NODE     948.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
****************************************************************************

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM      RUNOFF       Tc       INTENSITY       AREA
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1         29.64      7.98        4.481          8.93
  LONGEST FLOWPATH FROM NODE     865.00 TO NODE     948.00 =  1079.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM      RUNOFF       Tc       INTENSITY       AREA
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1        158.87     12.97        3.277         58.19
  LONGEST FLOWPATH FROM NODE     600.00 TO NODE     948.00 =  3742.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM      RUNOFF       Tc       INTENSITY
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1        128.63      7.98        4.481
     2        177.55     12.97        3.277

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     177.55   Tc(MIN.) =    12.97
  TOTAL AREA(ACRES) =      67.12

****************************************************************************
  FLOW PROCESS FROM NODE     948.00 TO NODE     948.00 IS CODE =  12
```

TM DRAINAGE STUDY
For
OTAY RANCH VILLAGE 2 SOUTH & R-15c

City of Chula Vista, California

Prepared for:
Baldwin & Sons, Inc.
610 W. Ash Street
Suite 1500
San Diego, CA 92121

W.O. 2807-35

November 13, 2013

Hunsaker & Associates
San Diego, Inc.

Alisa S. Vialpando, R.C.E. 47945
Principal

REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
No. 47945
Exp. 12/31/13
CIVIL
STATE OF CALIFORNIA

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CHAPTER 1 - EXECUTIVE SUMMARY

1.1 Introduction

This Preliminary Drainage Study has been prepared to assess the pre-developed and developed condition peak runoff rates from the proposed Otay Ranch Village 2 South and R-15c sites for Baldwin & Sons, Inc.

The Otay Ranch Village 2 South Tentative Map (TM) and the Village 2 R-15c TM project sites are located within the City of Chula Vista, California. Village 2 South is approximately one-half mile south of Olympic Parkway, north of Main Street, west of La Media Road, and east of Heritage Road. The Otay Ranch Village 2 North development is located immediately north of the Village 2 South project area. Village 2 R-15c is located northeast of Village 2 South and south of the Anapamu Avenue- Ortega Street intersection. Please refer to the Vicinity Map shown below for the combined project area.

The gross subdivision area for the Village 2 South portion is approximately 174.6 acres and will be developed for single family residential, multi-family residential, a community purposes facility, industrial, and open spaces. The R-15c portion is approximately 0.73 acres. The extension of Heritage Road south to Main Street is included with this TM to allow for site access and as stipulated in the overall Village 2 SPA.

VICINITY MAP
NOT TO SCALE

Chapters 1-7 of this report pertain to the combined development of Village 2 South and R-15c since the latter will ultimately drain towards Village 2 South. Chapter 8 presents the interim scenario that assumes Village 2 South is not constructed and R-15c is developed (and can stand alone).

Refer to Chapter 7 Exhibits 1.1 through 1.7 for an overview of the existing and proposed drainage patterns of the site. This study has been divided into two general hydrologic analyses'. The 'North Portion' consists of the main part of the Village 2 South/R-15c development which will include the single family residential, multi-family residential, a community purposes facility, industrial, and open spaces. This portion drains south and discharges its runoff into Wolf Canyon. In order to correctly analyze the ultimate developed scenario and recommend the required storm drain infrastructure including storm drain and facilities such as basins for water quality and peak flow detention, the developed condition hydrologic analysis of this portion will include the proposed offsite developed areas from Village 2 North as well as areas east of the TM boundary owned by others. Since the development of the North Portion will increase peak runoff flows, attenuation via a detention basin will be required. The proposed detention basin will be situated at the North Portion outlet point prior to outletting into Wolf Canyon. Analysis of this basin is included in Chapter 4 of this study.

The 'Heritage Road Portion' is the extension of Heritage Road from the southern boundary of the North Portion to Main Street. This portion drains south and outlets into the Otay River located immediately south of Main Street. Since the storm drain system within the Heritage Road Portion will ultimately include flows the Village 3 development, it will need to be sized to account for these additional flows. The 'Developed Condition' hydrologic model within this TM will include Village 3 flows based on a preliminary Village 3 TM site layout. Although the development of Village 3 and the Heritage Road Portion will increase flows with respect to the existing condition, the site's location immediately adjacent to the Otay River means that the peak flows from both the site and within the Otay River will not simultaneously arrive at the site's outlet point. A HEC-HMS analysis (Chapter 5) is included in this study to confirm this condition. A HEC-RAS analysis (Chapter 6) of peak flows at the outlet location into the Otay River is also included to analyze existing and developed river depths and velocities. Recommendations for energy dissipation at the outlet into the Otay River are included to address erosive velocities.

Both watersheds described in the preceding paragraphs flow south towards the Otay River in both the pre and post developed conditions. Per the Flood Insurance Rate Map No. 06073C2178, the site lies outside the FEMA floodplain boundary. Therefore, a Letter of Map Revision is not required. See Exhibit 1.7 for an overlay of the site on Flood Insurance Rate Map. The Multiple Species Conservation Program (MSCP) Open Space Preserve Area is located immediately south of the Heritage Road Portion along the Otay River. The development of Otay Ranch Village 2 South, as proposed in the TM, does not encroach into the existing (MSCP) Open Space Preserve Area located downstream of the North Portion which outlets into Wolf Canyon.

Per County of San Diego drainage criteria, the Modified Rational Method should be used to determine peak design flow rates when the contributing drainage area is less than 1.0-square mile. Since the total watershed area discharging from the Otay Ranch Village 2 South site is less than 1.0-square mile, the AES-2010 computer software was used to model the runoff response per the Modified Rational Method.

Methodology used for the computation of design rainfall events, runoff coefficients, and rainfall intensity values are consistent with criteria set forth in the most current "San Diego County Hydrology Manual" and the "City of Chula Vista Subdivision Manual". A more detailed explanation of methodology and model development used for this analysis is listed in Chapter 2 of this report.

1.2 Summary of Pre-Developed Conditions

The pre-developed condition hydrology maps (Exhibits 1.1, 1.2) are located in Chapter 7. The North Portion includes areas from the Village 2 North development. Approximately 46 acres from Village 2 North will convey its runoff through Village 2 South. The topography within the North Portion is varied throughout containing steep slopes, hilly areas, mass graded pads, and areas for stormwater detention. As shown on Exhibit 1.1 for the North Portion, runoff drains towards the south and empties into Wolf Canyon. Wolf Canyon confluences with the Otay River about one mile downstream of the developed North Portion.

The topography for existing Heritage Road Portion is as shown in hydrology Exhibit 1.2 in Chapter 7 and is characterized by farmland, rolling hills, vegetation consisting mainly of brush, and incised canyons that partition the study area into the watersheds shown. For reference purposes, the exhibit shows the proposed Heritage Road extension overlaid. The northern watershed boundary is defined by the grading which has occurred for the Otay Landfill. The westernmost watershed boundary has been set at the limits of the existing commercial businesses mostly consisting of vehicle junkyards and parts stores. The watersheds within this portion all drain directly into the Otay River. The defined 'Heritage Road Portion' watershed has its downstream outlet point located approximately one-half mile downstream of the Wolf Canyon confluence into the Otay River. The Otay River flows from east to west and ultimately empties into the San Diego Bay.

Table 1 on the following sheet summarizes the 100-year pre-development peak flows to each of the delineated watersheds. Runoff coefficients between 0.35 and 0.60 were used depending on the existing site condition and per the City of Chula Vista Subdivision Manual. The coefficients generally correspond to a vegetated state with flat to steep slopes. Supporting calculations for the data presented in Table 1 are located in Chapter 3 of this report. The corresponding hydrology maps (Exhibits 1.1 and 1.2) are located in Chapter 7.

TABLE 1 - Summary of Pre-Developed Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	100-Year Peak Flow (cfs)
1.1, North Portion	138	Wolf Canyon	251	454
1.2, Heritage Road Portion	105	Otay River	47	64
1.2, Heritage Road Portion	214	Otay River	95	145
1.2, Heritage Road Portion	407	Otay River	118	141
		TOTAL	**511**	**804**

1.3 Summary of Developed Conditions

The Otay Ranch Village 2 South and R-15c Tentative Map will consist of single family residential, multi-family residential, a community purposes facility, industrial, and open spaces with a gross subdivision area of 167.77 acres. The 'Developed Condition' hydrology maps (Exhibits 1.3, 1.4) are located in Chapter 7. As in the pre-developed analysis, the developed scenario was analyzed separately as the 'North Portion' and the 'Heritage Road Portion'.

Exhibit 1.3 shows the proposed North Portion of the Village 2 South/ R-15c development and shows the proposed drainage subareas delineated as well as the runoff flow direction. Although the gross subdivision area is about 168 acres, the developed areas consisting of single family residential, multi-family residential, community purposes facility, industrial, and open spaces account for the majority of the overall TM project. As in the existing condition, the North Portion developed site slopes towards the south. The proposed storm drain infrastructure will include storm drain, cleanouts, inlets, headwalls, energy dissipating measures, and basins (water quality/ hydromodification /desilt/ detention). The hydrologic analysis for the North Portion is included in Chapter 3.1. In preparing the hydrologic model and exhibit, all proposed developments upstream of the TM boundary were considered in order to correctly recommend the required storm drain infrastructure. Offsite areas tributary to the North Portion watershed include a part of the Village 2 North development as well as an area east of the TM boundary which is owned by Sunwood, LLC and will be built in the future. In addition, runoff from both the slopes west of Heritage Road and a part of Heritage Road itself is included in the North Portion hydrologic model.

The development of Village 2 South will increase runoff flowrates relative the existing condition. To attenuate developed peak flows, a detention basin is proposed at the downstream end of the North Portion prior to outletting into Wolf Canyon. The analysis is included in Chapter 4 and shows that the proposed basin and outlet riser structure will attenuate peak flows to below the pre-developed condition. This detention basin will also serve to address hydromdodification relative to the Village 2 South TM project including a part of the Village 2 North development. This detention basin was previously approved as part of the *Village 2 Master Drainage Study 2005*. In addition to this detention basin, two other basins located upstream are proposed for water quality and hydromodification purposes. Although these two basins will provide peak flow attenuation that would further reduce the downstream developed flowrate, they were not considered in the detention basin analysis in this study. For further detailed information on the basins relative to their water quality and hydromodification features, please reference the *Water Quality Technical Report for Otay Ranch Village 2 South and R*-15c dated November 2013 prepared by Hunsaker & Associates.

The extension of Heritage Road south to Main Street is included with this TM to allow access to the residential and industrial parts of Village 2 South as stipulated in the overall Village 2 SPA. Heritage Road will slope to the south towards Main Street and the Otay River. The hydrologic analysis and exhibit relative to Heritage Road is included in Chapter 3.4 and Exhibit 1.4, respectively. The proposed road alignment of Heritage Road shown on the exhibit accounts for the future development of Village 3. As was done for the North Portion hydrologic model, an ultimate proposed condition hydrology model was prepared in order to correctly represent the effect of the Village 3 development on the Heritage Road storm drain system. The Village 3 site design shown was obtained from a preliminary TM lotting study for Village 3. The full analysis within this study regarding the Heritage Road (Portion) storm drain system includes a HEC-HMS and a HEC-RAS analysis. These models were prepared for the Otay River watershed upstream of the ‘Heritage Road’ storm drain outlet. The HMS models determined the expected pre and post-developed flows at the outlet point along with the lag time of the watershed. The HEC-RAS analysis determined the pre and post-developed velocities and flow depths within the Otay River at the proposed outlet point. Outlet velocities from the Heritage Road storm drain system will require an APWA energy dissipating impact basin with baffle wall and rip rap in order to prevent erosive velocities in the Otay River.

Table 2 below summarizes the 100-year developed condition peak flows relative to the development of Village 2 South. Supporting calculations for the data presented in Table 2 are located in Chapter 3.4 of this report. The corresponding hydrology maps (Exhibits 1.3 and 1.4) are located in Chapter 7.

TABLE 2 - Summary of Developed Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	100-Year Peak Flow (cfs)
1.3, North Portion	260	Wolf Canyon	287.5	399*
1.4, Heritage Road Portion	650	Otay River	4	14
1.4, Heritage Road Portion	581	Otay River	258	742
1.4, Heritage Road Portion	715	Otay River	8	19
		TOTAL	**558**	**1,174**

*-Flowrate after detention. Pre-detention flow = 614 cfs

Where possible, landform grading has been incorporated to mimic existing conditions where the proposed grading ties into or daylights with the existing terrain. It is intended that the stormwater from the manufactured slopes will sheet flow and follow the existing drainage patterns.

1.4 Results & Recommendations

Table 3 summarizes the effects of site development at the receiving Otay River.

TABLE 3 - Summary of Pre vs. Post-Developed Condition Flows to Otay River

Condition	Drainage Area (acres)	100-Year Peak Flow (cfs)
Pre-Developed	511	804
Post-Developed	558	1,174
DIFFERENCE	**+ 47***	**+ 370**

* =Area diverted along eastern project boundary in Heritage Road portion

Development of Otay Ranch Village 2 South and R-15c combined with the preliminary site layout for Village 3 will result in a net cumulative runoff increase of 370 cfs discharged to the Otay River and Wolf Canyon. The increases are attributed to the future development of Village 3 and the area diversion created towards Heritage Road. Calculations for the North Portion indicate a runoff reduction into Wolf Canyon due to the detention basin.

Per the *Otay River Watershed Assessment Technical Report* prepared in August 2004 by Aspen Environmental Group, the Otay River Watershed at the existing Otay Valley Road/Heritage Road bridge crossing is approximately 122.7 square miles. The flow for the Otay River at this location is approximately 22,000 cfs (100-year storm event). The *Otay River Watershed Assessment Technical Report* (Section B.5.3) also notes that the existing Otay River downstream of the dam is starved for sediment and peak flows, stating "Theoretically, an increase in peak flow would tend to counteract the degradation trends by replacing water impounded by the reservoir and helping the River maintain its original platform". In addition, the time of concentration for the peak flows at the proposed outlet of the Heritage Road storm drain to the Otay River is approximately 11.5 minutes (see Section 3.4 for calculations). There would be substantial lag time between the time the peak flows from the proposed development outlet to the Otay River and time the peak flows along the Otay River reach the proposed outlet location since the tributary area to the Otay River is over 100 square miles. Based on the HEC-HMS study prepared for the 100-Year, 24-hour storm event, the time to peak for the flows along the Otay River (@ the Village 3 outlet), is approximately 21 hrs. This results in a lag time of over 20 hours. Due to this lag time, there is no net increase of flows to the Otay River from the Heritage Road Portion of the Village 2 South development when compared to existing conditions. Therefore, no detention basins are proposed for the Heritage Road Portion. Please refer to Chapter 5 for HEC-HMS supporting calculations.

The North Portion of the development does show an increase of runoff due to development. The proposed detention basin will be 20 feet deep and include a 6' x 6' riser box with a height of 9'. The calculations in Chapter 4 indicate that the basin will attenuate peak flows from 613 to 399 cfs. The outlet flow is approximately 55 cfs less than the pre-developed flow of 454 cfs. Flows exiting the detention basin will outlet into Wolf Canyon. Rip and energy dissipating devices will be designed during final engineering to reduce velocities as dictated by the standard drawings to address erosion concerns within Wolf Canyon.

The storm drain outfall from the proposed Heritage Road storm drain system outlets directly to the Otay River at the southwest corner of the Heritage Road-Main Street intersection. The storm drain will be a reinforced concrete pipe with an approximate 84" diameter. A concrete energy dissipator per San Diego Regional Standard Drawings D-41 (or APWA Impact Basin 384-0) and rip-rap apron will be constructed to reduce velocities as dictated by the standard drawings prior to outletting to the Otay River.

A HEC-HMS and a HEC-RAS analysis were also prepared to determine velocities and flows in the Otay River at the Heritage Road storm drain outlet. Refer to Chapters 5 and 6 for supporting calculations. The HEC-HMS study shows that there is no net increase of flows to the Otay River from the development of both Village 2 South and Village 3 due to the lag time, when compared to existing conditions. The HEC-RAS study calculates the approximate velocity of the flow in the Otay River to be 9.01 fps during the 100-year, 24-hour storm event. Therefore the potential for

lateral forces to affect the dissipation structure is highly unlikely and should remain intact.

Prior to discharge from the site, all developed site runoff will receive full water quality treatment in accordance with the most current City of Chula Vista Storm Water Manual standards applicable at the time of final engineering. The project will be designed to comply with any water quality standards or waste discharge requirements. Storm water treatment design is further discussed in the *Water Quality Technical Report for Otay Ranch Village 2 South and R-15c TM* dated November 2013 prepared by Hunsaker & Associates, San Diego.

Summary:

- Drainage facilities within Village 2 South and R-15c will be designed in accordance with the requirements of the Chula Vista Subdivision Manual, the San Diego County Hydrology Manual and the requirements of the San Diego Regional Water Quality Control Board.

- Peak discharge flows from the southern portion of the TM area will occur approximately 11.5 minutes after the storm event begins. The peak discharge flow from the Otay River Basin, at the Heritage Road storm drain outlet, will occur more than 20 hours after the storm event begins. Due to this difference in time, the projects direct, indirect and cumulative impacts are not significant.

- Development of the project site will not further degrade potential beneficial uses of downstream water bodies as designated by the Regional Water Quality Control Board, including water bodies listed on the Clean Water Section 303d list.

- Onsite and offsite drainage easements shall be provided to the satisfaction of the Director of Public Works.

References

City of Chula Vista Subdivision Manual; Engineering Department and Land Development; Section 3, July 1, 2002

San Diego County Hydrology Manual; County of San Diego Department of Public Works Flood Control Division, June 2003

Otay River Watershed Assessment Technical Report prepared by Aspen Environmental Group, August 2004

**Rough Grading Hydrology Study for Otay Ranch Village 2, South* prepared by Hunsaker and Associates, San Diego Inc., April 27, 2007.

Hydromodification Management Plan prepared for County of San Diego, California, March 2011

"Order No. R9-2007-0001, NPDES No. CAS0108758 – Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, San Diego Unified Port District and the San Diego County Regional Airport Authority", California Regional Water Quality Control Board – San Diego Region; January 24, 2007.

Water Quality Technical Report for Otay Ranch Village 2 South and R-15c Tentative Map prepared by Hunsaker and Associates, San Diego Inc., November 2013.

*- This study has not been approved by the City of Chula Vista but used for this study to aid in watershed delineation and future land uses.

CHAPTER 2 - METHODOLOGY

2.1 - Rational Method Model Development Summary

Computer Software Package – AES-2010

Design Storm – 100-Year Return Interval

Land Use – Single Family, Multi-Family, Industrial, Community Purpose Facilities, and Open Space

Soil Type - Hydrologic soil group D was assumed for all areas. Group D soils have very slow infiltration rates when thoroughly wetted. Consisting chiefly of clay soils with a high swelling potential, soils with a high permanent water table, soils with clay pan or clay layer at or near the surface, and shallow soils over nearly impervious materials, Group D soils have a very slow rate of water transmission.

Runoff Coefficient – In accordance with the City of Chula Vista Subdivision Manual, a runoff coefficient of 0.90 was used for fully paved areas, 0.85 for the Industrial/Commercial Sites, 0.75 for the Multi-Family Sites and dense residential, 0.65 for the Single-Family pads, 0.35 for proposed open space, and 0.30 for parks.

Method of Analysis – The Rational Method is the most widely used hydrologic model for estimating peak runoff rates. Applied to small urban and semi-urban areas with drainage areas less than 1.0 square mile, the Rational Method relates storm rainfall intensity, a runoff coefficient, and drainage area to peak runoff rate. This relationship is expressed by the equation:

Q = CIA, where:

Q = The peak runoff rate in cubic feet per second at the point of analysis.

C = A runoff coefficient representing the area - averaged ratio of runoff to rainfall intensity.

I = The time-averaged rainfall intensity in inches per hour corresponding to the time of concentration.

A = The drainage basin area in acres.

To perform a node-link study, the total watershed area is divided into subareas which discharge at designated nodes.

The procedure for the subarea summation model is as follows:

(1) Subdivide the watershed into an initial subarea (generally 1 lot) and subsequent subareas, which are generally less than 10 acres in size. Assign upstream and downstream node numbers to each subarea.

(2) Estimate an initial T_c by using the appropriate nomograph or overland flow velocity estimation.

(3) Using the initial T_c, determine the corresponding values of I. Then Q = C I A.

(4) Using Q, estimate the travel time between this node and the next by Manning's equation as applied to the particular channel or conduit linking the two nodes. Then, repeat the calculation for Q based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES-2010 computer subarea menu is as follows:

SUBAREA HYDROLOGIC PROCESS

1. Confluence analysis at node.
2. Initial subarea analysis (including time of concentration calculation).
3. Pipeflow travel time (computer estimated).
4. Pipeflow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through subarea.
7. User - specified information at node.
8. Addition of subarea runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

$$Q_p = Q_a + Q_b;\ T_p = T_a = T_b$$

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by the ratio of rainfall intensities.

$Q_p = Q_a + Q_b \ (I_a/I_b)$; $T_p = T_a$

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

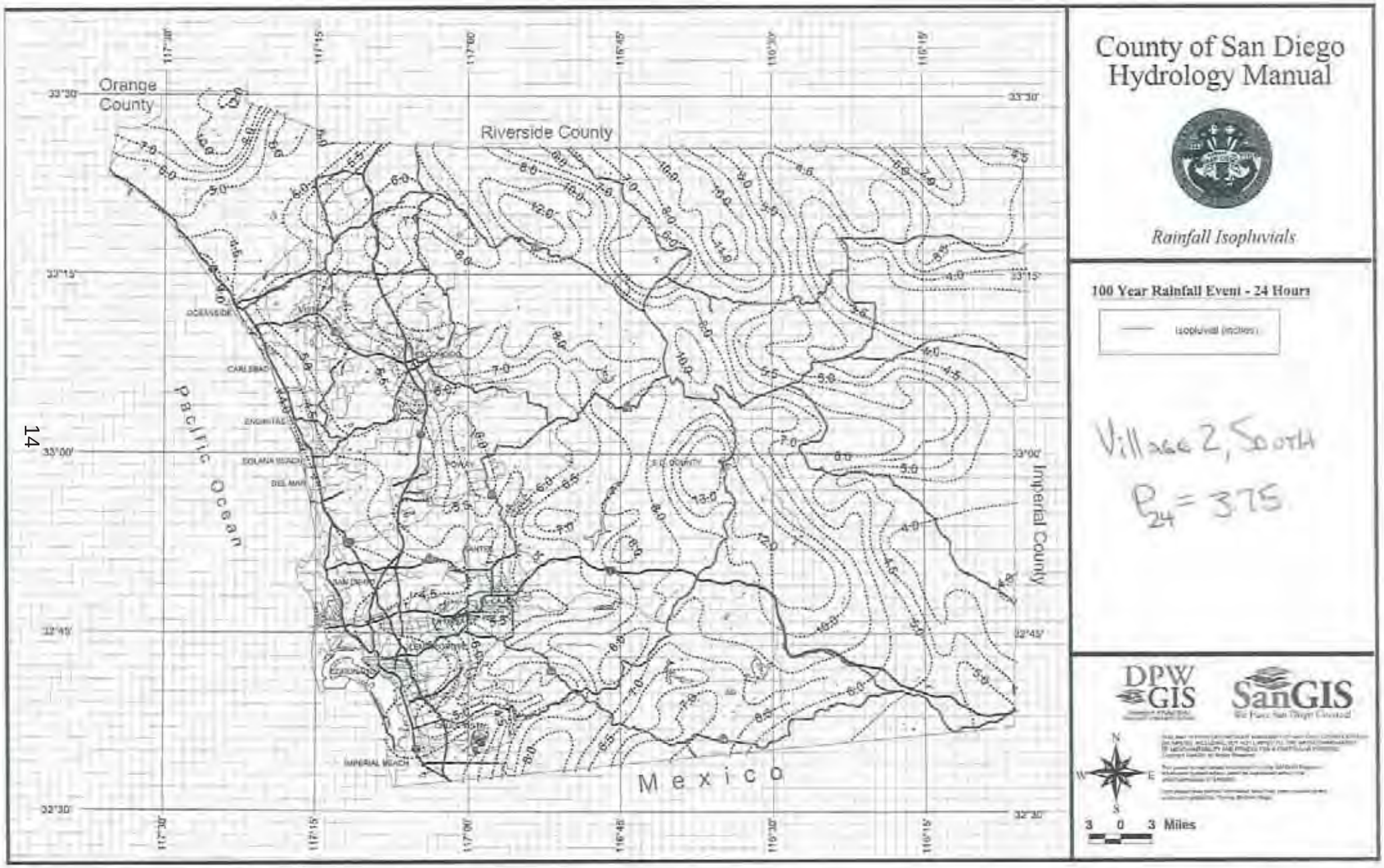
$Q_p = Q_b + Q_a \ (T_b/T_a)$; $T_p = T_b$

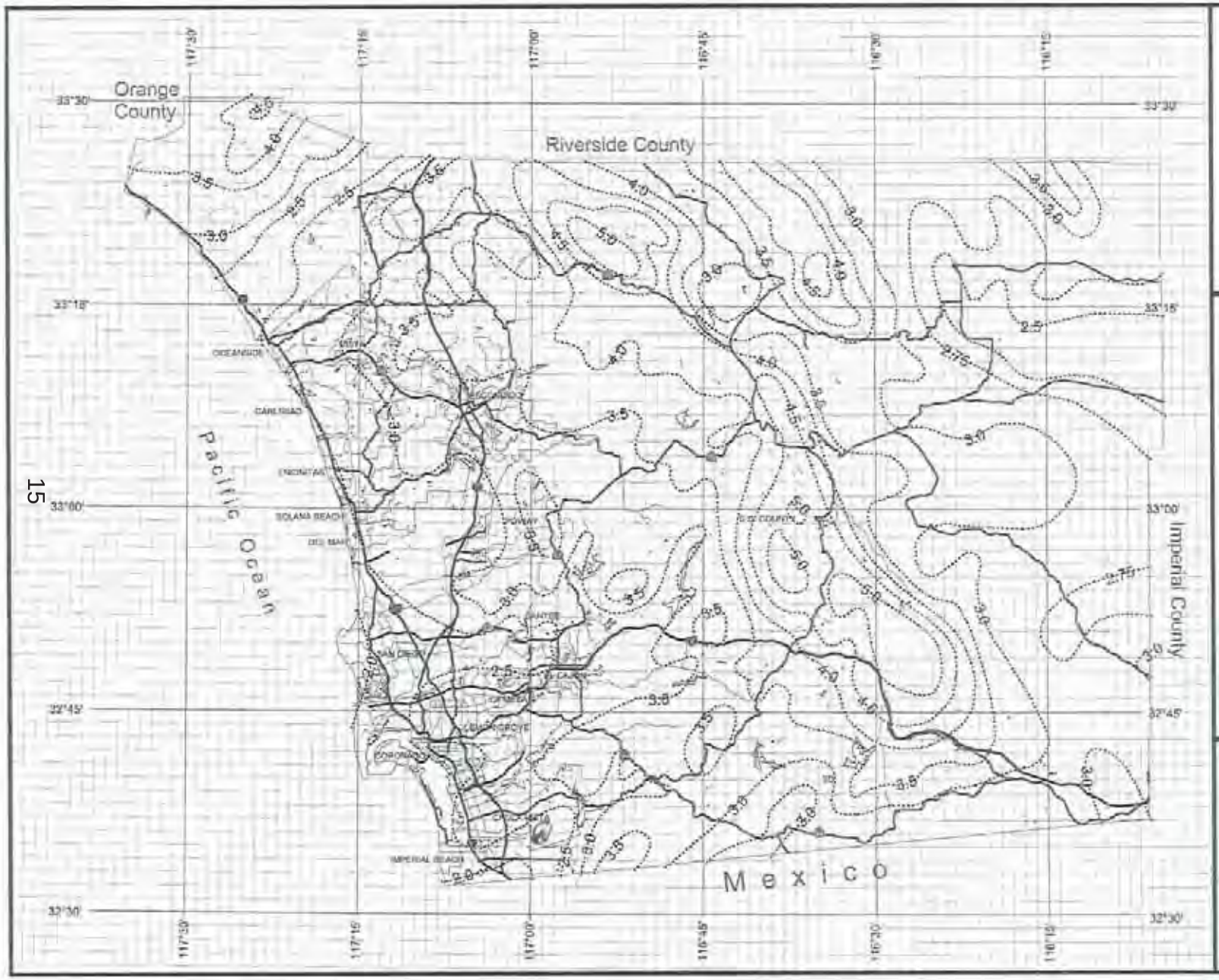
CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.2 – Design Rainfall Determination

100-Year, 6-Hour and 100-Year, 6-Hour Rainfall Isopluvial Maps from San Diego County Hydrology Manual


County of San Diego
Hydrology Manual
Rainfall Isopluvials
100 Year Rainfall Event - 24 Hours
Isopluvial (inches)
Village 2, South
P_{24} = 3.75
Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico
OCEANSIDE
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
SAN DIEGO
IMPERIAL BEACH
DPW GIS
SanGIS
N
S
E
W
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Village 2, South

$P_6 = 2.25$

DPW GIS

SanGIS

We Love San Diego County!

N S E W

3 0 3 Miles

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.3 – Runoff Coefficient Determination

3-203.1 **Previously Approved Reports** - Runoff quantities, as set forth or derived from the report prepared by Lawrence, Fogg, Florer and Smith titled "A Special Study of Storm Drain Facilities" on file in the office of the City Engineer may be used in the design of drainage facilities in Chula Vista. A hydrologic study prepared and approved at General Development Plan (GDP) or Specific Planning Area (SPA) plan may be used as determined by the City Engineer.

3-203.2 For local drainage basins, storm discharge flow may be estimated based on the Rational Method or the Modified Rational Method. For all lateral and major drainage basins the SCS method, U.S. Army Corps of Engineers HEC-1 computer method or other tabular or computer method may be used upon City Engineer approval.

3-203.3 **Rational and Modified Rational Methods**

(1) The rational method equation relates storm rainfall intensity (I), a selected runoff coefficient (C) and drainage area (A) to the peak runoff rate (Q):

$$Q = CIA \text{ (Empirical Units)}$$

where:

Q = Peak runoff in cubic feet per second
C = Runoff coefficient
I = Intensity, inches per hours
A = Drainage basin area in acres

Or

$$Q = 0.278CIA \text{ (Metric Units)}$$

where:

Q = Peak runoff in cubic meters per second
C = Runoff coefficient
I = Intensity in millimeters per second
A = Drainage area in square kilometers

(2) Coefficient of Runoff: Consider probable development. Use highest number of the following values:

a)	Paved Surface	0.90
b)	Commercial Area	0.85
c)	Dense Residential (R2, R3)	0.75
d)	Normal Residential (R1)	0.65
e)	Suburban Property (RE)	0.55
f)	Barren Slopes Steep	0.80
g)	Barren Slopes Hilly	0.75
h)	" " Rolling	0.70
i)	" " Flat	0.65
j)	Vegetated Slopes Steep	0.60
k)	" " Hilly	0.55
l)	" " Rolling	0.50
m)	" " Flat	0.45

n)	Farm Land	0.35
o)	Parks, Golf Courses	0.30

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

-Maximum Overland Flow Length & Initial Time of Concentration

-Urban Watershed Overland Time of Flow Nomograph

-Gutter & Roadway Discharge-Velocity Chart

- Manning's Equation Nomograph

-Intensity-Duration Design Chart

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.

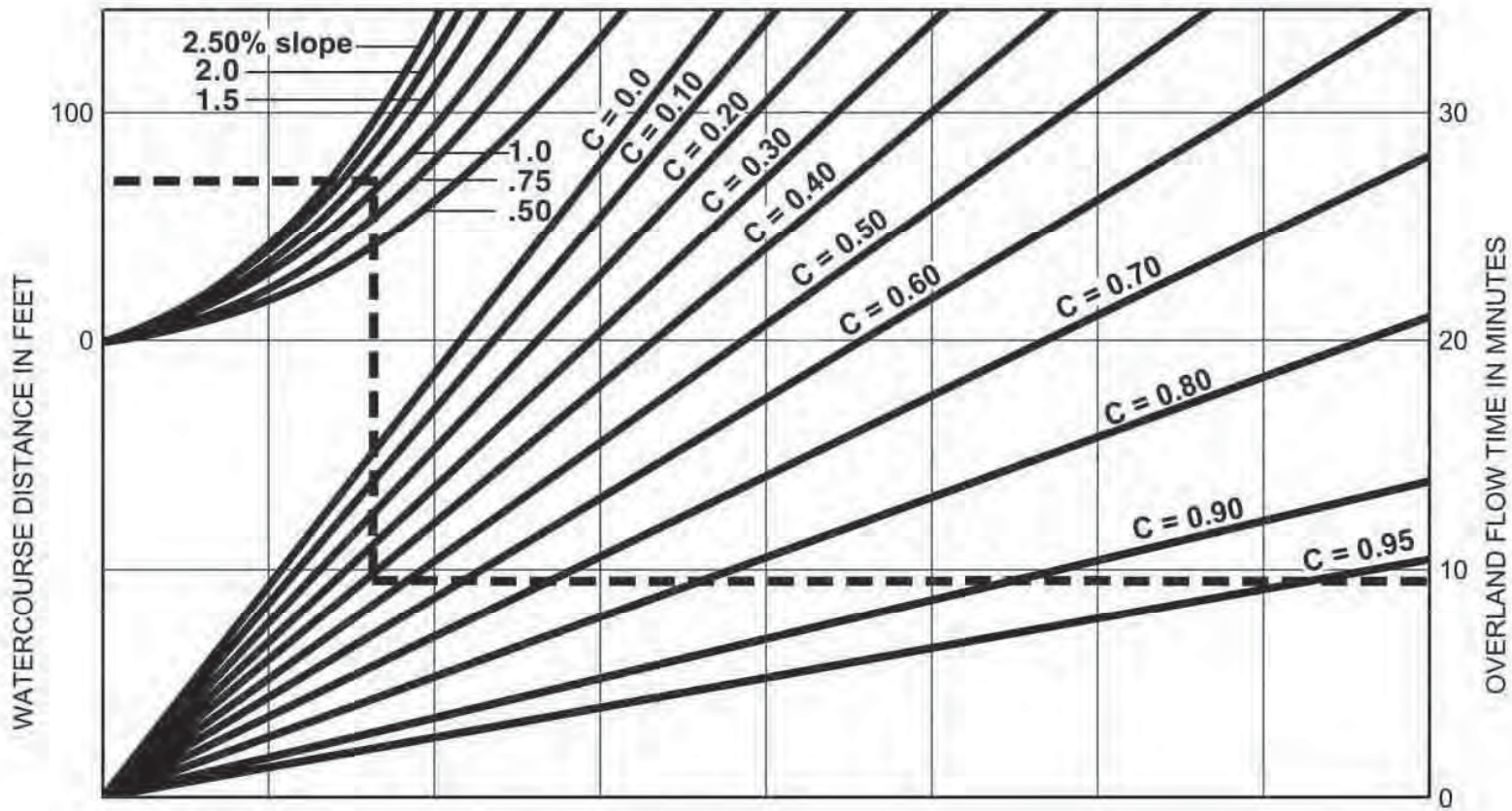
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved 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/	.5%		1%		2%		3%		5%		10%	
	Acre	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



EXAMPLE:

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

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

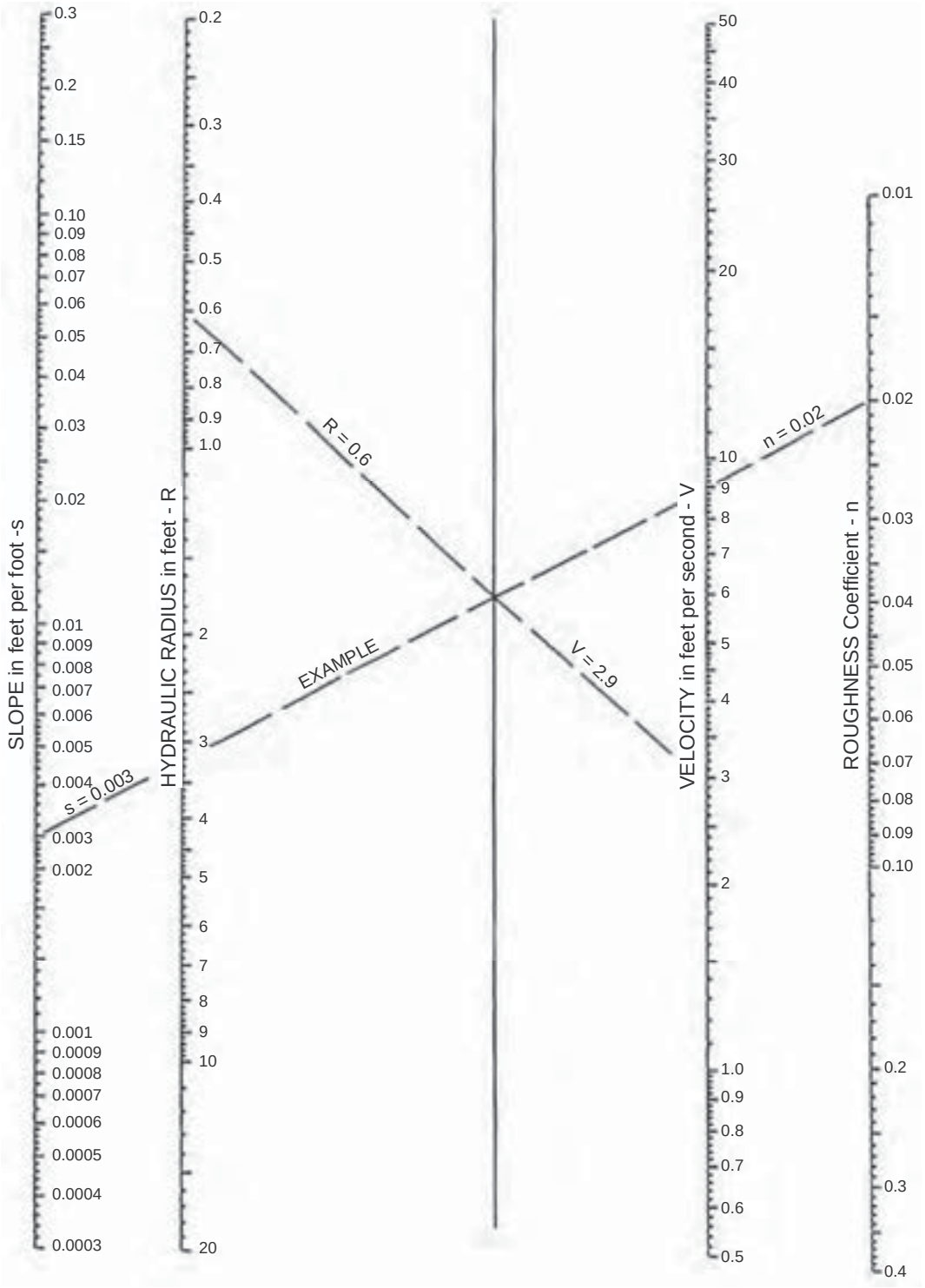
SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

Rational Formula - Overland Time of Flow Nomograph

3-3

EQUATION: $V = \frac{1.49}{n} R^{2/3} s^{1/2}$



GENERAL SOLUTION

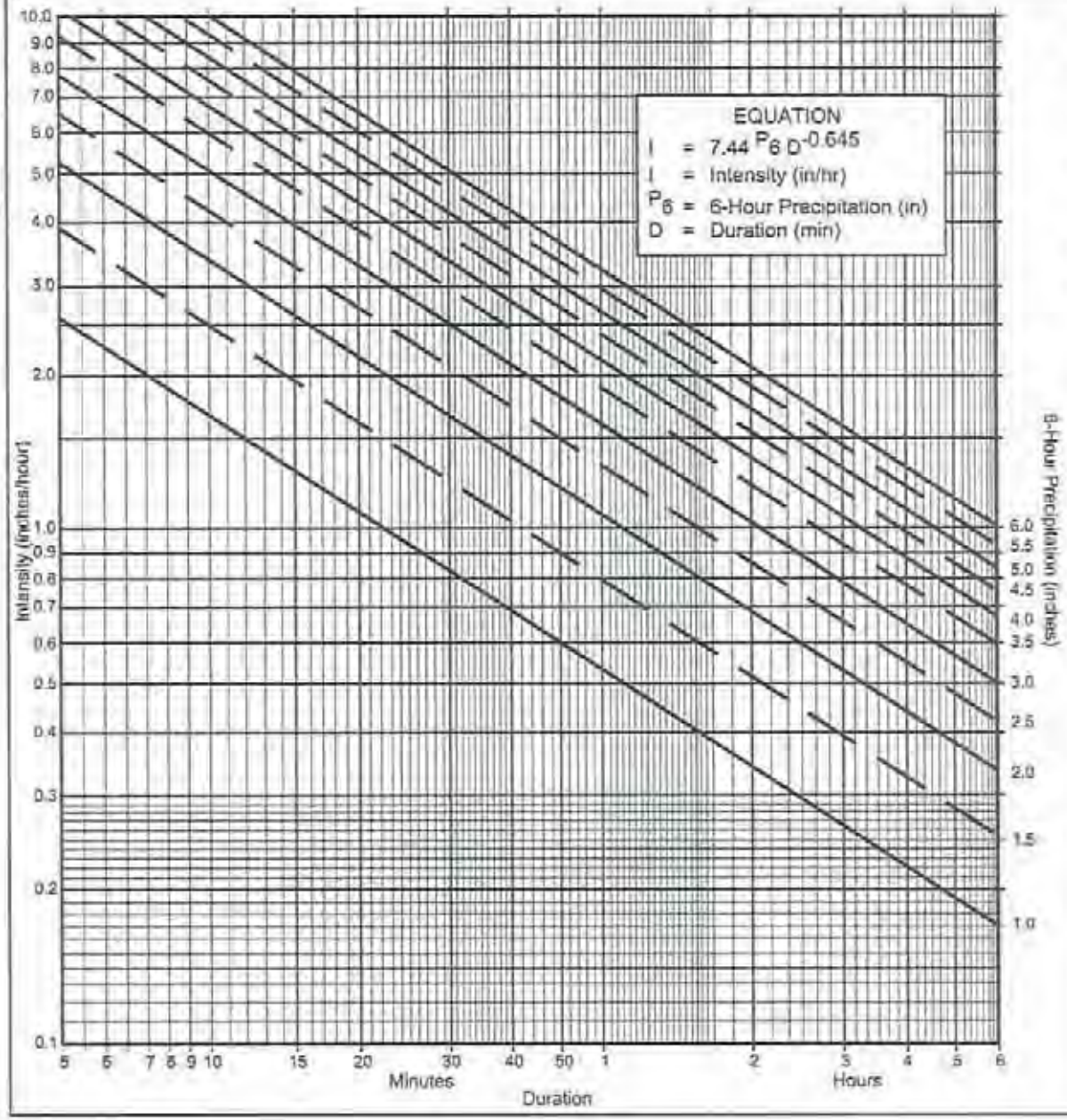
SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

Manning's Equation Nomograph

3-7

VILLAGE 2, SOUTH TH



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.25 in., P_{24} = 3.75 $\frac{P_6}{P_{24}}$ = 60.0 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.25 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1 I	1.5 I	2 I	2.5 I	3 I	3.5 I	4 I	4.5 I	5 I	5.5 I	6 I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.89	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

CHAPTER 3

HYDROLOGIC ANALYSIS

CHAPTER 3

100-YEAR HYDROLOGIC ANALYSIS

3.1 – North Portion Pre-Developed Condition AES Model Output

Refer to Exhibit 1.1 in Chapter 7

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____________________________________________________________________________
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                          2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                    Hunsaker & Associates San Diego, Inc.
                              9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch, Village 2 South                                              *
* 100-year Existing Condition Hydrology Model.                             *
* W.O. 2807-35,  DLN:  1089                                                *
 ****************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\EX100.DAT
  TIME/DATE OF STUDY: 10:28 05/23/2012
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.250
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150


  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    488.00
  DOWNSTREAM ELEVATION(FEET) =    487.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      1.32
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.32

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   484.00  DOWNSTREAM(FEET) =   468.00
  FLOW LENGTH(FEET) =  1627.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.32
  PIPE TRAVEL TIME(MIN.) =   6.96    Tc(MIN.) =   12.04
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1697.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.363
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7990
  SUBAREA AREA(ACRES) =   14.33   SUBAREA RUNOFF(CFS) =   38.56
  TOTAL AREA(ACRES) =       14.6   TOTAL RUNOFF(CFS) =      39.32
  TC(MIN.) =   12.04

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.04
  RAINFALL INTENSITY(INCH/HR) =   3.36
  TOTAL STREAM AREA(ACRES) =    14.63
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     39.32

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    500.00
  DOWNSTREAM ELEVATION(FEET) =    490.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.60
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.60

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   476.00  DOWNSTREAM(FEET) =   470.00
  FLOW LENGTH(FEET) =   548.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.60
```

```
  PIPE TRAVEL TIME(MIN.) =   2.83    Tc(MIN.) =    7.01
  LONGEST FLOWPATH FROM NODE    105.00 TO NODE    107.00 =     648.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.766
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    0.83   SUBAREA RUNOFF(CFS) =    2.37
  TOTAL AREA(ACRES) =        1.0   TOTAL RUNOFF(CFS) =       2.86
  TC(MIN.) =    7.01

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.01
  RAINFALL INTENSITY(INCH/HR) =   4.77
  TOTAL STREAM AREA(ACRES) =     1.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.86

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       39.32    12.04        3.363         14.63
      2        2.86     7.01        4.766          1.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       25.76     7.01       4.766
      2       41.33    12.04       3.363

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      41.33   Tc(MIN.) =   12.04
  TOTAL AREA(ACRES) =       15.6
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1697.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   465.00  DOWNSTREAM(FEET) =   459.00
  FLOW LENGTH(FEET) =   488.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.01
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      41.33
  PIPE TRAVEL TIME(MIN.) =   0.81    Tc(MIN.) =   12.85
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =    2185.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =   12.85
  RAINFALL INTENSITY(INCH/HR) =   3.22
  TOTAL STREAM AREA(ACRES) =    15.63
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     41.33

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    273.00
  DOWNSTREAM ELEVATION(FEET) =    272.40
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.36
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      1.36

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.00  DOWNSTREAM ELEVATION(FEET) =  464.00
  STREET LENGTH(FEET) =   367.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.20
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.09
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.60
  STREET FLOW TRAVEL TIME(MIN.) =   2.92   Tc(MIN.) =    6.41
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.051
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    0.85      SUBAREA RUNOFF(CFS) =    3.65
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       4.81

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.67
  FLOW VELOCITY(FEET/SEC.) =  2.28   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =     427.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.41
  RAINFALL INTENSITY(INCH/HR) =   5.05
  TOTAL STREAM AREA(ACRES) =     1.12
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.81
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    495.00
  DOWNSTREAM ELEVATION(FEET) =    485.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.43
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.43

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   470.00  DOWNSTREAM(FEET) =   465.00
  FLOW LENGTH(FEET) =   445.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.90
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.43
  PIPE TRAVEL TIME(MIN.) =   2.55    Tc(MIN.) =    6.73
  LONGEST FLOWPATH FROM NODE    115.00 TO NODE    117.00 =     545.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.893
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    0.50   SUBAREA RUNOFF(CFS) =    1.47
  TOTAL AREA(ACRES) =        0.6   TOTAL RUNOFF(CFS) =       1.82
  TC(MIN.) =    6.73

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.73
  RAINFALL INTENSITY(INCH/HR) =   4.89
  TOTAL STREAM AREA(ACRES) =     0.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.82

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       41.33    12.85        3.225         15.63
      2        4.81     6.41        5.051          1.12
      3        1.82     6.73        4.893          0.62

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       32.93     6.41       5.051
      2       33.72     6.73       4.893
      3       45.60    12.85       3.225

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      45.60   Tc(MIN.) =   12.85
  TOTAL AREA(ACRES) =       17.4
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =    2185.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   459.00  DOWNSTREAM(FEET) =   442.00
  FLOW LENGTH(FEET) =  1173.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.87
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      45.60
  PIPE TRAVEL TIME(MIN.) =   1.80    Tc(MIN.) =   14.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    3358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.65
  RAINFALL INTENSITY(INCH/HR) =   2.96
  TOTAL STREAM AREA(ACRES) =    17.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     45.60

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    465.00
  DOWNSTREAM ELEVATION(FEET) =    464.40
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.55
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.55

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  463.30  DOWNSTREAM ELEVATION(FEET) =  447.00
  STREET LENGTH(FEET) =  1093.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
```

```
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.59
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.79
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.57
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   7.08   Tc(MIN.) =   10.57
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.658
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    2.50      SUBAREA RUNOFF(CFS) =    7.77
  TOTAL AREA(ACRES) =        2.6        PEAK FLOW RATE(CFS) =       8.11

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.29
  FLOW VELOCITY(FEET/SEC.) =  2.92   DEPTH*VELOCITY(FT*FT/SEC.) =   1.03
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =    1153.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.57
  RAINFALL INTENSITY(INCH/HR) =   3.66
  TOTAL STREAM AREA(ACRES) =     2.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.11

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    126.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (FLAT) RUNOFF COEFFICIENT = .5500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    500.15
  DOWNSTREAM ELEVATION(FEET) =    499.00
  ELEVATION DIFFERENCE(FEET) =      1.15
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.505
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.29
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.562
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.23

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   499.50  DOWNSTREAM(FEET) =   451.00
  FLOW LENGTH(FEET) =  1990.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.17
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.23
  PIPE TRAVEL TIME(MIN.) =  10.46    Tc(MIN.) =   17.96
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    127.00 =    2075.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.598
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (ROLLING) RUNOFF COEFFICIENT = .5000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5003
  SUBAREA AREA(ACRES) =   14.39   SUBAREA RUNOFF(CFS) =   18.69
  TOTAL AREA(ACRES) =       14.5   TOTAL RUNOFF(CFS) =      18.82
  TC(MIN.) =   17.96

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   17.96
  RAINFALL INTENSITY(INCH/HR) =   2.60
  TOTAL STREAM AREA(ACRES) =    14.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     18.82

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       45.60    14.65        2.964         17.37
      2        8.11    10.57        3.658          2.61
      3       18.82    17.96        2.598         14.48

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       56.14    10.57       3.658
      2       67.53    14.65       2.964
      3       64.57    17.96       2.598

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      67.53   Tc(MIN.) =   14.65
  TOTAL AREA(ACRES) =       34.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    3358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    128.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   442.00  DOWNSTREAM(FEET) =   435.00
  FLOW LENGTH(FEET) =   295.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.67
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      67.53
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =   14.98
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =    3653.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    129.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    435.00  DOWNSTREAM(FEET) =    372.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1200.00   CHANNEL SLOPE =  0.0525
```

```
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  15.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.671
  *USER SPECIFIED(SUBAREA):
  BARREN SLOPES (STEEP) RUNOFF COEFFICIENT = .7000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      87.62
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   9.00
  AVERAGE FLOW DEPTH(FEET) =   0.83   TRAVEL TIME(MIN.) =   2.22
  Tc(MIN.) =   17.21
  SUBAREA AREA(ACRES) =    21.47       SUBAREA RUNOFF(CFS) =   40.15
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.681
  TOTAL AREA(ACRES) =       55.9         PEAK FLOW RATE(CFS) =     101.79

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.91   FLOW VELOCITY(FEET/SEC.) =   9.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    129.00 =    4853.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    129.00 TO NODE    129.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   17.21
  RAINFALL INTENSITY(INCH/HR) =   2.67
  TOTAL STREAM AREA(ACRES) =    55.93
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    101.79

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    131.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  BARREN SLOPES (FLAT) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    502.40
  DOWNSTREAM ELEVATION(FEET) =    501.70
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    132.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    501.70  DOWNSTREAM(FEET) =    423.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2267.00   CHANNEL SLOPE =  0.0345
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.220
  *USER SPECIFIED(SUBAREA):
  BARREN SLOPES (ROLLING) RUNOFF COEFFICIENT = .7000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      76.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.95
  AVERAGE FLOW DEPTH(FEET) =   0.58   TRAVEL TIME(MIN.) =   6.35
  Tc(MIN.) =   12.88
  SUBAREA AREA(ACRES) =    65.14       SUBAREA RUNOFF(CFS) =  146.84
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
  TOTAL AREA(ACRES) =       65.2         PEAK FLOW RATE(CFS) =     147.03

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.84   FLOW VELOCITY(FEET/SEC.) =   7.47
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    132.00 =    2337.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    129.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   370.00
  FLOW LENGTH(FEET) =   486.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  32.02
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     147.03
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   13.13
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    129.00 =    2823.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    129.00 TO NODE    129.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.13
  RAINFALL INTENSITY(INCH/HR) =   3.18
  TOTAL STREAM AREA(ACRES) =    65.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    147.03

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      101.79    17.21        2.671         55.93
      2      147.03    13.13        3.180         65.23

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      232.53    13.13       3.180
      2      225.30    17.21       2.671

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     232.53   Tc(MIN.) =   13.13
  TOTAL AREA(ACRES) =      121.2
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    129.00 =    4853.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    129.00 TO NODE    137.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   370.00  DOWNSTREAM(FEET) =   290.00
  FLOW LENGTH(FEET) =  1225.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  28.86
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     232.53
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =   13.84
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    137.00 =    6078.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    129.00 TO NODE    137.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.074
  *USER SPECIFIED(SUBAREA):
  BARREN SLOPES (ROLLING) RUNOFF COEFFICIENT = .7000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6931
  SUBAREA AREA(ACRES) =   32.13   SUBAREA RUNOFF(CFS) =   69.14
  TOTAL AREA(ACRES) =      153.3   TOTAL RUNOFF(CFS) =     326.65
  TC(MIN.) =   13.84

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    137.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.84
  RAINFALL INTENSITY(INCH/HR) =   3.07
  TOTAL STREAM AREA(ACRES) =   153.29
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    326.65

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    136.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (FLAT) RUNOFF COEFFICIENT = .4500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    496.70
  DOWNSTREAM ELEVATION(FEET) =    496.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.433
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.937
  SUBAREA RUNOFF(CFS) =      1.26
  TOTAL AREA(ACRES) =      0.71   TOTAL RUNOFF(CFS) =      1.26

****************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    137.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    496.00  DOWNSTREAM(FEET) =    290.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  2240.00   CHANNEL SLOPE =  0.0920
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.26
  FLOW VELOCITY(FEET/SEC) =   4.75 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   7.86   Tc(MIN.) =   17.29
  LONGEST FLOWPATH FROM NODE    135.00 TO NODE    137.00 =    2310.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    137.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.663
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5484
  SUBAREA AREA(ACRES) =   44.18   SUBAREA RUNOFF(CFS) =   64.71
  TOTAL AREA(ACRES) =       44.9   TOTAL RUNOFF(CFS) =      65.57
  TC(MIN.) =   17.29

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    137.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   17.29
  RAINFALL INTENSITY(INCH/HR) =   2.66
  TOTAL STREAM AREA(ACRES) =    44.89
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     65.57

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      326.65    13.84        3.074        153.29
      2       65.57    17.29        2.663         44.89

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      379.14    13.84       3.074
      2      348.54    17.29       2.663

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     379.14   Tc(MIN.) =   13.84
  TOTAL AREA(ACRES) =      198.2
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    137.00 =    6078.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    138.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    290.00  DOWNSTREAM(FEET) =    277.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   930.00   CHANNEL SLOPE =  0.0140
  CHANNEL FLOW THRU SUBAREA(CFS) =     379.14
  FLOW VELOCITY(FEET/SEC) =   8.48 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.83   Tc(MIN.) =   15.67
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    138.00 =    7008.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    138.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.838
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6371
  SUBAREA AREA(ACRES) =   53.00   SUBAREA RUNOFF(CFS) =   82.72
  TOTAL AREA(ACRES) =      251.2   TOTAL RUNOFF(CFS) =     454.11
  TC(MIN.) =   15.67
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      251.2  TC(MIN.) =     15.67
  PEAK FLOW RATE(CFS)   =     454.11
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 3

100-YEAR HYDROLOGIC ANALYSIS

3.2 – Heritage Road Portion Pre-Developed Condition AES Model Output

Refer to Exhibit 1.2 in Chapter 7

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                          2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                    Hunsaker & Associates San Diego, Inc.
                              9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch, Village 2 South TM                                           *
* 100-year Return interval Existing Condition  HERITAGE ROAD PORTION       *
* W.O. 2807-35, DLN: 1089                                                  *
 ***************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\S\EX2.DAT
  TIME/DATE OF STUDY: 19:29 06/01/2012
---------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
---------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.250
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   17.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  3   20.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  4   16.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  5   26.0     18.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  6   44.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
---------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
===========================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    645.00
  DOWNSTREAM ELEVATION(FEET) =    640.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.895
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.415
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.35   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    350.00  DOWNSTREAM(FEET) =    280.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   860.00   CHANNEL SLOPE =  0.0814
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.452
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.51
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.91
  AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =   3.67
  Tc(MIN.) =   11.57
  SUBAREA AREA(ACRES) =     8.14       SUBAREA RUNOFF(CFS) =   14.05
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.494
  TOTAL AREA(ACRES) =        8.5         PEAK FLOW RATE(CFS) =      14.47

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.24   FLOW VELOCITY(FEET/SEC.) =   4.83
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     960.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    280.00  DOWNSTREAM(FEET) =    246.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   616.00   CHANNEL SLOPE =  0.0552
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.116
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      27.49
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.17
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   1.99
  Tc(MIN.) =   13.55
  SUBAREA AREA(ACRES) =    16.69       SUBAREA RUNOFF(CFS) =   26.00
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.498
  TOTAL AREA(ACRES) =       25.2         PEAK FLOW RATE(CFS) =      39.07

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.46   FLOW VELOCITY(FEET/SEC.) =   5.78
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1576.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    246.00  DOWNSTREAM(FEET) =    204.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   685.00   CHANNEL SLOPE =  0.0613
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.878
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      49.88
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.41
  AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   1.78
  Tc(MIN.) =   15.33
  SUBAREA AREA(ACRES) =    15.02       SUBAREA RUNOFF(CFS) =   21.61
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.499
  TOTAL AREA(ACRES) =       40.2         PEAK FLOW RATE(CFS) =      57.69

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.55   FLOW VELOCITY(FEET/SEC.) =   6.73
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2261.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    204.00  DOWNSTREAM(FEET) =    140.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   635.00   CHANNEL SLOPE =  0.1008
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.731
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      62.19
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.15
  AVERAGE FLOW DEPTH(FEET) =   0.51   TRAVEL TIME(MIN.) =   1.30
  Tc(MIN.) =   16.63
  SUBAREA AREA(ACRES) =     6.60       SUBAREA RUNOFF(CFS) =    9.01
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.499
  TOTAL AREA(ACRES) =       46.8         PEAK FLOW RATE(CFS) =      63.75

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.51   FLOW VELOCITY(FEET/SEC.) =   8.32
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    2896.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    470.00
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.013
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.918
  SUBAREA RUNOFF(CFS) =      1.18
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.18

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    460.00  DOWNSTREAM(FEET) =    330.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   909.00   CHANNEL SLOPE =  0.1430
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.476
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.89
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.58
  AVERAGE FLOW DEPTH(FEET) =   0.19   TRAVEL TIME(MIN.) =   2.72
  Tc(MIN.) =    7.73
  SUBAREA AREA(ACRES) =    10.24       SUBAREA RUNOFF(CFS) =   22.92
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =       10.6         PEAK FLOW RATE(CFS) =      23.81

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.27   FLOW VELOCITY(FEET/SEC.) =   6.89
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1009.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    330.00  DOWNSTREAM(FEET) =    278.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   714.00   CHANNEL SLOPE =  0.0728
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.904
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      41.32
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.53
  AVERAGE FLOW DEPTH(FEET) =   0.44   TRAVEL TIME(MIN.) =   1.82
  Tc(MIN.) =    9.55
  SUBAREA AREA(ACRES) =    17.90       SUBAREA RUNOFF(CFS) =   34.95
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =       28.5         PEAK FLOW RATE(CFS) =      55.72

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.52   FLOW VELOCITY(FEET/SEC.) =   7.12
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1723.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    278.00  DOWNSTREAM(FEET) =    240.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   598.00   CHANNEL SLOPE =  0.0635
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.572
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      64.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.05
  AVERAGE FLOW DEPTH(FEET) =   0.58   TRAVEL TIME(MIN.) =   1.41
  Tc(MIN.) =   10.97
  SUBAREA AREA(ACRES) =     9.44       SUBAREA RUNOFF(CFS) =   16.86
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =       38.0         PEAK FLOW RATE(CFS) =      67.83

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.60   FLOW VELOCITY(FEET/SEC.) =   7.10
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =    2321.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    240.00  DOWNSTREAM(FEET) =    178.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   829.00   CHANNEL SLOPE =  0.0748
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.244
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      75.08
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.82
  AVERAGE FLOW DEPTH(FEET) =   0.60   TRAVEL TIME(MIN.) =   1.77
  Tc(MIN.) =   12.73
  SUBAREA AREA(ACRES) =     8.94       SUBAREA RUNOFF(CFS) =   14.50
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =       46.9         PEAK FLOW RATE(CFS) =      76.10

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =   7.83
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =    3150.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.73
  RAINFALL INTENSITY(INCH/HR) =   3.24
  TOTAL STREAM AREA(ACRES) =    46.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     76.10

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    380.00
  DOWNSTREAM ELEVATION(FEET) =    370.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.125
  SUBAREA RUNOFF(CFS) =      0.56
  TOTAL AREA(ACRES) =      0.31   TOTAL RUNOFF(CFS) =      0.56

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    212.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    370.00  DOWNSTREAM(FEET) =    290.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   913.00   CHANNEL SLOPE =  0.0876
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.780
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.05
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.03
  AVERAGE FLOW DEPTH(FEET) =   0.17   TRAVEL TIME(MIN.) =   3.78
  Tc(MIN.) =   10.05
  SUBAREA AREA(ACRES) =     7.92       SUBAREA RUNOFF(CFS) =   14.97
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.494
  TOTAL AREA(ACRES) =        8.2         PEAK FLOW RATE(CFS) =      15.38

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.24   FLOW VELOCITY(FEET/SEC.) =   5.13
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    212.00 =    1013.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    213.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    290.00  DOWNSTREAM(FEET) =    250.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   892.00   CHANNEL SLOPE =  0.0448
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.164
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      24.16
```

```
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.66
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   3.19
  Tc(MIN.) =   13.24
  SUBAREA AREA(ACRES) =    11.08       SUBAREA RUNOFF(CFS) =   17.53
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.498
  TOTAL AREA(ACRES) =       19.3         PEAK FLOW RATE(CFS) =      30.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.42   FLOW VELOCITY(FEET/SEC.) =   5.03
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    213.00 =    1905.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    213.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    250.00  DOWNSTREAM(FEET) =    178.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1042.00   CHANNEL SLOPE =  0.0691
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.800
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      38.93
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.29
  AVERAGE FLOW DEPTH(FEET) =   0.43   TRAVEL TIME(MIN.) =   2.76
  Tc(MIN.) =   16.00
  SUBAREA AREA(ACRES) =    12.18       SUBAREA RUNOFF(CFS) =   17.05
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.499
  TOTAL AREA(ACRES) =       31.5         PEAK FLOW RATE(CFS) =      43.95

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.46   FLOW VELOCITY(FEET/SEC.) =   6.50
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    205.00 =    2947.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   16.00
  RAINFALL INTENSITY(INCH/HR) =   2.80
  TOTAL STREAM AREA(ACRES) =    31.49
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     43.95

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       76.10    12.73        3.244         46.92
      2       43.95    16.00        2.800         31.49

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      111.09    12.73       3.244
      2      109.64    16.00       2.800

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     111.09   Tc(MIN.) =   12.73
  TOTAL AREA(ACRES) =       78.4
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =    3150.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    214.00 IS CODE =  51
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    178.00  DOWNSTREAM(FEET) =    146.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   554.00   CHANNEL SLOPE =  0.0578
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.071
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     123.68
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.16
  AVERAGE FLOW DEPTH(FEET) =   0.83   TRAVEL TIME(MIN.) =   1.13
  Tc(MIN.) =   13.86
  SUBAREA AREA(ACRES) =    16.41       SUBAREA RUNOFF(CFS) =   25.19
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =       94.8         PEAK FLOW RATE(CFS) =     145.44

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.90   FLOW VELOCITY(FEET/SEC.) =   8.54
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    214.00 =    3704.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    478.00
  DOWNSTREAM ELEVATION(FEET) =    468.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.125
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    468.00  DOWNSTREAM(FEET) =    380.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   700.00   CHANNEL SLOPE =  0.1257
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.128
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.39
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.67
  AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =   2.50
  Tc(MIN.) =    8.76
  SUBAREA AREA(ACRES) =     7.79       SUBAREA RUNOFF(CFS) =   16.08
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.496
  TOTAL AREA(ACRES) =        8.0         PEAK FLOW RATE(CFS) =      16.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.23   FLOW VELOCITY(FEET/SEC.) =   5.92
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     800.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    380.00  DOWNSTREAM(FEET) =    330.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   710.00   CHANNEL SLOPE =  0.0704
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.599
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      27.52
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.71
  AVERAGE FLOW DEPTH(FEET) =   0.36   TRAVEL TIME(MIN.) =   2.07
  Tc(MIN.) =   10.84
  SUBAREA AREA(ACRES) =    12.35       SUBAREA RUNOFF(CFS) =   22.23
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.498
  TOTAL AREA(ACRES) =       20.4         PEAK FLOW RATE(CFS) =      36.52

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.42   FLOW VELOCITY(FEET/SEC.) =   6.19
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =    1510.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    330.00  DOWNSTREAM(FEET) =    294.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   747.00   CHANNEL SLOPE =  0.0482
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.222
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      56.85
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.14
  AVERAGE FLOW DEPTH(FEET) =   0.58   TRAVEL TIME(MIN.) =   2.03
  Tc(MIN.) =   12.87
  SUBAREA AREA(ACRES) =    25.21       SUBAREA RUNOFF(CFS) =   40.62
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.499
  TOTAL AREA(ACRES) =       45.6         PEAK FLOW RATE(CFS) =      73.31

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.67   FLOW VELOCITY(FEET/SEC.) =   6.60
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =    2257.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    405.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    294.00  DOWNSTREAM(FEET) =    262.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   861.00   CHANNEL SLOPE =  0.0372
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.902
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      87.06
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   6.32
  AVERAGE FLOW DEPTH(FEET) =   0.78   TRAVEL TIME(MIN.) =   2.27
  Tc(MIN.) =   15.13
  SUBAREA AREA(ACRES) =    18.94       SUBAREA RUNOFF(CFS) =   27.48
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.499
  TOTAL AREA(ACRES) =       64.5         PEAK FLOW RATE(CFS) =      93.50

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.80   FLOW VELOCITY(FEET/SEC.) =   6.45
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    405.00 =    3118.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    406.00 IS CODE =  51
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    262.00  DOWNSTREAM(FEET) =    208.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1152.00   CHANNEL SLOPE =  0.0469
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.617
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     110.40
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.31
  AVERAGE FLOW DEPTH(FEET) =   0.83   TRAVEL TIME(MIN.) =   2.63
  Tc(MIN.) =   17.76
  SUBAREA AREA(ACRES) =    25.79       SUBAREA RUNOFF(CFS) =   33.75
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =       90.3         PEAK FLOW RATE(CFS) =     118.08

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.85   FLOW VELOCITY(FEET/SEC.) =   7.49
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    406.00 =    4270.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    407.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    208.00  DOWNSTREAM(FEET) =    162.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1140.00   CHANNEL SLOPE =  0.0404
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.397
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     134.60
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.34
  AVERAGE FLOW DEPTH(FEET) =   0.94   TRAVEL TIME(MIN.) =   2.59
  Tc(MIN.) =   20.35
  SUBAREA AREA(ACRES) =    27.56       SUBAREA RUNOFF(CFS) =   33.04
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =      117.9         PEAK FLOW RATE(CFS) =     141.20

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.97   FLOW VELOCITY(FEET/SEC.) =   7.43
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    407.00 =    5410.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      117.9  TC(MIN.) =     20.35
  PEAK FLOW RATE(CFS)   =     141.20
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 3

100-YEAR HYDROLOGIC ANALYSIS

3.3 – North Portion Developed Condition AES Model Output

Refer to Exhibit 1.3 in Chapter 7

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                    Hunsaker & Associates San Diego, Inc.
                              9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch, Village 2 South                                              *
* 100-year Proposed Condition Hydrology Model.                             *
* W.O. 2807-35,  DLN: 1089                                                 *
 ****************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\S\PR100.DAT
  TIME/DATE OF STUDY: 11:08 02/25/2013
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.250
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   17.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  3   20.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  4   16.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  5   26.0     18.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  6   44.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    488.00
  DOWNSTREAM ELEVATION(FEET) =    487.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.97
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.97

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   486.00  DOWNSTREAM(FEET) =   475.00
  FLOW LENGTH(FEET) =   788.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.03
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.97
  PIPE TRAVEL TIME(MIN.) =   3.26    Tc(MIN.) =    8.34
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     853.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.263
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    9.19   SUBAREA RUNOFF(CFS) =   29.39
  TOTAL AREA(ACRES) =        9.4   TOTAL RUNOFF(CFS) =      30.09
  TC(MIN.) =    8.34

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   475.00  DOWNSTREAM(FEET) =   474.00
  FLOW LENGTH(FEET) =   121.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.09
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.09
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    8.58
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =     974.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.58
  RAINFALL INTENSITY(INCH/HR) =   4.18
  TOTAL STREAM AREA(ACRES) =     9.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     30.09

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    483.00
  DOWNSTREAM ELEVATION(FEET) =    482.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.628
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.96
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.96

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  482.35  DOWNSTREAM ELEVATION(FEET) =  478.00
  STREET LENGTH(FEET) =   446.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 17.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.88
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.82
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.56
  STREET FLOW TRAVEL TIME(MIN.) =   3.77   Tc(MIN.) =    7.40
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.605
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    0.97      SUBAREA RUNOFF(CFS) =    3.80
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       4.54

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.62
  FLOW VELOCITY(FEET/SEC.) =  2.18   DEPTH*VELOCITY(FT*FT/SEC.) =   0.69
  LONGEST FLOWPATH FROM NODE    105.00 TO NODE    107.00 =     511.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.40
  RAINFALL INTENSITY(INCH/HR) =   4.60
  TOTAL STREAM AREA(ACRES) =     1.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.54

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       30.09     8.58        4.183          9.41
      2        4.54     7.40        4.605          1.16

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       30.47     7.40       4.605
      2       34.21     8.58       4.183

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      34.21   Tc(MIN.) =    8.58
  TOTAL AREA(ACRES) =       10.6
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =     974.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   474.00  DOWNSTREAM(FEET) =   473.00
  FLOW LENGTH(FEET) =    95.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.14
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      34.21
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    8.76
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =    1069.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.76
  RAINFALL INTENSITY(INCH/HR) =   4.13
  TOTAL STREAM AREA(ACRES) =    10.57
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     34.21

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    483.00
  DOWNSTREAM ELEVATION(FEET) =    482.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.96
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.96

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  4 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  482.35  DOWNSTREAM ELEVATION(FEET) =  276.00
  STREET LENGTH(FEET) =   394.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.07
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.16
    HALFSTREET FLOOD WIDTH(FEET) =    1.50
    AVERAGE FLOW VELOCITY(FEET/SEC.) =   13.65
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.13
  STREET FLOW TRAVEL TIME(MIN.) =   0.48   Tc(MIN.) =    3.97
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    0.84      SUBAREA RUNOFF(CFS) =    4.23
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       5.19
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.19   HALFSTREET FLOOD WIDTH(FEET) =   3.29
  FLOW VELOCITY(FEET/SEC.) = 11.45   DEPTH*VELOCITY(FT*FT/SEC.) =   2.20
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =     459.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   474.00  DOWNSTREAM(FEET) =   473.00
  FLOW LENGTH(FEET) =    82.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.14
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.19
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    4.19
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    108.00 =     541.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.19
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     1.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.19

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       34.21     8.76        4.130        10.57
      2        5.19     4.19        5.928         1.03

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       29.02     4.19       5.928
      2       37.83     8.76       4.130

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      37.83   Tc(MIN.) =    8.76
  TOTAL AREA(ACRES) =       11.6
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =    1069.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   473.00  DOWNSTREAM(FEET) =   464.00
  FLOW LENGTH(FEET) =   695.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.13
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      37.83
  PIPE TRAVEL TIME(MIN.) =   1.14    Tc(MIN.) =    9.90
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1764.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =    9.90
  RAINFALL INTENSITY(INCH/HR) =   3.82
  TOTAL STREAM AREA(ACRES) =    11.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.83

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    481.50
  DOWNSTREAM ELEVATION(FEET) =    480.90
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.31
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.31

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   480.90  DOWNSTREAM(FEET) =   474.50
  FLOW LENGTH(FEET) =   780.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.64
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.31
  PIPE TRAVEL TIME(MIN.) =   3.57    Tc(MIN.) =    7.05
  LONGEST FLOWPATH FROM NODE    115.00 TO NODE    117.00 =     840.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.749
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    9.39   SUBAREA RUNOFF(CFS) =   37.90
  TOTAL AREA(ACRES) =        9.7   TOTAL RUNOFF(CFS) =      38.95
  TC(MIN.) =    7.05

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   465.00  DOWNSTREAM(FEET) =   464.00
  FLOW LENGTH(FEET) =   127.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.45
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.95
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    7.30
  LONGEST FLOWPATH FROM NODE    115.00 TO NODE    122.00 =     967.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.30
  RAINFALL INTENSITY(INCH/HR) =   4.64
  TOTAL STREAM AREA(ACRES) =     9.65
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     38.95

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    478.00
  DOWNSTREAM ELEVATION(FEET) =    476.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.06
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      1.06

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  476.00  DOWNSTREAM ELEVATION(FEET) =  470.00
  STREET LENGTH(FEET) =   603.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 17.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0150

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.88
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.13
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
  STREET FLOW TRAVEL TIME(MIN.) =   4.73   Tc(MIN.) =    7.72
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.481
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    1.46      SUBAREA RUNOFF(CFS) =    5.56
  TOTAL AREA(ACRES) =        1.7        PEAK FLOW RATE(CFS) =       6.36

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.10
  FLOW VELOCITY(FEET/SEC.) =  2.35   DEPTH*VELOCITY(FT*FT/SEC.) =   0.82
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     703.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.72
  RAINFALL INTENSITY(INCH/HR) =   4.48
  TOTAL STREAM AREA(ACRES) =     1.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.36

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
```

```
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       37.83     9.90        3.815         11.60
      2       38.95     7.30        4.643          9.65
      3        6.36     7.72        4.481          1.67

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       76.06     7.30       4.643
      2       76.16     7.72       4.481
      3       75.25     9.90       3.815

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      76.16   Tc(MIN.) =    7.72
  TOTAL AREA(ACRES) =       22.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1764.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   464.00  DOWNSTREAM(FEET) =   463.00
  FLOW LENGTH(FEET) =   101.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.71
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      76.16
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    7.87
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    123.00 =    1865.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.87
  RAINFALL INTENSITY(INCH/HR) =   4.42
  TOTAL STREAM AREA(ACRES) =    22.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     76.16

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    126.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    475.22
  DOWNSTREAM ELEVATION(FEET) =    474.57
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.782
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    53.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.06
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      1.06

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  474.57  DOWNSTREAM ELEVATION(FEET) =  469.00
  STREET LENGTH(FEET) =   341.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.83
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.86
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.40
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.63
  STREET FLOW TRAVEL TIME(MIN.) =   2.37   Tc(MIN.) =    6.15
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.188
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    3.53
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       4.45

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.50
  FLOW VELOCITY(FEET/SEC.) =  2.65   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    127.00 =     441.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   464.00  DOWNSTREAM(FEET) =   463.00
  FLOW LENGTH(FEET) =    83.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.87
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.45
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =    6.38
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    123.00 =     524.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.38
  RAINFALL INTENSITY(INCH/HR) =   5.06
  TOTAL STREAM AREA(ACRES) =     1.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.45

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       76.16     7.87        4.423         22.92
      2        4.45     6.38        5.064          1.01

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       70.98     6.38       5.064
      2       80.05     7.87       4.423

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      80.05   Tc(MIN.) =    7.87
```

```
  TOTAL AREA(ACRES) =       23.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    123.00 =    1865.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    137.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   463.00  DOWNSTREAM(FEET) =   458.00
  FLOW LENGTH(FEET) =   481.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.29
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      80.05
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =    8.58
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    137.00 =    2346.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    137.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.58
  RAINFALL INTENSITY(INCH/HR) =   4.18
  TOTAL STREAM AREA(ACRES) =    23.93
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     80.05

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    131.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .3000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    473.50
  DOWNSTREAM ELEVATION(FEET) =    472.80
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   11.610
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.443
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      0.27

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    132.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   472.00  DOWNSTREAM(FEET) =   467.00
  FLOW LENGTH(FEET) =   784.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.09
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.27
  PIPE TRAVEL TIME(MIN.) =   6.27    Tc(MIN.) =   17.88
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    132.00 =     854.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    132.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.606
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .3000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =    6.32   SUBAREA RUNOFF(CFS) =    4.94
```

```
  TOTAL AREA(ACRES) =        6.6   TOTAL RUNOFF(CFS) =       5.14
  TC(MIN.) =   17.88

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    137.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   460.00  DOWNSTREAM(FEET) =   459.00
  FLOW LENGTH(FEET) =    97.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.75
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.14
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   18.16
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    137.00 =     951.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    137.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.16
  RAINFALL INTENSITY(INCH/HR) =   2.58
  TOTAL STREAM AREA(ACRES) =     6.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.14

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    136.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    469.00
  DOWNSTREAM ELEVATION(FEET) =    468.40
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.847
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    52.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.11
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      1.11

****************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    137.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.00  DOWNSTREAM ELEVATION(FEET) =  464.50
  STREET LENGTH(FEET) =   376.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.83
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.84
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.93
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
  STREET FLOW TRAVEL TIME(MIN.) =   3.25   Tc(MIN.) =    7.09
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.731
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    0.85      SUBAREA RUNOFF(CFS) =    3.42
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       4.30

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.50
  FLOW VELOCITY(FEET/SEC.) =  2.11   DEPTH*VELOCITY(FT*FT/SEC.) =   0.67
  LONGEST FLOWPATH FROM NODE    135.00 TO NODE    137.00 =     476.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    137.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.09
  RAINFALL INTENSITY(INCH/HR) =   4.73
  TOTAL STREAM AREA(ACRES) =     1.07
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       80.05     8.58        4.183         23.93
      2        5.14    18.16        2.580          6.58
      3        4.30     7.09        4.731          1.07

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       77.09     7.09       4.731
      2       86.29     8.58       4.183
      3       56.86    18.16       2.580

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      86.29   Tc(MIN.) =    8.58
  TOTAL AREA(ACRES) =       31.6
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    137.00 =    2346.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    137.00 TO NODE    138.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   459.00  DOWNSTREAM(FEET) =   458.00
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.03
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      86.29
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    8.70
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    138.00 =    2426.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    138.00 TO NODE    138.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.70
  RAINFALL INTENSITY(INCH/HR) =   4.15
  TOTAL STREAM AREA(ACRES) =    31.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     86.29
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    141.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    469.50
  DOWNSTREAM ELEVATION(FEET) =    467.95
  ELEVATION DIFFERENCE(FEET) =      1.55
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.970
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.67
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.86
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.86

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    142.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  467.95  DOWNSTREAM ELEVATION(FEET) =  463.00
  STREET LENGTH(FEET) =   349.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.77
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.04
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.26
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.60
  STREET FLOW TRAVEL TIME(MIN.) =   2.58   Tc(MIN.) =    5.55
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.544
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    0.81      SUBAREA RUNOFF(CFS) =    3.82
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       4.62

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.91
  FLOW VELOCITY(FEET/SEC.) =  2.53   DEPTH*VELOCITY(FT*FT/SEC.) =   0.77
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    142.00 =     424.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    138.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   459.00  DOWNSTREAM(FEET) =   458.00
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.01
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.62
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    5.77
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    138.00 =     504.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    138.00 TO NODE    138.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.77
  RAINFALL INTENSITY(INCH/HR) =   5.41
  TOTAL STREAM AREA(ACRES) =     0.98
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.62

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       86.29     8.70        4.149         31.58
      2        4.62     5.77        5.405          0.98

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       70.85     5.77       5.405
      2       89.83     8.70       4.149

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      89.83   Tc(MIN.) =    8.70
  TOTAL AREA(ACRES) =       32.6
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    138.00 =    2426.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    138.00 TO NODE    143.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   458.00  DOWNSTREAM(FEET) =   449.00
  FLOW LENGTH(FEET) =   681.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.37
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      89.83
  PIPE TRAVEL TIME(MIN.) =   0.92    Tc(MIN.) =    9.61
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    143.00 =    3107.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    143.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.61
  RAINFALL INTENSITY(INCH/HR) =   3.89
  TOTAL STREAM AREA(ACRES) =    32.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     89.83

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    146.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    486.50
  DOWNSTREAM ELEVATION(FEET) =    485.70
  ELEVATION DIFFERENCE(FEET) =      0.80
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
```

```
  SUBAREA RUNOFF(CFS) =      0.79
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.79

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    147.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   462.50  DOWNSTREAM(FEET) =   454.00
  FLOW LENGTH(FEET) =   618.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.77
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.79
  PIPE TRAVEL TIME(MIN.) =   2.73    Tc(MIN.) =    7.81
  LONGEST FLOWPATH FROM NODE    145.00 TO NODE    147.00 =     698.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    147.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.446
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    4.74   SUBAREA RUNOFF(CFS) =   15.81
  TOTAL AREA(ACRES) =        4.9   TOTAL RUNOFF(CFS) =      16.41
  TC(MIN.) =    7.81

****************************************************************************
  FLOW PROCESS FROM NODE    147.00 TO NODE    143.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   450.00  DOWNSTREAM(FEET) =   449.00
  FLOW LENGTH(FEET) =    92.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.78
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.41
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    8.01
  LONGEST FLOWPATH FROM NODE    145.00 TO NODE    143.00 =     790.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    143.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.01
  RAINFALL INTENSITY(INCH/HR) =   4.38
  TOTAL STREAM AREA(ACRES) =     4.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.41

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       89.83     9.61        3.889         32.56
      2       16.41     8.01        4.375          4.92

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       96.26     8.01       4.375
      2      104.42     9.61       3.889

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =     104.42   Tc(MIN.) =    9.61
  TOTAL AREA(ACRES) =       37.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    143.00 =    3107.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    148.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  26.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.19
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     104.42
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    9.76
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    148.00 =    3257.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    148.00 TO NODE    148.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.76
  RAINFALL INTENSITY(INCH/HR) =   3.85
  TOTAL STREAM AREA(ACRES) =    37.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    104.42

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    151.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    468.70
  DOWNSTREAM ELEVATION(FEET) =    460.00
  ELEVATION DIFFERENCE(FEET) =      8.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.004
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.91
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.91

****************************************************************************
  FLOW PROCESS FROM NODE    151.00 TO NODE    152.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   460.00  DOWNSTREAM(FEET) =   451.50
  FLOW LENGTH(FEET) =   342.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.83
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.91
  PIPE TRAVEL TIME(MIN.) =   1.18    Tc(MIN.) =    3.18
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    152.00 =     432.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    151.00 TO NODE    152.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7601
  SUBAREA AREA(ACRES) =    1.60   SUBAREA RUNOFF(CFS) =    7.11
  TOTAL AREA(ACRES) =        1.8   TOTAL RUNOFF(CFS) =       8.02
```

```
  TC(MIN.) =    3.18

****************************************************************************
  FLOW PROCESS FROM NODE    152.00 TO NODE    148.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   446.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.55
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.02
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =    3.41
  LONGEST FLOWPATH FROM NODE    150.00 TO NODE    148.00 =     522.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    148.00 TO NODE    148.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.41
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     1.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.02

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      104.42     9.76        3.851         37.48
      2        8.02     3.41        5.928          1.78

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       75.86     3.41       5.928
      2      109.63     9.76       3.851

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     109.63   Tc(MIN.) =    9.76
  TOTAL AREA(ACRES) =       39.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    148.00 =    3257.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    148.00 TO NODE    162.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   440.00
  FLOW LENGTH(FEET) =   260.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.38
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     109.63
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   10.04
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    162.00 =    3517.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    162.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.04
  RAINFALL INTENSITY(INCH/HR) =   3.78
  TOTAL STREAM AREA(ACRES) =    39.26
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    109.63
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    155.00 TO NODE    156.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .3000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    62.00
  UPSTREAM ELEVATION(FEET) =    459.61
  DOWNSTREAM ELEVATION(FEET) =    457.75
  ELEVATION DIFFERENCE(FEET) =      1.86
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.862
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.427
  SUBAREA RUNOFF(CFS) =      0.11
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.11

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    157.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   457.75  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =   206.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.72
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.11
  PIPE TRAVEL TIME(MIN.) =   1.26    Tc(MIN.) =    9.12
  LONGEST FLOWPATH FROM NODE    155.00 TO NODE    157.00 =     268.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    157.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.022
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .3000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =    1.20   SUBAREA RUNOFF(CFS) =    1.45
  TOTAL AREA(ACRES) =        1.3   TOTAL RUNOFF(CFS) =       1.54
  TC(MIN.) =    9.12

****************************************************************************
  FLOW PROCESS FROM NODE    157.00 TO NODE    162.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   441.00  DOWNSTREAM(FEET) =   440.00
  FLOW LENGTH(FEET) =   980.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.79
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.54
  PIPE TRAVEL TIME(MIN.) =   9.12    Tc(MIN.) =   18.25
  LONGEST FLOWPATH FROM NODE    155.00 TO NODE    162.00 =    1248.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    162.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.25
  RAINFALL INTENSITY(INCH/HR) =   2.57
  TOTAL STREAM AREA(ACRES) =     1.28
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.54

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    161.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    464.05
  DOWNSTREAM ELEVATION(FEET) =    463.00
  ELEVATION DIFFERENCE(FEET) =      1.05
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.169
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.86
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.86

****************************************************************************
  FLOW PROCESS FROM NODE    161.00 TO NODE    162.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  463.00  DOWNSTREAM ELEVATION(FEET) =  450.00
  STREET LENGTH(FEET) =  1089.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.32
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.04
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.31
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.71
  STREET FLOW TRAVEL TIME(MIN.) =   7.86   Tc(MIN.) =   11.03
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.560
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    2.19      SUBAREA RUNOFF(CFS) =    6.63
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       7.14

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.21
  FLOW VELOCITY(FEET/SEC.) =  2.59   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    160.00 TO NODE    162.00 =    1159.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    162.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.03
  RAINFALL INTENSITY(INCH/HR) =   3.56
  TOTAL STREAM AREA(ACRES) =     2.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.14

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      109.63    10.04        3.781         39.26
      2        1.54    18.25        2.572          1.28
      3        7.14    11.03        3.560          2.36
```

```
  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      116.98    10.04       3.781
      2      111.27    11.03       3.560
      3       81.27    18.25       2.572

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     116.98   Tc(MIN.) =   10.04
  TOTAL AREA(ACRES) =       42.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    162.00 =    3517.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    163.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   439.00
  FLOW LENGTH(FEET) =   138.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  36.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.80
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     116.98
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   10.25
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    163.00 =    3655.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    163.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.25
  RAINFALL INTENSITY(INCH/HR) =   3.73
  TOTAL STREAM AREA(ACRES) =    42.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    116.98

****************************************************************************
  FLOW PROCESS FROM NODE    165.00 TO NODE    166.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    469.00
  DOWNSTREAM ELEVATION(FEET) =    468.40
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.86
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.86

****************************************************************************
  FLOW PROCESS FROM NODE    166.00 TO NODE    167.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  467.00  DOWNSTREAM ELEVATION(FEET) =  454.15
  STREET LENGTH(FEET) =   532.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
```

```
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    6.96
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.92
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.77
  STREET FLOW TRAVEL TIME(MIN.) =   3.04   Tc(MIN.) =    6.53
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.992
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    1.24      SUBAREA RUNOFF(CFS) =    5.26
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       5.98

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.91
  FLOW VELOCITY(FEET/SEC.) =  3.28   DEPTH*VELOCITY(FT*FT/SEC.) =   1.00
  LONGEST FLOWPATH FROM NODE    165.00 TO NODE    167.00 =     592.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    167.00 TO NODE    163.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   441.00  DOWNSTREAM(FEET) =   439.00
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.56
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.98
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =    6.91
  LONGEST FLOWPATH FROM NODE    165.00 TO NODE    163.00 =     743.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    163.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.91
  RAINFALL INTENSITY(INCH/HR) =   4.81
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.98

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      116.98    10.25        3.731         42.90
      2        5.98     6.91        4.812          1.41

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       96.68     6.91       4.812
      2      121.62    10.25       3.731

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     121.62   Tc(MIN.) =   10.25
  TOTAL AREA(ACRES) =       44.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    163.00 =    3655.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    168.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   439.00  DOWNSTREAM(FEET) =   434.00
  FLOW LENGTH(FEET) =   477.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.51
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     121.62
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =   10.89
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    168.00 =    4132.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    168.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.89
  RAINFALL INTENSITY(INCH/HR) =   3.59
  TOTAL STREAM AREA(ACRES) =    44.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    121.62

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    465.60
  DOWNSTREAM ELEVATION(FEET) =    464.00
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.47
  TOTAL AREA(ACRES) =      0.33   TOTAL RUNOFF(CFS) =      1.47

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   460.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =   685.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.33
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.47
  PIPE TRAVEL TIME(MIN.) =   2.14    Tc(MIN.) =    6.62
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     765.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.948
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    7.93   SUBAREA RUNOFF(CFS) =   29.43
  TOTAL AREA(ACRES) =        8.3   TOTAL RUNOFF(CFS) =      30.66
  TC(MIN.) =    6.62

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    168.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   434.00
  FLOW LENGTH(FEET) =   110.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.66
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    6.71
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    168.00 =     875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    168.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.71
  RAINFALL INTENSITY(INCH/HR) =   4.91
  TOTAL STREAM AREA(ACRES) =     8.26
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     30.66

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    452.20
  DOWNSTREAM ELEVATION(FEET) =    451.00
  ELEVATION DIFFERENCE(FEET) =      1.20
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.128
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    75.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.199
  SUBAREA RUNOFF(CFS) =      0.84
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      0.84

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    207.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.41
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.84
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    6.23
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    207.00 =     125.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    207.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.145
  *USER SPECIFIED(SUBAREA):
  SUBURBAN PROPERTY (RE) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6500
  SUBAREA AREA(ACRES) =    4.38   SUBAREA RUNOFF(CFS) =   14.65
  TOTAL AREA(ACRES) =        4.6   TOTAL RUNOFF(CFS) =      15.48
  TC(MIN.) =    6.23

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    168.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   442.00  DOWNSTREAM(FEET) =   434.00
  FLOW LENGTH(FEET) =    68.00   MANNING'S N =  0.013
```

```
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.87
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.48
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    6.29
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    168.00 =     193.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    168.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.29
  RAINFALL INTENSITY(INCH/HR) =   5.11
  TOTAL STREAM AREA(ACRES) =     4.63
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.48

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      121.62    10.89        3.589         44.31
      2       30.66     6.71        4.905          8.26
      3       15.48     6.29        5.113          4.63

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      129.59     6.29       5.113
      2      134.48     6.71       4.905
      3      154.91    10.89       3.589

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     154.91   Tc(MIN.) =   10.89
  TOTAL AREA(ACRES) =       57.2
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    168.00 =    4132.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    208.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   434.00  DOWNSTREAM(FEET) =   430.00
  FLOW LENGTH(FEET) =   600.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  57.0 INCH PIPE IS  41.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.20
  ESTIMATED PIPE DIAMETER(INCH) =  57.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     154.91
  PIPE TRAVEL TIME(MIN.) =   0.89    Tc(MIN.) =   11.78
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    208.00 =    4732.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.78
  RAINFALL INTENSITY(INCH/HR) =   3.41
  TOTAL STREAM AREA(ACRES) =    57.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    154.91

****************************************************************************
  FLOW PROCESS FROM NODE    215.00 TO NODE    216.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
```

```
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    455.50
  DOWNSTREAM ELEVATION(FEET) =    454.00
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.093
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.51
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.51

****************************************************************************
  FLOW PROCESS FROM NODE    216.00 TO NODE    217.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   450.00  DOWNSTREAM(FEET) =   438.00
  FLOW LENGTH(FEET) =   728.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.85
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.51
  PIPE TRAVEL TIME(MIN.) =   2.50    Tc(MIN.) =    5.59
  LONGEST FLOWPATH FROM NODE    215.00 TO NODE    217.00 =     803.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    216.00 TO NODE    217.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.514
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    8.92   SUBAREA RUNOFF(CFS) =   41.80
  TOTAL AREA(ACRES) =        9.2   TOTAL RUNOFF(CFS) =      43.21
  TC(MIN.) =    5.59

****************************************************************************
  FLOW PROCESS FROM NODE    217.00 TO NODE    208.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   438.00  DOWNSTREAM(FEET) =   430.00
  FLOW LENGTH(FEET) =   135.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.58
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      43.21
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    5.72
  LONGEST FLOWPATH FROM NODE    215.00 TO NODE    208.00 =     938.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.72
  RAINFALL INTENSITY(INCH/HR) =   5.44
  TOTAL STREAM AREA(ACRES) =     9.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     43.21

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      154.91    11.78        3.411         57.20
      2       43.21     5.72        5.438          9.22

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      140.37     5.72       5.438
      2      182.01    11.78       3.411

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     182.01   Tc(MIN.) =   11.78
  TOTAL AREA(ACRES) =       66.4
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    208.00 =    4732.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    227.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   430.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   270.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  38.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.82
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     182.01
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   12.05
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    227.00 =    5002.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    227.00 TO NODE    227.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.05
  RAINFALL INTENSITY(INCH/HR) =   3.36
  TOTAL STREAM AREA(ACRES) =    66.42
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    182.01

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .1900
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    450.80
  DOWNSTREAM ELEVATION(FEET) =    448.00
  ELEVATION DIFFERENCE(FEET) =      2.80
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.902
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    88.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.586
  SUBAREA RUNOFF(CFS) =      0.13
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.13

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   430.00
  FLOW LENGTH(FEET) =   685.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.56
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.13
  PIPE TRAVEL TIME(MIN.) =   4.45    Tc(MIN.) =   15.35
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =     785.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.875
  *USER SPECIFIED(SUBAREA):
  PARKS, GOLF COURSES RUNOFF COEFFICIENT = .3000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2959
  SUBAREA AREA(ACRES) =    4.86   SUBAREA RUNOFF(CFS) =    4.19
  TOTAL AREA(ACRES) =        5.1   TOTAL RUNOFF(CFS) =       4.30
  TC(MIN.) =   15.35

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    227.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   430.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   110.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.42
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.30
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   15.55
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    227.00 =     895.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    227.00 TO NODE    227.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.55
  RAINFALL INTENSITY(INCH/HR) =   2.85
  TOTAL STREAM AREA(ACRES) =     5.05
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.30

****************************************************************************
  FLOW PROCESS FROM NODE    225.00 TO NODE    226.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    450.80
  DOWNSTREAM ELEVATION(FEET) =    449.30
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.06
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      1.06

****************************************************************************
  FLOW PROCESS FROM NODE    226.00 TO NODE    227.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  448.54  DOWNSTREAM ELEVATION(FEET) =  430.00
  STREET LENGTH(FEET) =   917.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
```

```
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.90
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.62
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.79
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   5.48   Tc(MIN.) =    8.46
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.222
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    1.55      SUBAREA RUNOFF(CFS) =    5.56
  TOTAL AREA(ACRES) =        1.8        PEAK FLOW RATE(CFS) =       6.32

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.46
  FLOW VELOCITY(FEET/SEC.) =  3.12   DEPTH*VELOCITY(FT*FT/SEC.) =   0.98
  LONGEST FLOWPATH FROM NODE    225.00 TO NODE    227.00 =     992.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    227.00 TO NODE    227.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.46
  RAINFALL INTENSITY(INCH/HR) =   4.22
  TOTAL STREAM AREA(ACRES) =     1.76
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.32

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      182.01    12.05        3.362         66.42
      2        4.30    15.55        2.852          5.05
      3        6.32     8.46        4.222          1.76

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      153.59     8.46       4.222
      2      190.37    12.05       3.362
      3      162.97    15.55       2.852

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     190.37   Tc(MIN.) =   12.05
  TOTAL AREA(ACRES) =       73.2
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    227.00 =    5002.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    227.00 TO NODE    228.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   423.00
  FLOW LENGTH(FEET) =   308.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  47.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.54
  ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     190.37
  PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =   12.49
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    228.00 =    5310.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    228.00 TO NODE    228.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.49
  RAINFALL INTENSITY(INCH/HR) =   3.28
  TOTAL STREAM AREA(ACRES) =    73.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    190.37

****************************************************************************
  FLOW PROCESS FROM NODE    230.00 TO NODE    231.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    446.70
  DOWNSTREAM ELEVATION(FEET) =    445.43
  ELEVATION DIFFERENCE(FEET) =      1.27
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.134
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    74.94
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.196
  SUBAREA RUNOFF(CFS) =      1.89
  TOTAL AREA(ACRES) =      0.56   TOTAL RUNOFF(CFS) =      1.89

****************************************************************************
  FLOW PROCESS FROM NODE    231.00 TO NODE    232.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   825.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.89
  PIPE TRAVEL TIME(MIN.) =   2.56    Tc(MIN.) =    8.69
  LONGEST FLOWPATH FROM NODE    230.00 TO NODE    232.00 =     910.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    231.00 TO NODE    232.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.150
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6500
  SUBAREA AREA(ACRES) =    8.04   SUBAREA RUNOFF(CFS) =   21.69
  TOTAL AREA(ACRES) =        8.6   TOTAL RUNOFF(CFS) =      23.20
  TC(MIN.) =    8.69

****************************************************************************
  FLOW PROCESS FROM NODE    232.00 TO NODE    228.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.69
  RAINFALL INTENSITY(INCH/HR) =   4.15
  TOTAL STREAM AREA(ACRES) =     8.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      190.37    12.49        3.284         73.23
      2       23.20     8.69        4.150          8.60
```

```
  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      173.86     8.69       4.150
      2      208.73    12.49       3.284

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     208.73   Tc(MIN.) =   12.49
  TOTAL AREA(ACRES) =       81.8
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    228.00 =    5310.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    228.00 TO NODE    233.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   423.00  DOWNSTREAM(FEET) =   413.00
  FLOW LENGTH(FEET) =   169.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  27.30
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     208.73
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   12.60
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    233.00 =    5479.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    233.00 TO NODE    238.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   413.00  DOWNSTREAM(FEET) =   411.00
  FLOW LENGTH(FEET) =   188.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  57.0 INCH PIPE IS  43.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.26
  ESTIMATED PIPE DIAMETER(INCH) =  57.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     208.73
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =   12.82
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    238.00 =    5667.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    238.00 TO NODE    238.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.82
  RAINFALL INTENSITY(INCH/HR) =   3.23
  TOTAL STREAM AREA(ACRES) =    81.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    208.73

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    241.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    441.40
  DOWNSTREAM ELEVATION(FEET) =    440.00
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.31
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.31

****************************************************************************
  FLOW PROCESS FROM NODE    241.00 TO NODE    242.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   437.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   807.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.51
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.31
  PIPE TRAVEL TIME(MIN.) =   2.98    Tc(MIN.) =    5.97
  LONGEST FLOWPATH FROM NODE    240.00 TO NODE    242.00 =     877.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    241.00 TO NODE    242.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.286
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    7.59   SUBAREA RUNOFF(CFS) =   34.10
  TOTAL AREA(ACRES) =        7.9   TOTAL RUNOFF(CFS) =      35.27
  TC(MIN.) =    5.97

****************************************************************************
  FLOW PROCESS FROM NODE    242.00 TO NODE    238.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.97
  RAINFALL INTENSITY(INCH/HR) =   5.29
  TOTAL STREAM AREA(ACRES) =     7.85
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     35.27

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      208.73    12.82        3.230         81.83
      2       35.27     5.97        5.286          7.85

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      162.84     5.97       5.286
      2      230.29    12.82       3.230

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     230.29   Tc(MIN.) =   12.82
  TOTAL AREA(ACRES) =       89.7
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    238.00 =    5667.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    238.00 TO NODE    237.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   411.00  DOWNSTREAM(FEET) =   410.00
  FLOW LENGTH(FEET) =   178.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  66.0 INCH PIPE IS  52.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.45
  ESTIMATED PIPE DIAMETER(INCH) =  66.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     230.29
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =   13.07
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    237.00 =    5845.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    237.00 TO NODE    237.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.07
  RAINFALL INTENSITY(INCH/HR) =   3.19
  TOTAL STREAM AREA(ACRES) =    89.68
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    230.29

****************************************************************************
  FLOW PROCESS FROM NODE    235.00 TO NODE    236.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    445.70
  DOWNSTREAM ELEVATION(FEET) =    444.90
  ELEVATION DIFFERENCE(FEET) =      0.80
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.167
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.66
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.66

****************************************************************************
  FLOW PROCESS FROM NODE    236.00 TO NODE    237.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  443.00  DOWNSTREAM ELEVATION(FEET) =  421.60
  STREET LENGTH(FEET) =  1500.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.35
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.53
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.61
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.83
  STREET FLOW TRAVEL TIME(MIN.) =   9.58   Tc(MIN.) =   12.75
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.242
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    3.22      SUBAREA RUNOFF(CFS) =    8.87
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =       9.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.99
  FLOW VELOCITY(FEET/SEC.) =  2.97   DEPTH*VELOCITY(FT*FT/SEC.) =   1.09
  LONGEST FLOWPATH FROM NODE    235.00 TO NODE    237.00 =    1560.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    237.00 TO NODE    237.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.75
  RAINFALL INTENSITY(INCH/HR) =   3.24
```

```
  TOTAL STREAM AREA(ACRES) =     3.35
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.23

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      230.29    13.07        3.189         89.68
      2        9.23    12.75        3.242          3.35

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      235.76    12.75       3.242
      2      239.37    13.07       3.189

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     239.37   Tc(MIN.) =   13.07
  TOTAL AREA(ACRES) =       93.0
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    237.00 =    5845.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    237.00 TO NODE    608.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   410.00  DOWNSTREAM(FEET) =   408.00
  FLOW LENGTH(FEET) =   418.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  69.0 INCH PIPE IS  54.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.88
  ESTIMATED PIPE DIAMETER(INCH) =  69.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     239.37
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =   13.71
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    608.00 =    6263.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    608.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    245.00 TO NODE    246.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    438.20
  DOWNSTREAM ELEVATION(FEET) =    436.50
  ELEVATION DIFFERENCE(FEET) =      1.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.750
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.417
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
  FLOW PROCESS FROM NODE    246.00 TO NODE    247.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   434.00  DOWNSTREAM(FEET) =   424.00
  FLOW LENGTH(FEET) =   652.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.17
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.39
  PIPE TRAVEL TIME(MIN.) =   3.43    Tc(MIN.) =    9.18
  LONGEST FLOWPATH FROM NODE    245.00 TO NODE    247.00 =     737.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    246.00 TO NODE    247.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.006
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6500
  SUBAREA AREA(ACRES) =    2.31   SUBAREA RUNOFF(CFS) =    6.01
  TOTAL AREA(ACRES) =        2.4   TOTAL RUNOFF(CFS) =       6.30
  TC(MIN.) =    9.18

****************************************************************************
  FLOW PROCESS FROM NODE    247.00 TO NODE    243.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.18
  RAINFALL INTENSITY(INCH/HR) =   4.01
  TOTAL STREAM AREA(ACRES) =     2.42
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.30

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    251.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    436.60
  DOWNSTREAM ELEVATION(FEET) =    435.95
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.44
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
  FLOW PROCESS FROM NODE    251.00 TO NODE    252.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  434.00  DOWNSTREAM ELEVATION(FEET) =  424.00
  STREET LENGTH(FEET) =   675.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.29
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.34
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.77
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.92
  STREET FLOW TRAVEL TIME(MIN.) =   4.06   Tc(MIN.) =    9.14
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.016
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.85      SUBAREA RUNOFF(CFS) =    5.57
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =       5.87

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.16
  FLOW VELOCITY(FEET/SEC.) =  3.18   DEPTH*VELOCITY(FT*FT/SEC.) =   1.24
  LONGEST FLOWPATH FROM NODE    250.00 TO NODE    252.00 =     740.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    252.00 TO NODE    243.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.14
  RAINFALL INTENSITY(INCH/HR) =   4.02
  TOTAL STREAM AREA(ACRES) =     1.95
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.87

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.30     9.18        4.006         2.42
      2        5.87     9.14        4.016         1.95

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       12.15     9.14       4.016
      2       12.16     9.18       4.006

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.16   Tc(MIN.) =    9.18
  TOTAL AREA(ACRES) =        4.4
  LONGEST FLOWPATH FROM NODE    250.00 TO NODE    243.00 =     740.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    243.00 TO NODE    253.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   412.00  DOWNSTREAM(FEET) =   410.00
  FLOW LENGTH(FEET) =   315.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.91
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.16
  PIPE TRAVEL TIME(MIN.) =   0.89    Tc(MIN.) =   10.07
  LONGEST FLOWPATH FROM NODE    250.00 TO NODE    253.00 =    1055.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    253.00 TO NODE    253.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.07
  RAINFALL INTENSITY(INCH/HR) =   3.77
  TOTAL STREAM AREA(ACRES) =     4.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.16
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    255.00 TO NODE    256.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    436.58
  DOWNSTREAM ELEVATION(FEET) =    435.30
  ELEVATION DIFFERENCE(FEET) =      1.28
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.167
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.06
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.60
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.60

****************************************************************************
  FLOW PROCESS FROM NODE    256.00 TO NODE    257.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  435.30  DOWNSTREAM ELEVATION(FEET) =  413.60
  STREET LENGTH(FEET) =  1231.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.34
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.44
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.04
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.02
  STREET FLOW TRAVEL TIME(MIN.) =   6.76   Tc(MIN.) =    9.92
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.810
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .8000
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.801
  SUBAREA AREA(ACRES) =    4.23      SUBAREA RUNOFF(CFS) =   12.89
  TOTAL AREA(ACRES) =        4.3        PEAK FLOW RATE(CFS) =      13.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.32
  FLOW VELOCITY(FEET/SEC.) =  3.51   DEPTH*VELOCITY(FT*FT/SEC.) =   1.38
  LONGEST FLOWPATH FROM NODE    255.00 TO NODE    257.00 =    1316.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    257.00 TO NODE    253.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   412.00  DOWNSTREAM(FEET) =   410.00
  FLOW LENGTH(FEET) =   256.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.30
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.28
  PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =   10.60
  LONGEST FLOWPATH FROM NODE    255.00 TO NODE    253.00 =    1572.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    253.00 TO NODE    253.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.60
  RAINFALL INTENSITY(INCH/HR) =   3.65
  TOTAL STREAM AREA(ACRES) =     4.35
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.28

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.16    10.07        3.774          4.37
      2       13.28    10.60        3.651          4.35

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       24.78    10.07       3.774
      2       25.05    10.60       3.651

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      25.05   Tc(MIN.) =   10.60
  TOTAL AREA(ACRES) =        8.7
  LONGEST FLOWPATH FROM NODE    255.00 TO NODE    253.00 =    1572.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    253.00 TO NODE    258.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   410.00  DOWNSTREAM(FEET) =   384.50
  FLOW LENGTH(FEET) =   129.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  25.84
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.05
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   10.68
  LONGEST FLOWPATH FROM NODE    255.00 TO NODE    258.00 =    1701.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    258.00 TO NODE    258.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.633
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (FLAT) RUNOFF COEFFICIENT = .4000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7067
  SUBAREA AREA(ACRES) =    1.17   SUBAREA RUNOFF(CFS) =    1.70
  TOTAL AREA(ACRES) =        9.9   TOTAL RUNOFF(CFS) =      25.39
  TC(MIN.) =   10.68

****************************************************************************
  FLOW PROCESS FROM NODE    258.00 TO NODE    259.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   484.50  DOWNSTREAM(FEET) =   470.00
  FLOW LENGTH(FEET) =   418.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.19
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.39
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =   11.21
  LONGEST FLOWPATH FROM NODE    255.00 TO NODE    259.00 =    2119.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    259.00 TO NODE    259.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| BEGIN HYDROLOGY MODEL FOR WATERSHED DRAINING TO SOUTHERN WATER           |
| QUALITY BASIN (BASIN 2).                                                 |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    486.10
  DOWNSTREAM ELEVATION(FEET) =    485.50
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.880
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.11
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      1.11

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  485.50  DOWNSTREAM ELEVATION(FEET) =  483.00
  STREET LENGTH(FEET) =   308.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.27
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.74
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   2.56   Tc(MIN.) =    7.44
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.586
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.82      SUBAREA RUNOFF(CFS) =    6.26
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       7.12

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.13
  FLOW VELOCITY(FEET/SEC.) =  2.24   DEPTH*VELOCITY(FT*FT/SEC.) =   0.83
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     368.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    406.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.586
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7600
```

```
  SUBAREA AREA(ACRES) =    0.23   SUBAREA RUNOFF(CFS) =    0.90
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =       8.02
  TC(MIN.) =    7.44

****************************************************************************
  FLOW PROCESS FROM NODE    406.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   480.00  DOWNSTREAM(FEET) =   475.00
  FLOW LENGTH(FEET) =   444.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.58
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.02
  PIPE TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =    8.57
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    412.00 =     812.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    412.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.57
  RAINFALL INTENSITY(INCH/HR) =   4.19
  TOTAL STREAM AREA(ACRES) =     2.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.02

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    411.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    491.50
  DOWNSTREAM ELEVATION(FEET) =    480.00
  ELEVATION DIFFERENCE(FEET) =     11.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.171
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.66
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.66

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   485.00  DOWNSTREAM(FEET) =   475.00
  FLOW LENGTH(FEET) =  1075.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.12
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.66
  PIPE TRAVEL TIME(MIN.) =   5.75    Tc(MIN.) =    7.92
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    412.00 =    1150.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.407
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7514
  SUBAREA AREA(ACRES) =    4.69   SUBAREA RUNOFF(CFS) =   15.50
  TOTAL AREA(ACRES) =        4.8   TOTAL RUNOFF(CFS) =      16.00
```

```
  TC(MIN.) =    7.92

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    412.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.92
  RAINFALL INTENSITY(INCH/HR) =   4.41
  TOTAL STREAM AREA(ACRES) =     4.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        8.02     8.57        4.188          2.30
      2       16.00     7.92        4.407          4.83

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       23.40     7.92       4.407
      2       23.22     8.57       4.188

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      23.40   Tc(MIN.) =    7.92
  TOTAL AREA(ACRES) =        7.1
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    412.00 =    1150.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    417.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   475.00  DOWNSTREAM(FEET) =   457.00
  FLOW LENGTH(FEET) =   725.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.23
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.40
  PIPE TRAVEL TIME(MIN.) =   1.08    Tc(MIN.) =    8.99
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    417.00 =    1875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    417.00 TO NODE    417.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.99
  RAINFALL INTENSITY(INCH/HR) =   4.06
  TOTAL STREAM AREA(ACRES) =     7.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.40

****************************************************************************
  FLOW PROCESS FROM NODE    415.00 TO NODE    416.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .7000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    483.20
  DOWNSTREAM ELEVATION(FEET) =    482.55
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.805
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.384
  SUBAREA RUNOFF(CFS) =      0.57
```

```
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.57

****************************************************************************
  FLOW PROCESS FROM NODE    416.00 TO NODE    417.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  481.16  DOWNSTREAM ELEVATION(FEET) =  462.40
  STREET LENGTH(FEET) =   991.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.55
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.33
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.18
  STREET FLOW TRAVEL TIME(MIN.) =   4.96   Tc(MIN.) =   10.76
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.615
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7000
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
  SUBAREA AREA(ACRES) =    6.93      SUBAREA RUNOFF(CFS) =   17.54
  TOTAL AREA(ACRES) =        7.1        PEAK FLOW RATE(CFS) =      17.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.84
  FLOW VELOCITY(FEET/SEC.) =  3.86   DEPTH*VELOCITY(FT*FT/SEC.) =   1.63
  LONGEST FLOWPATH FROM NODE    415.00 TO NODE    417.00 =    1056.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    417.00 TO NODE    417.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.76
  RAINFALL INTENSITY(INCH/HR) =   3.62
  TOTAL STREAM AREA(ACRES) =     7.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.92

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       23.40     8.99        4.059          7.13
      2       17.92    10.76        3.615          7.08

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       38.37     8.99       4.059
      2       38.76    10.76       3.615

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      38.76   Tc(MIN.) =   10.76
  TOTAL AREA(ACRES) =       14.2
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    417.00 =    1875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    417.00 TO NODE    418.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   457.00  DOWNSTREAM(FEET) =   455.00
  FLOW LENGTH(FEET) =    31.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.84
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.76
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   10.79
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    418.00 =    1906.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    418.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    421.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    486.10
  DOWNSTREAM ELEVATION(FEET) =    485.45
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.81
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      0.81

****************************************************************************
  FLOW PROCESS FROM NODE    421.00 TO NODE    422.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  483.00  DOWNSTREAM ELEVATION(FEET) =  477.00
  STREET LENGTH(FEET) =   313.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.72
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.57
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.69
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.75
  STREET FLOW TRAVEL TIME(MIN.) =   1.94   Tc(MIN.) =    8.47
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.220
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    2.11      SUBAREA RUNOFF(CFS) =    5.79
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       6.47

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.72
  FLOW VELOCITY(FEET/SEC.) =  3.05   DEPTH*VELOCITY(FT*FT/SEC.) =   0.98
  LONGEST FLOWPATH FROM NODE    420.00 TO NODE    422.00 =     378.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    422.00 TO NODE    427.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   472.00  DOWNSTREAM(FEET) =   460.00
  FLOW LENGTH(FEET) =   930.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.62
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.47
  PIPE TRAVEL TIME(MIN.) =   2.34    Tc(MIN.) =   10.81
  LONGEST FLOWPATH FROM NODE    420.00 TO NODE    427.00 =    1308.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    427.00 TO NODE    427.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.81
  RAINFALL INTENSITY(INCH/HR) =   3.60
  TOTAL STREAM AREA(ACRES) =     2.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.47

****************************************************************************
  FLOW PROCESS FROM NODE    425.00 TO NODE    426.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    478.90
  DOWNSTREAM ELEVATION(FEET) =    478.25
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.71
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.71

****************************************************************************
  FLOW PROCESS FROM NODE    426.00 TO NODE    427.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  475.00  DOWNSTREAM ELEVATION(FEET) =  463.50
  STREET LENGTH(FEET) =   850.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.64
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.22
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.77
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.97
  STREET FLOW TRAVEL TIME(MIN.) =   5.11   Tc(MIN.) =   11.64
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.438
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    6.06      SUBAREA RUNOFF(CFS) =   13.54
  TOTAL AREA(ACRES) =        6.3        PEAK FLOW RATE(CFS) =      14.03

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.34
  FLOW VELOCITY(FEET/SEC.) =  3.23   DEPTH*VELOCITY(FT*FT/SEC.) =   1.33
```

```
  LONGEST FLOWPATH FROM NODE    425.00 TO NODE    427.00 =     915.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    427.00 TO NODE    427.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.64
  RAINFALL INTENSITY(INCH/HR) =   3.44
  TOTAL STREAM AREA(ACRES) =     6.28
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.03

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.47    10.81        3.605          2.36
      2       14.03    11.64        3.438          6.28

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       19.51    10.81       3.605
      2       20.21    11.64       3.438

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.21   Tc(MIN.) =   11.64
  TOTAL AREA(ACRES) =        8.6
  LONGEST FLOWPATH FROM NODE    420.00 TO NODE    427.00 =    1308.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    427.00 TO NODE    418.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   460.00  DOWNSTREAM(FEET) =   455.00
  FLOW LENGTH(FEET) =    48.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.23
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.21
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   11.68
  LONGEST FLOWPATH FROM NODE    420.00 TO NODE    418.00 =    1356.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    418.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.21    11.68       3.430        8.64
  LONGEST FLOWPATH FROM NODE    420.00 TO NODE    418.00 =    1356.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       38.76    10.79       3.609       14.21
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    418.00 =    1906.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      57.43      10.79        3.609
      2      57.04      11.68        3.430

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      57.43   Tc(MIN.) =   10.79
```

```
  TOTAL AREA(ACRES) =       22.8

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    418.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    418.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.79
  RAINFALL INTENSITY(INCH/HR) =   3.61
  TOTAL STREAM AREA(ACRES) =    22.85
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     57.43

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    431.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    470.80
  DOWNSTREAM ELEVATION(FEET) =    470.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.68
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.68

****************************************************************************
  FLOW PROCESS FROM NODE    431.00 TO NODE    432.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.20  DOWNSTREAM ELEVATION(FEET) =  462.40
  STREET LENGTH(FEET) =   557.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.45
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.42
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   3.84   Tc(MIN.) =   10.37
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.703
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    4.73      SUBAREA RUNOFF(CFS) =   11.39
  TOTAL AREA(ACRES) =        4.9        PEAK FLOW RATE(CFS) =      11.89

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.16
  FLOW VELOCITY(FEET/SEC.) =  2.80   DEPTH*VELOCITY(FT*FT/SEC.) =   1.15
  LONGEST FLOWPATH FROM NODE    430.00 TO NODE    432.00 =     622.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    432.00 TO NODE    418.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   457.00  DOWNSTREAM(FEET) =   455.00
  FLOW LENGTH(FEET) =    55.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.35
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.89
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   10.45
  LONGEST FLOWPATH FROM NODE    430.00 TO NODE    418.00 =     677.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    418.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.45
  RAINFALL INTENSITY(INCH/HR) =   3.68
  TOTAL STREAM AREA(ACRES) =     4.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.89

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       57.43    10.79        3.609         22.85
      2       11.89    10.45        3.685          4.94

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       67.51    10.45       3.685
      2       69.08    10.79       3.609

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      69.08   Tc(MIN.) =   10.79
  TOTAL AREA(ACRES) =       27.8
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    418.00 =    1906.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    437.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   455.00  DOWNSTREAM(FEET) =   450.00
  FLOW LENGTH(FEET) =   480.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.85
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      69.08
  PIPE TRAVEL TIME(MIN.) =   0.74    Tc(MIN.) =   11.53
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    437.00 =    2386.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    437.00 TO NODE    437.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.53
  RAINFALL INTENSITY(INCH/HR) =   3.46
  TOTAL STREAM AREA(ACRES) =    27.79
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     69.08

****************************************************************************
  FLOW PROCESS FROM NODE    435.00 TO NODE    436.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    474.70
  DOWNSTREAM ELEVATION(FEET) =    474.05
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.35

******************************************************************************
  FLOW PROCESS FROM NODE    436.00 TO NODE    437.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  472.75  DOWNSTREAM ELEVATION(FEET) =  458.00
  STREET LENGTH(FEET) =   753.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.14
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.21
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.32
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.16
  STREET FLOW TRAVEL TIME(MIN.) =   3.78   Tc(MIN.) =    8.86
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.100
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    5.60      SUBAREA RUNOFF(CFS) =   17.22
  TOTAL AREA(ACRES) =        5.7        PEAK FLOW RATE(CFS) =      17.47

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.59
  FLOW VELOCITY(FEET/SEC.) =  3.89   DEPTH*VELOCITY(FT*FT/SEC.) =   1.62
  LONGEST FLOWPATH FROM NODE    435.00 TO NODE    437.00 =     818.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    437.00 TO NODE    437.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.86
  RAINFALL INTENSITY(INCH/HR) =   4.10
  TOTAL STREAM AREA(ACRES) =     5.68
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.47

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       69.08    11.53        3.459         27.79
      2       17.47     8.86        4.100          5.68

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
```

```
      1       75.74     8.86       4.100
      2       83.81    11.53       3.459

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      83.81   Tc(MIN.) =   11.53
  TOTAL AREA(ACRES) =       33.5
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    437.00 =    2386.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    437.00 TO NODE    438.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   453.00  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.18
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      83.81
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   11.61
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    438.00 =    2451.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    438.00 TO NODE    438.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    440.00 TO NODE    441.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    483.56
  DOWNSTREAM ELEVATION(FEET) =    482.96
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.55
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.55

****************************************************************************
  FLOW PROCESS FROM NODE    441.00 TO NODE    442.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  482.96  DOWNSTREAM ELEVATION(FEET) =  476.00
  STREET LENGTH(FEET) =   640.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 17.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.15
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    7.98
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.09
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.60
  STREET FLOW TRAVEL TIME(MIN.) =   5.11   Tc(MIN.) =    8.60
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.179
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
```

```
  SUBAREA AREA(ACRES) =    1.43      SUBAREA RUNOFF(CFS) =    5.08
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       5.47

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.19
  FLOW VELOCITY(FEET/SEC.) =  2.36   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    442.00 =     700.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    445.00 TO NODE    446.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.179
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    0.32   SUBAREA RUNOFF(CFS) =    1.14
  TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =       6.61
  TC(MIN.) =    8.60

****************************************************************************
  FLOW PROCESS FROM NODE    446.00 TO NODE    452.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   470.00  DOWNSTREAM(FEET) =   467.00
  FLOW LENGTH(FEET) =   189.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.19
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.61
  PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =    9.04
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    452.00 =     889.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    452.00 TO NODE    452.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.04
  RAINFALL INTENSITY(INCH/HR) =   4.05
  TOTAL STREAM AREA(ACRES) =     1.86
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.61

****************************************************************************
  FLOW PROCESS FROM NODE    450.00 TO NODE    451.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    483.00
  DOWNSTREAM ELEVATION(FEET) =    482.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
  FLOW PROCESS FROM NODE    451.00 TO NODE    452.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  481.50  DOWNSTREAM ELEVATION(FEET) =  472.70
```

```
  STREET LENGTH(FEET) =   770.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 10.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.42
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.16
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.18
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.63
  STREET FLOW TRAVEL TIME(MIN.) =   5.88   Tc(MIN.) =   10.96
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.573
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.25      SUBAREA RUNOFF(CFS) =    6.03
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       6.22

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.00
  FLOW VELOCITY(FEET/SEC.) =  2.54   DEPTH*VELOCITY(FT*FT/SEC.) =   0.86
  LONGEST FLOWPATH FROM NODE    450.00 TO NODE    452.00 =     835.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    452.00 TO NODE    452.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.96
  RAINFALL INTENSITY(INCH/HR) =   3.57
  TOTAL STREAM AREA(ACRES) =     2.32
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.22

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.61     9.04        4.047          1.86
      2        6.22    10.96        3.573          2.32

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       11.73     9.04       4.047
      2       12.05    10.96       3.573

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.05   Tc(MIN.) =   10.96
  TOTAL AREA(ACRES) =        4.2
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    452.00 =     889.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    452.00 TO NODE    453.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   467.00  DOWNSTREAM(FEET) =   466.00
  FLOW LENGTH(FEET) =    57.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.47
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.05
```

```
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   11.08
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    453.00 =     946.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    453.00 TO NODE    453.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.08
  RAINFALL INTENSITY(INCH/HR) =   3.55
  TOTAL STREAM AREA(ACRES) =     4.18
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.05

****************************************************************************
  FLOW PROCESS FROM NODE    455.00 TO NODE    456.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    483.00
  DOWNSTREAM ELEVATION(FEET) =    482.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
  FLOW PROCESS FROM NODE    456.00 TO NODE    457.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  479.70  DOWNSTREAM ELEVATION(FEET) =  473.00
  STREET LENGTH(FEET) =   630.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.65
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.59
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.13
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =   4.93   Tc(MIN.) =   10.01
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.790
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.29      SUBAREA RUNOFF(CFS) =    6.51
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       6.71

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.16
  FLOW VELOCITY(FEET/SEC.) =  2.46   DEPTH*VELOCITY(FT*FT/SEC.) =   0.86
  LONGEST FLOWPATH FROM NODE    455.00 TO NODE    457.00 =     695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    457.00 TO NODE    453.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   467.00  DOWNSTREAM(FEET) =   466.00
  FLOW LENGTH(FEET) =    55.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.60
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.71
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   10.13
  LONGEST FLOWPATH FROM NODE    455.00 TO NODE    453.00 =     750.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    453.00 TO NODE    453.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.13
  RAINFALL INTENSITY(INCH/HR) =   3.76
  TOTAL STREAM AREA(ACRES) =     2.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.71

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.05    11.08        3.549          4.18
      2        6.71    10.13        3.760          2.36

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       18.08    10.13       3.760
      2       18.38    11.08       3.549

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      18.38   Tc(MIN.) =   11.08
  TOTAL AREA(ACRES) =        6.5
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    453.00 =     946.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    453.00 TO NODE    462.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   466.00  DOWNSTREAM(FEET) =   464.00
  FLOW LENGTH(FEET) =   235.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.16
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.38
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =   11.62
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    462.00 =    1181.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    462.00 TO NODE    462.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.62
  RAINFALL INTENSITY(INCH/HR) =   3.44
  TOTAL STREAM AREA(ACRES) =     6.54
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     18.38

****************************************************************************
  FLOW PROCESS FROM NODE    460.00 TO NODE    461.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    480.75
  DOWNSTREAM ELEVATION(FEET) =    480.10
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.31

******************************************************************************
  FLOW PROCESS FROM NODE    461.00 TO NODE    462.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  479.25  DOWNSTREAM ELEVATION(FEET) =  470.00
  STREET LENGTH(FEET) =   750.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 10.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.19
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.77
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.21
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.62
  STREET FLOW TRAVEL TIME(MIN.) =   5.67   Tc(MIN.) =   10.74
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.619
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.06      SUBAREA RUNOFF(CFS) =    5.59
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       5.78

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.00
  FLOW VELOCITY(FEET/SEC.) =  2.52   DEPTH*VELOCITY(FT*FT/SEC.) =   0.83
  LONGEST FLOWPATH FROM NODE    460.00 TO NODE    462.00 =     815.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    462.00 TO NODE    462.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.74
  RAINFALL INTENSITY(INCH/HR) =   3.62
  TOTAL STREAM AREA(ACRES) =     2.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.78

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       18.38    11.62        3.441          6.54
      2        5.78    10.74        3.619          2.13

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       23.25    10.74       3.619
      2       23.88    11.62       3.441

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      23.88   Tc(MIN.) =   11.62
  TOTAL AREA(ACRES) =        8.7
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    462.00 =    1181.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    462.00 TO NODE    463.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   464.00  DOWNSTREAM(FEET) =   463.00
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.59
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.88
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   11.74
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    463.00 =    1246.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    463.00 TO NODE    463.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.74
  RAINFALL INTENSITY(INCH/HR) =   3.42
  TOTAL STREAM AREA(ACRES) =     8.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.88

****************************************************************************
  FLOW PROCESS FROM NODE    465.00 TO NODE    466.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    478.00
  DOWNSTREAM ELEVATION(FEET) =    477.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.31
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
  FLOW PROCESS FROM NODE    466.00 TO NODE    467.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  474.80  DOWNSTREAM ELEVATION(FEET) =  470.21
  STREET LENGTH(FEET) =   416.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
```

```
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.93
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.90
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.48
  STREET FLOW TRAVEL TIME(MIN.) =   3.65   Tc(MIN.) =    8.73
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.138
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.03      SUBAREA RUNOFF(CFS) =    3.20
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       3.41

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.22
  FLOW VELOCITY(FEET/SEC.) =  2.15   DEPTH*VELOCITY(FT*FT/SEC.) =   0.63
  LONGEST FLOWPATH FROM NODE    465.00 TO NODE    467.00 =     481.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    467.00 TO NODE    463.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.73
  RAINFALL INTENSITY(INCH/HR) =   4.14
  TOTAL STREAM AREA(ACRES) =     1.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.41

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       23.88    11.74        3.419         8.67
      2        3.41     8.73        4.138         1.10

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       23.14     8.73       4.138
      2       26.70    11.74       3.419

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.70   Tc(MIN.) =   11.74
  TOTAL AREA(ACRES) =        9.8
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    463.00 =    1246.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    463.00 TO NODE    438.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   463.00  DOWNSTREAM(FEET) =   452.00
  FLOW LENGTH(FEET) =   495.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.40
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.70
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =   12.46
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    438.00 =    1741.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    438.00 TO NODE    438.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
```

```
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       26.70    12.46       3.290        9.77
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    438.00 =    1741.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       83.81    11.61       3.443       33.47
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    438.00 =    2451.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     108.69      11.61        3.443
      2     106.78      12.46        3.290

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     108.69   Tc(MIN.) =   11.61
  TOTAL AREA(ACRES) =       43.2

****************************************************************************
  FLOW PROCESS FROM NODE    438.00 TO NODE    438.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    438.00 TO NODE    472.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   452.00  DOWNSTREAM(FEET) =   447.00
  FLOW LENGTH(FEET) =   475.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  34.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.10
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     108.69
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =   12.27
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    472.00 =    2926.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    472.00 TO NODE    472.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.27
  RAINFALL INTENSITY(INCH/HR) =   3.32
  TOTAL STREAM AREA(ACRES) =    43.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    108.69

****************************************************************************
  FLOW PROCESS FROM NODE    470.00 TO NODE    471.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    471.60
  DOWNSTREAM ELEVATION(FEET) =    470.95
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    471.00 TO NODE    472.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.41  DOWNSTREAM ELEVATION(FEET) =  454.00
  STREET LENGTH(FEET) =   768.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.96
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.41
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.93
  STREET FLOW TRAVEL TIME(MIN.) =   4.31   Tc(MIN.) =    9.39
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.949
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7000
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.702
  SUBAREA AREA(ACRES) =    3.82      SUBAREA RUNOFF(CFS) =   10.56
  TOTAL AREA(ACRES) =        3.9        PEAK FLOW RATE(CFS) =      10.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.16
  FLOW VELOCITY(FEET/SEC.) =  3.42   DEPTH*VELOCITY(FT*FT/SEC.) =   1.26
  LONGEST FLOWPATH FROM NODE    470.00 TO NODE    472.00 =     833.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    472.00 TO NODE    472.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.39
  RAINFALL INTENSITY(INCH/HR) =   3.95
  TOTAL STREAM AREA(ACRES) =     3.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.91

****************************************************************************
  FLOW PROCESS FROM NODE    475.00 TO NODE    476.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    468.90
  DOWNSTREAM ELEVATION(FEET) =    466.18
  ELEVATION DIFFERENCE(FEET) =      2.72
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.106
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.40
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.40

****************************************************************************
  FLOW PROCESS FROM NODE    476.00 TO NODE    477.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.18  DOWNSTREAM ELEVATION(FEET) =  454.00
  STREET LENGTH(FEET) =   724.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
```

```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.65
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.34
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.86
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   4.22   Tc(MIN.) =    6.33
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.092
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.754
  SUBAREA AREA(ACRES) =    2.17      SUBAREA RUNOFF(CFS) =    8.29
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       8.63

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.91
  FLOW VELOCITY(FEET/SEC.) =  3.30   DEPTH*VELOCITY(FT*FT/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    475.00 TO NODE    477.00 =     784.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    477.00 TO NODE    472.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.33
  RAINFALL INTENSITY(INCH/HR) =   5.09
  TOTAL STREAM AREA(ACRES) =     2.25
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.63

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      108.69    12.27        3.323         43.24
      2       10.91     9.39        3.949          3.94
      3        8.63     6.33        5.092          2.25

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       72.08     6.33       5.092
      2      100.79     9.39       3.949
      3      123.51    12.27       3.323

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     123.51   Tc(MIN.) =   12.27
  TOTAL AREA(ACRES) =       49.4
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    472.00 =    2926.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    472.00 TO NODE    478.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   447.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  35.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.34
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     123.51
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   12.53
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    478.00 =    3124.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    478.00 TO NODE    478.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    480.00 TO NODE    481.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    747.76
  DOWNSTREAM ELEVATION(FEET) =    747.16
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.76
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.76

****************************************************************************
  FLOW PROCESS FROM NODE    481.00 TO NODE    482.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  474.16  DOWNSTREAM ELEVATION(FEET) =  469.76
  STREET LENGTH(FEET) =   398.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 19.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.60
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.54
  STREET FLOW TRAVEL TIME(MIN.) =   3.31   Tc(MIN.) =    6.80
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.863
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    0.88      SUBAREA RUNOFF(CFS) =    3.64
  TOTAL AREA(ACRES) =        1.0        PEAK FLOW RATE(CFS) =       4.26

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.09
  FLOW VELOCITY(FEET/SEC.) =  2.25   DEPTH*VELOCITY(FT*FT/SEC.) =   0.69
  LONGEST FLOWPATH FROM NODE    480.00 TO NODE    482.00 =     458.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    485.00 TO NODE    486.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.863
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    0.38   SUBAREA RUNOFF(CFS) =    1.57
  TOTAL AREA(ACRES) =        1.4   TOTAL RUNOFF(CFS) =       5.83
  TC(MIN.) =    6.80

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    486.00 TO NODE    487.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   463.00  DOWNSTREAM(FEET) =   459.00
  FLOW LENGTH(FEET) =   424.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.73
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.83
  PIPE TRAVEL TIME(MIN.) =   1.23    Tc(MIN.) =    8.03
  LONGEST FLOWPATH FROM NODE    480.00 TO NODE    487.00 =     882.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    487.00 TO NODE    487.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.03
  RAINFALL INTENSITY(INCH/HR) =   4.37
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.83

****************************************************************************
  FLOW PROCESS FROM NODE    490.00 TO NODE    491.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    474.70
  DOWNSTREAM ELEVATION(FEET) =    473.00
  ELEVATION DIFFERENCE(FEET) =      1.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.89
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.89

****************************************************************************
  FLOW PROCESS FROM NODE    491.00 TO NODE    492.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   470.00  DOWNSTREAM(FEET) =   463.00
  FLOW LENGTH(FEET) =   481.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.98
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.89
  PIPE TRAVEL TIME(MIN.) =   2.01    Tc(MIN.) =    6.49
  LONGEST FLOWPATH FROM NODE    490.00 TO NODE    492.00 =     566.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    491.00 TO NODE    492.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.012
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    4.45   SUBAREA RUNOFF(CFS) =   16.73
  TOTAL AREA(ACRES) =        4.6   TOTAL RUNOFF(CFS) =      17.48
  TC(MIN.) =    6.49
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    492.00 TO NODE    487.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   463.00  DOWNSTREAM(FEET) =   459.00
  FLOW LENGTH(FEET) =   119.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.77
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.48
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    6.65
  LONGEST FLOWPATH FROM NODE    490.00 TO NODE    487.00 =     685.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    487.00 TO NODE    487.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.65
  RAINFALL INTENSITY(INCH/HR) =   4.93
  TOTAL STREAM AREA(ACRES) =     4.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.48

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.83     8.03        4.367          1.41
      2       17.48     6.65        4.930          4.65

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       22.31     6.65       4.930
      2       21.31     8.03       4.367

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      22.31   Tc(MIN.) =    6.65
  TOTAL AREA(ACRES) =        6.1
  LONGEST FLOWPATH FROM NODE    480.00 TO NODE    487.00 =     882.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    487.00 TO NODE    497.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   459.00  DOWNSTREAM(FEET) =   451.00
  FLOW LENGTH(FEET) =   555.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.23
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.31
  PIPE TRAVEL TIME(MIN.) =   1.00    Tc(MIN.) =    7.66
  LONGEST FLOWPATH FROM NODE    480.00 TO NODE    497.00 =    1437.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    497.00 TO NODE    497.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.66
  RAINFALL INTENSITY(INCH/HR) =   4.50
  TOTAL STREAM AREA(ACRES) =     6.06
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     22.31
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    495.00 TO NODE    496.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    468.78
  DOWNSTREAM ELEVATION(FEET) =    468.18
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.45
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
  FLOW PROCESS FROM NODE    496.00 TO NODE    497.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.18  DOWNSTREAM ELEVATION(FEET) =  455.20
  STREET LENGTH(FEET) =   943.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.07
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.34
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.56
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.80
  STREET FLOW TRAVEL TIME(MIN.) =   6.15   Tc(MIN.) =    9.64
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.883
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.753
  SUBAREA AREA(ACRES) =    3.04      SUBAREA RUNOFF(CFS) =    8.85
  TOTAL AREA(ACRES) =        3.1        PEAK FLOW RATE(CFS) =       9.15

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.03
  FLOW VELOCITY(FEET/SEC.) =  2.92   DEPTH*VELOCITY(FT*FT/SEC.) =   1.07
  LONGEST FLOWPATH FROM NODE    495.00 TO NODE    497.00 =    1003.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    497.00 TO NODE    497.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.64
  RAINFALL INTENSITY(INCH/HR) =   3.88
  TOTAL STREAM AREA(ACRES) =     3.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.15

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       22.31     7.66        4.504          6.06
      2        9.15     9.64        3.883          3.13

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       29.58     7.66       4.504
      2       28.38     9.64       3.883

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.58   Tc(MIN.) =    7.66
  TOTAL AREA(ACRES) =        9.2
  LONGEST FLOWPATH FROM NODE    480.00 TO NODE    497.00 =    1437.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    497.00 TO NODE    478.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.00  DOWNSTREAM(FEET) =   445.00
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.42
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      29.58
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    7.70
  LONGEST FLOWPATH FROM NODE    480.00 TO NODE    478.00 =    1490.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    478.00 TO NODE    478.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       29.58     7.70       4.488        9.19
  LONGEST FLOWPATH FROM NODE    480.00 TO NODE    478.00 =    1490.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      123.51    12.53       3.277       49.43
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    478.00 =    3124.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     105.43       7.70        4.488
      2     145.11      12.53        3.277

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     145.11   Tc(MIN.) =   12.53
  TOTAL AREA(ACRES) =       58.6

****************************************************************************
  FLOW PROCESS FROM NODE    478.00 TO NODE    478.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    478.00 TO NODE    502.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   440.00
  FLOW LENGTH(FEET) =   325.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.12
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     145.11
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   12.89
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    502.00 =    3449.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.89
  RAINFALL INTENSITY(INCH/HR) =   3.22
  TOTAL STREAM AREA(ACRES) =    58.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    145.11

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.90
  DOWNSTREAM ELEVATION(FEET) =    464.25
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  463.10  DOWNSTREAM ELEVATION(FEET) =  445.70
  STREET LENGTH(FEET) =   754.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.09
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.56
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.96
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.82
  STREET FLOW TRAVEL TIME(MIN.) =   4.24   Tc(MIN.) =    9.32
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.967
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.46      SUBAREA RUNOFF(CFS) =    7.32
  TOTAL AREA(ACRES) =        2.5        PEAK FLOW RATE(CFS) =       7.56

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =   9.95
  FLOW VELOCITY(FEET/SEC.) =  3.41   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =     819.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.32
  RAINFALL INTENSITY(INCH/HR) =   3.97
  TOTAL STREAM AREA(ACRES) =     2.54
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.56

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      145.11    12.89        3.218         58.62
      2        7.56     9.32        3.967          2.54

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      112.46     9.32       3.967
      2      151.24    12.89       3.218

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     151.24   Tc(MIN.) =   12.89
  TOTAL AREA(ACRES) =       61.2
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    502.00 =    3449.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    507.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   422.00
  FLOW LENGTH(FEET) =   634.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.01
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     151.24
  PIPE TRAVEL TIME(MIN.) =   0.56    Tc(MIN.) =   13.45
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    507.00 =    4083.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    507.00 TO NODE    507.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.45
  RAINFALL INTENSITY(INCH/HR) =   3.13
  TOTAL STREAM AREA(ACRES) =    61.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    151.24

****************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    506.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    448.30
  DOWNSTREAM ELEVATION(FEET) =    447.65
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.75
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.75

****************************************************************************
  FLOW PROCESS FROM NODE    506.00 TO NODE    507.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  444.70  DOWNSTREAM ELEVATION(FEET) =  427.90
  STREET LENGTH(FEET) =   560.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.93
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.04
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.71
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.14
  STREET FLOW TRAVEL TIME(MIN.) =   2.52   Tc(MIN.) =    7.60
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.527
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    3.61      SUBAREA RUNOFF(CFS) =   12.26
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =      12.83

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.78
  FLOW VELOCITY(FEET/SEC.) =  4.26   DEPTH*VELOCITY(FT*FT/SEC.) =   1.54
  LONGEST FLOWPATH FROM NODE    505.00 TO NODE    507.00 =     625.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    507.00 TO NODE    507.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.60
  RAINFALL INTENSITY(INCH/HR) =   4.53
  TOTAL STREAM AREA(ACRES) =     3.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.83

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      151.24    13.45        3.132         61.16
      2       12.83     7.60        4.527          3.78

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      117.46     7.60       4.527
      2      160.12    13.45       3.132

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     160.12   Tc(MIN.) =   13.45
  TOTAL AREA(ACRES) =       64.9
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    507.00 =    4083.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    507.00 TO NODE    508.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   422.00  DOWNSTREAM(FEET) =   415.00
```

```
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  37.09
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     160.12
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =   13.47
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    508.00 =    4128.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    508.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    511.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    470.85
  DOWNSTREAM ELEVATION(FEET) =    470.20
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.71
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.71

****************************************************************************
  FLOW PROCESS FROM NODE    511.00 TO NODE    512.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  468.20  DOWNSTREAM ELEVATION(FEET) =  460.00
  STREET LENGTH(FEET) =   411.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.87
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.22
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.03
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.94
  STREET FLOW TRAVEL TIME(MIN.) =   2.26   Tc(MIN.) =    8.79
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.120
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    3.83      SUBAREA RUNOFF(CFS) =   10.26
  TOTAL AREA(ACRES) =        4.0        PEAK FLOW RATE(CFS) =      10.85

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.97
  FLOW VELOCITY(FEET/SEC.) =  3.50   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    512.00 =     476.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    512.00 TO NODE    517.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   455.00  DOWNSTREAM(FEET) =   418.00
  FLOW LENGTH(FEET) =   615.00   MANNING'S N =  0.013
```

```
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.42
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.85
  PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =    9.55
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    517.00 =    1091.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    517.00 TO NODE    517.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.55
  RAINFALL INTENSITY(INCH/HR) =   3.90
  TOTAL STREAM AREA(ACRES) =     4.05
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.85

****************************************************************************
  FLOW PROCESS FROM NODE    515.00 TO NODE    516.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    459.80
  DOWNSTREAM ELEVATION(FEET) =    459.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.75
  TOTAL AREA(ACRES) =      0.23   TOTAL RUNOFF(CFS) =      0.75

****************************************************************************
  FLOW PROCESS FROM NODE    516.00 TO NODE    517.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  455.00  DOWNSTREAM ELEVATION(FEET) =  423.00
  STREET LENGTH(FEET) =   555.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.58
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    5.59
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.16
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
  STREET FLOW TRAVEL TIME(MIN.) =   2.22   Tc(MIN.) =    8.75
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.131
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    2.10      SUBAREA RUNOFF(CFS) =    5.64
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       6.26

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.42
  FLOW VELOCITY(FEET/SEC.) =  4.68   DEPTH*VELOCITY(FT*FT/SEC.) =   1.29
  LONGEST FLOWPATH FROM NODE    515.00 TO NODE    517.00 =     620.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    517.00 TO NODE    517.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.75
  RAINFALL INTENSITY(INCH/HR) =   4.13
  TOTAL STREAM AREA(ACRES) =     2.33
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.26

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.85     9.55        3.905          4.05
      2        6.26     8.75        4.131          2.33

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       16.20     8.75       4.131
      2       16.76     9.55       3.905

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      16.76   Tc(MIN.) =    9.55
  TOTAL AREA(ACRES) =        6.4
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    517.00 =    1091.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    517.00 TO NODE    522.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   418.00  DOWNSTREAM(FEET) =   416.00
  FLOW LENGTH(FEET) =   141.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.46
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.76
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =    9.83
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    522.00 =    1232.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    522.00 TO NODE    522.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.83
  RAINFALL INTENSITY(INCH/HR) =   3.83
  TOTAL STREAM AREA(ACRES) =     6.38
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.76

****************************************************************************
  FLOW PROCESS FROM NODE    520.00 TO NODE    521.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    430.55
  DOWNSTREAM ELEVATION(FEET) =    429.90
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    521.00 TO NODE    522.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  426.90  DOWNSTREAM ELEVATION(FEET) =  421.00
  STREET LENGTH(FEET) =   188.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.23
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   1.04   Tc(MIN.) =    7.57
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.535
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    1.16      SUBAREA RUNOFF(CFS) =    3.42
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       3.89

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   6.86
  FLOW VELOCITY(FEET/SEC.) =  3.31   DEPTH*VELOCITY(FT*FT/SEC.) =   0.87
  LONGEST FLOWPATH FROM NODE    520.00 TO NODE    522.00 =     253.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    522.00 TO NODE    522.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.57
  RAINFALL INTENSITY(INCH/HR) =   4.54
  TOTAL STREAM AREA(ACRES) =     1.32
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.89

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       16.76     9.83        3.833          6.38
      2        3.89     7.57        4.535          1.32

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       18.06     7.57       4.535
      2       20.05     9.83       3.833

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.05   Tc(MIN.) =    9.83
  TOTAL AREA(ACRES) =        7.7
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    522.00 =    1232.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    522.00 TO NODE    508.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   416.00  DOWNSTREAM(FEET) =   415.00
```

```
  FLOW LENGTH(FEET) =   193.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.05
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.05
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =   10.36
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    508.00 =    1425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    508.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       20.05    10.36       3.705        7.70
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    508.00 =    1425.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      160.12    13.47       3.129       64.94
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    508.00 =    4128.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     143.24      10.36        3.705
      2     177.05      13.47        3.129

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     177.05   Tc(MIN.) =   13.47
  TOTAL AREA(ACRES) =       72.6

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    508.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    523.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   415.00  DOWNSTREAM(FEET) =   414.00
  FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  63.0 INCH PIPE IS  50.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.56
  ESTIMATED PIPE DIAMETER(INCH) =  63.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     177.05
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =   13.89
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    523.00 =    4368.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    523.00 TO NODE    523.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.89
  RAINFALL INTENSITY(INCH/HR) =   3.07
  TOTAL STREAM AREA(ACRES) =    72.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    177.05

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    526.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    442.91
  DOWNSTREAM ELEVATION(FEET) =    442.00
  ELEVATION DIFFERENCE(FEET) =      0.91
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.812
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    69.50
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.28   TOTAL RUNOFF(CFS) =      1.24

****************************************************************************
  FLOW PROCESS FROM NODE    526.00 TO NODE    527.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  439.00  DOWNSTREAM ELEVATION(FEET) =  422.00
  STREET LENGTH(FEET) =   703.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.23
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.09
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.30
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.02
  STREET FLOW TRAVEL TIME(MIN.) =   3.55   Tc(MIN.) =    8.37
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.253
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.657
  SUBAREA AREA(ACRES) =    3.52      SUBAREA RUNOFF(CFS) =    9.73
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =      10.63

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.41
  FLOW VELOCITY(FEET/SEC.) =  3.74   DEPTH*VELOCITY(FT*FT/SEC.) =   1.33
  LONGEST FLOWPATH FROM NODE    525.00 TO NODE    527.00 =     773.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    527.00 TO NODE    523.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.37
  RAINFALL INTENSITY(INCH/HR) =   4.25
  TOTAL STREAM AREA(ACRES) =     3.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.63

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      177.05    13.89        3.068         72.64
      2       10.63     8.37        4.253          3.80

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      117.29     8.37       4.253
      2      184.71    13.89       3.068

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     184.71   Tc(MIN.) =   13.89
  TOTAL AREA(ACRES) =       76.4
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    523.00 =    4368.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    523.00 TO NODE    532.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   414.00  DOWNSTREAM(FEET) =   412.00
  FLOW LENGTH(FEET) =   194.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  43.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.57
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     184.71
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =   14.12
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    532.00 =    4562.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    532.00 TO NODE    532.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.12
  RAINFALL INTENSITY(INCH/HR) =   3.03
  TOTAL STREAM AREA(ACRES) =    76.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    184.71

****************************************************************************
  FLOW PROCESS FROM NODE    530.00 TO NODE    531.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    426.60
  DOWNSTREAM ELEVATION(FEET) =    425.40
  ELEVATION DIFFERENCE(FEET) =      1.20
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.169
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.66
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.66

****************************************************************************
  FLOW PROCESS FROM NODE    531.00 TO NODE    532.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  425.40  DOWNSTREAM ELEVATION(FEET) =  416.50
  STREET LENGTH(FEET) =   365.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.00
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.40
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.84
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.72
  STREET FLOW TRAVEL TIME(MIN.) =   2.14   Tc(MIN.) =    5.31
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.703
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.669
  SUBAREA AREA(ACRES) =    1.25      SUBAREA RUNOFF(CFS) =    4.63
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       5.26

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.41
  FLOW VELOCITY(FEET/SEC.) =  3.19   DEPTH*VELOCITY(FT*FT/SEC.) =   0.94
  LONGEST FLOWPATH FROM NODE    530.00 TO NODE    532.00 =     445.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    532.00 TO NODE    532.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.31
  RAINFALL INTENSITY(INCH/HR) =   5.70
  TOTAL STREAM AREA(ACRES) =     1.38
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.26

****************************************************************************
  FLOW PROCESS FROM NODE    535.00 TO NODE    536.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    427.40
  DOWNSTREAM ELEVATION(FEET) =    425.00
  ELEVATION DIFFERENCE(FEET) =      2.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.196
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.45
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
  FLOW PROCESS FROM NODE    536.00 TO NODE    537.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   422.00  DOWNSTREAM(FEET) =   416.00
  FLOW LENGTH(FEET) =   193.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.28
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.45
  PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =    2.95
  LONGEST FLOWPATH FROM NODE    535.00 TO NODE    537.00 =     253.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    536.00 TO NODE    537.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    0.73   SUBAREA RUNOFF(CFS) =    3.68
  TOTAL AREA(ACRES) =        0.8   TOTAL RUNOFF(CFS) =       4.13
```

```
  TC(MIN.) =    2.95

****************************************************************************
  FLOW PROCESS FROM NODE    537.00 TO NODE    532.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    2.95
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     0.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.13

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      184.71    14.12        3.034         76.44
      2        5.26     5.31        5.703          1.38
      3        4.13     2.95        5.928          0.82

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      101.59     2.95       5.928
      2      107.51     5.31       5.703
      3      189.62    14.12       3.034

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     189.62   Tc(MIN.) =   14.12
  TOTAL AREA(ACRES) =       78.6
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    532.00 =    4562.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    532.00 TO NODE    538.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   412.00  DOWNSTREAM(FEET) =   411.00
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  39.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.28
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     189.62
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   14.21
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    538.00 =    4637.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    538.00 TO NODE    538.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.21
  RAINFALL INTENSITY(INCH/HR) =   3.02
  TOTAL STREAM AREA(ACRES) =    78.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    189.62

****************************************************************************
  FLOW PROCESS FROM NODE    540.00 TO NODE    541.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    439.85
  DOWNSTREAM ELEVATION(FEET) =    439.20
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      1.17
  TOTAL AREA(ACRES) =      0.36   TOTAL RUNOFF(CFS) =      1.17

****************************************************************************
  FLOW PROCESS FROM NODE    541.00 TO NODE    542.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  436.50  DOWNSTREAM ELEVATION(FEET) =  416.70
  STREET LENGTH(FEET) =   792.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.68
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.14
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.89
  STREET FLOW TRAVEL TIME(MIN.) =   4.21   Tc(MIN.) =   10.74
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.621
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    2.94      SUBAREA RUNOFF(CFS) =    6.92
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =       7.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.91
  FLOW VELOCITY(FEET/SEC.) =  3.53   DEPTH*VELOCITY(FT*FT/SEC.) =   1.15
  LONGEST FLOWPATH FROM NODE    540.00 TO NODE    542.00 =     857.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    542.00 TO NODE    538.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.74
  RAINFALL INTENSITY(INCH/HR) =   3.62
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.77

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    546.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    424.85
  DOWNSTREAM ELEVATION(FEET) =    424.20
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    546.00 TO NODE    547.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
```

```
  UPSTREAM ELEVATION(FEET) =  421.50  DOWNSTREAM ELEVATION(FEET) =  412.00
  STREET LENGTH(FEET) =   506.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.08
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.78
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.86
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.86
  STREET FLOW TRAVEL TIME(MIN.) =   2.95   Tc(MIN.) =    9.48
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.923
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    3.54      SUBAREA RUNOFF(CFS) =    9.03
  TOTAL AREA(ACRES) =        3.7        PEAK FLOW RATE(CFS) =       9.44

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.41
  FLOW VELOCITY(FEET/SEC.) =  3.32   DEPTH*VELOCITY(FT*FT/SEC.) =   1.18
  LONGEST FLOWPATH FROM NODE    545.00 TO NODE    547.00 =     571.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    547.00 TO NODE    538.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   413.00  DOWNSTREAM(FEET) =   411.00
  FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.73
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.44
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    9.93
  LONGEST FLOWPATH FROM NODE    545.00 TO NODE    538.00 =     751.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    538.00 TO NODE    538.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.93
  RAINFALL INTENSITY(INCH/HR) =   3.81
  TOTAL STREAM AREA(ACRES) =     3.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.44

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      189.62    14.21        3.023         78.64
      2        7.77    10.74        3.621          3.30
      3        9.44     9.93        3.809          3.70

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      167.12     9.93       3.809
      2      175.04    10.74       3.621
      3      203.60    14.21       3.023
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     203.60   Tc(MIN.) =   14.21
  TOTAL AREA(ACRES) =       85.6
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    538.00 =    4637.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    538.00 TO NODE    548.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   411.00  DOWNSTREAM(FEET) =   400.00
  FLOW LENGTH(FEET) =   265.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.84
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     203.60
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   14.39
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    548.00 =    4902.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    548.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.39
  RAINFALL INTENSITY(INCH/HR) =   3.00
  TOTAL STREAM AREA(ACRES) =    85.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    203.60

****************************************************************************
  FLOW PROCESS FROM NODE    550.00 TO NODE    551.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    416.75
  DOWNSTREAM ELEVATION(FEET) =    416.10
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.97
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      0.97

****************************************************************************
  FLOW PROCESS FROM NODE    551.00 TO NODE    552.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  413.50  DOWNSTREAM ELEVATION(FEET) =  406.00
  STREET LENGTH(FEET) =   592.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.83
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.16
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.54
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   3.89   Tc(MIN.) =   10.42
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.692
```

```
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    3.99      SUBAREA RUNOFF(CFS) =    9.57
  TOTAL AREA(ACRES) =        4.3        PEAK FLOW RATE(CFS) =      10.29

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.84
  FLOW VELOCITY(FEET/SEC.) =  2.91   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    550.00 TO NODE    552.00 =     657.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    552.00 TO NODE    548.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   401.00  DOWNSTREAM(FEET) =   400.00
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.51
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.29
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   10.52
  LONGEST FLOWPATH FROM NODE    550.00 TO NODE    548.00 =     710.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    548.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.52
  RAINFALL INTENSITY(INCH/HR) =   3.67
  TOTAL STREAM AREA(ACRES) =     4.29
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.29

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      203.60    14.39        2.998         85.64
      2       10.29    10.52        3.668          4.29

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      176.67    10.52       3.668
      2      212.01    14.39       2.998

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     212.01   Tc(MIN.) =   14.39
  TOTAL AREA(ACRES) =       89.9
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    548.00 =    4902.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    557.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   400.00  DOWNSTREAM(FEET) =   399.00
  FLOW LENGTH(FEET) =   133.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  48.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.44
  ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     212.01
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   14.57
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    557.00 =    5035.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    557.00 TO NODE    557.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.57
  RAINFALL INTENSITY(INCH/HR) =   2.97
  TOTAL STREAM AREA(ACRES) =    89.93
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    212.01

****************************************************************************
  FLOW PROCESS FROM NODE    555.00 TO NODE    556.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    409.80
  DOWNSTREAM ELEVATION(FEET) =    409.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.58
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.58

****************************************************************************
  FLOW PROCESS FROM NODE    556.00 TO NODE    557.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  409.15  DOWNSTREAM ELEVATION(FEET) =  404.00
  STREET LENGTH(FEET) =   374.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.60
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.36
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   2.64   Tc(MIN.) =    9.17
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.008
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =    5.99
  TOTAL AREA(ACRES) =        2.5        PEAK FLOW RATE(CFS) =       6.46

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.41
  FLOW VELOCITY(FEET/SEC.) =  2.69   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
  LONGEST FLOWPATH FROM NODE    555.00 TO NODE    557.00 =     439.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    557.00 TO NODE    557.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.17
  RAINFALL INTENSITY(INCH/HR) =   4.01
  TOTAL STREAM AREA(ACRES) =     2.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.46
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      212.01    14.57        2.974         89.93
      2        6.46     9.17        4.008          2.48

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      163.76     9.17       4.008
      2      216.80    14.57       2.974

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     216.80   Tc(MIN.) =   14.57
  TOTAL AREA(ACRES) =       92.4
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    557.00 =    5035.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    557.00 TO NODE    562.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   399.00  DOWNSTREAM(FEET) =   397.00
  FLOW LENGTH(FEET) =   361.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  66.0 INCH PIPE IS  49.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.32
  ESTIMATED PIPE DIAMETER(INCH) =  66.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     216.80
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =   15.10
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    562.00 =    5396.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    562.00 TO NODE    562.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.10
  RAINFALL INTENSITY(INCH/HR) =   2.91
  TOTAL STREAM AREA(ACRES) =    92.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    216.80

****************************************************************************
  FLOW PROCESS FROM NODE    560.00 TO NODE    561.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    414.55
  DOWNSTREAM ELEVATION(FEET) =    413.90
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.58
  TOTAL AREA(ACRES) =      0.18   TOTAL RUNOFF(CFS) =      0.58

****************************************************************************
  FLOW PROCESS FROM NODE    561.00 TO NODE    562.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  413.90  DOWNSTREAM ELEVATION(FEET) =  402.50
  STREET LENGTH(FEET) =   466.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
```

```
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.96
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.16
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.16
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.92
  STREET FLOW TRAVEL TIME(MIN.) =   2.46   Tc(MIN.) =    8.99
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.062
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    3.29      SUBAREA RUNOFF(CFS) =    8.69
  TOTAL AREA(ACRES) =        3.5        PEAK FLOW RATE(CFS) =       9.16

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.66
  FLOW VELOCITY(FEET/SEC.) =  3.65   DEPTH*VELOCITY(FT*FT/SEC.) =   1.24
  LONGEST FLOWPATH FROM NODE    560.00 TO NODE    562.00 =     531.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    562.00 TO NODE    562.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.99
  RAINFALL INTENSITY(INCH/HR) =   4.06
  TOTAL STREAM AREA(ACRES) =     3.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.16

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      216.80    15.10        2.906         92.41
      2        9.16     8.99        4.062          3.47

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      164.28     8.99       4.062
      2      223.36    15.10       2.906

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     223.36   Tc(MIN.) =   15.10
  TOTAL AREA(ACRES) =       95.9
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    562.00 =    5396.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    562.00 TO NODE    563.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   397.00  DOWNSTREAM(FEET) =   395.00
  FLOW LENGTH(FEET) =    73.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  38.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.46
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     223.36
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =   15.16
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    563.00 =    5469.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    563.00 TO NODE    563.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.16
  RAINFALL INTENSITY(INCH/HR) =   2.90
  TOTAL STREAM AREA(ACRES) =    95.88
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    223.36

****************************************************************************
  FLOW PROCESS FROM NODE    564.00 TO NODE    565.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    427.00
  DOWNSTREAM ELEVATION(FEET) =    426.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.49
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.49

****************************************************************************
  FLOW PROCESS FROM NODE    566.00 TO NODE    567.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  424.20  DOWNSTREAM ELEVATION(FEET) =  401.70
  STREET LENGTH(FEET) =   784.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.83
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    6.96
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.18
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   4.11   Tc(MIN.) =   10.64
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.642
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    2.78      SUBAREA RUNOFF(CFS) =    6.58
  TOTAL AREA(ACRES) =        2.9        PEAK FLOW RATE(CFS) =       6.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.16
  FLOW VELOCITY(FEET/SEC.) =  3.63   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    564.00 TO NODE    567.00 =     849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    567.00 TO NODE    563.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.64
  RAINFALL INTENSITY(INCH/HR) =   3.64
  TOTAL STREAM AREA(ACRES) =     2.93
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.94
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      223.36    15.16        2.899         95.88
      2        6.94    10.64        3.642          2.93

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      184.72    10.64       3.642
      2      228.88    15.16       2.899

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     228.88   Tc(MIN.) =   15.16
  TOTAL AREA(ACRES) =       98.8
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    563.00 =    5469.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    563.00 TO NODE    568.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   395.00  DOWNSTREAM(FEET) =   392.00
  FLOW LENGTH(FEET) =   255.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  57.0 INCH PIPE IS  45.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.03
  ESTIMATED PIPE DIAMETER(INCH) =  57.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     228.88
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   15.44
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    568.00 =    5724.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    568.00 TO NODE    568.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.44
  RAINFALL INTENSITY(INCH/HR) =   2.86
  TOTAL STREAM AREA(ACRES) =    98.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    228.88

****************************************************************************
  FLOW PROCESS FROM NODE    570.00 TO NODE    571.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    415.80
  DOWNSTREAM ELEVATION(FEET) =    415.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.88
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE    571.00 TO NODE    572.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  413.90  DOWNSTREAM ELEVATION(FEET) =  397.20
  STREET LENGTH(FEET) =   405.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
```

```
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.84
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.88
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.04
  STREET FLOW TRAVEL TIME(MIN.) =   1.74   Tc(MIN.) =    8.27
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.285
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    2.84      SUBAREA RUNOFF(CFS) =    7.91
  TOTAL AREA(ACRES) =        3.1        PEAK FLOW RATE(CFS) =       8.66

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.34
  FLOW VELOCITY(FEET/SEC.) =  4.37   DEPTH*VELOCITY(FT*FT/SEC.) =   1.37
  LONGEST FLOWPATH FROM NODE    570.00 TO NODE    572.00 =     470.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    572.00 TO NODE    568.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.27
  RAINFALL INTENSITY(INCH/HR) =   4.29
  TOTAL STREAM AREA(ACRES) =     3.11
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.66

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      228.88    15.44        2.864         98.81
      2        8.66     8.27        4.285          3.11

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      161.65     8.27       4.285
      2      234.67    15.44       2.864

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     234.67   Tc(MIN.) =   15.44
  TOTAL AREA(ACRES) =      101.9
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    568.00 =    5724.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    568.00 TO NODE    573.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.00  DOWNSTREAM(FEET) =   383.00
  FLOW LENGTH(FEET) =   355.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  38.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.40
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     234.67
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =   15.73
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    573.00 =    6079.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    573.00 TO NODE    573.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.73
  RAINFALL INTENSITY(INCH/HR) =   2.83
  TOTAL STREAM AREA(ACRES) =   101.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    234.67

****************************************************************************
  FLOW PROCESS FROM NODE    575.00 TO NODE    576.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    404.75
  DOWNSTREAM ELEVATION(FEET) =    404.10
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.55
  TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.55

****************************************************************************
  FLOW PROCESS FROM NODE    576.00 TO NODE    577.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  401.50  DOWNSTREAM ELEVATION(FEET) =  387.00
  STREET LENGTH(FEET) =   647.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.68
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.09
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.87
  STREET FLOW TRAVEL TIME(MIN.) =   3.57   Tc(MIN.) =   10.10
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.768
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    3.33      SUBAREA RUNOFF(CFS) =    8.16
  TOTAL AREA(ACRES) =        3.5        PEAK FLOW RATE(CFS) =       8.57

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.59
  FLOW VELOCITY(FEET/SEC.) =  3.46   DEPTH*VELOCITY(FT*FT/SEC.) =   1.17
  LONGEST FLOWPATH FROM NODE    575.00 TO NODE    577.00 =     712.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    577.00 TO NODE    573.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   384.00  DOWNSTREAM(FEET) =   383.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.63
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.57
```

```
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   10.32
  LONGEST FLOWPATH FROM NODE    575.00 TO NODE    573.00 =     802.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    573.00 TO NODE    573.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.32
  RAINFALL INTENSITY(INCH/HR) =   3.71
  TOTAL STREAM AREA(ACRES) =     3.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.57

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      234.67    15.73        2.830        101.92
      2        8.57    10.32        3.714          3.50

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      187.38    10.32       3.714
      2      241.20    15.73       2.830

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     241.20   Tc(MIN.) =   15.73
  TOTAL AREA(ACRES) =      105.4
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    573.00 =    6079.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    573.00 TO NODE    578.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   583.00  DOWNSTREAM(FEET) =   474.50
  FLOW LENGTH(FEET) =   345.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  53.24
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     241.20
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   15.84
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    578.00 =    6424.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    578.00 TO NODE    578.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.818
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (FLAT) RUNOFF COEFFICIENT = .4000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6947
  SUBAREA AREA(ACRES) =    1.58   SUBAREA RUNOFF(CFS) =    1.78
  TOTAL AREA(ACRES) =      107.0   TOTAL RUNOFF(CFS) =     241.20
  TC(MIN.) =   15.84
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    578.00 TO NODE    578.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| Begin hydrology for Heritage Road Storm drain adjacent to Village 2 Sout |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    84.00
  UPSTREAM ELEVATION(FEET) =    377.56
  DOWNSTREAM ELEVATION(FEET) =    366.00
  ELEVATION DIFFERENCE(FEET) =     11.56
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.829
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.42
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.42

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    607.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   450.00  DOWNSTREAM(FEET) =   430.00
  FLOW LENGTH(FEET) =   580.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.20
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.42
  PIPE TRAVEL TIME(MIN.) =   1.56    Tc(MIN.) =    5.39
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =     664.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    607.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.39
  RAINFALL INTENSITY(INCH/HR) =   5.65
  TOTAL STREAM AREA(ACRES) =     0.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.42

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    87.00
  UPSTREAM ELEVATION(FEET) =    440.50
  DOWNSTREAM ELEVATION(FEET) =    440.23
  ELEVATION DIFFERENCE(FEET) =      0.27
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.009
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.56
  TOTAL AREA(ACRES) =      0.31   TOTAL RUNOFF(CFS) =      1.56

****************************************************************************
  FLOW PROCESS FROM NODE    606.00 TO NODE    607.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  440.23  DOWNSTREAM ELEVATION(FEET) =  435.13
  STREET LENGTH(FEET) =   421.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  26.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.71
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.16
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.48
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.82
  STREET FLOW TRAVEL TIME(MIN.) =   2.83   Tc(MIN.) =    6.84
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.845
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    2.00      SUBAREA RUNOFF(CFS) =    8.24
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       9.51

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.55
  FLOW VELOCITY(FEET/SEC.) =  2.81   DEPTH*VELOCITY(FT*FT/SEC.) =   1.06
  LONGEST FLOWPATH FROM NODE    605.00 TO NODE    607.00 =     508.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    607.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.84
  RAINFALL INTENSITY(INCH/HR) =   4.85
  TOTAL STREAM AREA(ACRES) =     2.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.51

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        1.42     5.39        5.650          0.40
      2        9.51     6.84        4.845          2.31

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        8.92     5.39       5.650
      2       10.73     6.84       4.845

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.73   Tc(MIN.) =    6.84
  TOTAL AREA(ACRES) =        2.7
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =     664.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    608.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   430.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.26
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.73
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =    7.11
```

```
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    608.00 =     832.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    608.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.11
  RAINFALL INTENSITY(INCH/HR) =   4.72
  TOTAL STREAM AREA(ACRES) =     2.71
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.73

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    611.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (FLAT) RUNOFF COEFFICIENT = .4500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    496.70
  DOWNSTREAM ELEVATION(FEET) =    496.00
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.433
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.937
  SUBAREA RUNOFF(CFS) =      1.26
  TOTAL AREA(ACRES) =      0.71   TOTAL RUNOFF(CFS) =      1.26

****************************************************************************
  FLOW PROCESS FROM NODE    611.00 TO NODE    612.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    496.00  DOWNSTREAM(FEET) =    398.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   793.00   CHANNEL SLOPE =  0.1236
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.26
  FLOW VELOCITY(FEET/SEC) =   4.96 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.67   Tc(MIN.) =   12.10
  LONGEST FLOWPATH FROM NODE    610.00 TO NODE    612.00 =     863.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    611.00 TO NODE    612.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.353
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5462
  SUBAREA AREA(ACRES) =   17.78   SUBAREA RUNOFF(CFS) =   32.78
  TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      33.86
  TC(MIN.) =   12.10

****************************************************************************
  FLOW PROCESS FROM NODE    612.00 TO NODE    608.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   426.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  24.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.93
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      33.86
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   12.37
  LONGEST FLOWPATH FROM NODE    610.00 TO NODE    608.00 =     993.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    608.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.37
  RAINFALL INTENSITY(INCH/HR) =   3.30
  TOTAL STREAM AREA(ACRES) =    18.49
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     33.86

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.73     7.11        4.725         2.71
      2       33.86    12.37        3.305        18.49

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       30.18     7.11       4.725
      2       41.36    12.37       3.305

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      41.36   Tc(MIN.) =   12.37
  TOTAL AREA(ACRES) =       21.2
  LONGEST FLOWPATH FROM NODE    610.00 TO NODE    608.00 =     993.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    608.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       41.36    12.37       3.305       21.20
  LONGEST FLOWPATH FROM NODE    610.00 TO NODE    608.00 =     993.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      239.37    13.71       3.092       93.03
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    608.00 =    6263.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     257.31      12.37        3.305
      2     278.07      13.71        3.092

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     278.07   Tc(MIN.) =   13.71
  TOTAL AREA(ACRES) =      114.2

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    608.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    617.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   400.00
  FLOW LENGTH(FEET) =   770.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  40.2 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.17
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     278.07
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =   14.27
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    617.00 =    7033.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    617.00 TO NODE    617.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.27
  RAINFALL INTENSITY(INCH/HR) =   3.01
  TOTAL STREAM AREA(ACRES) =   114.23
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    278.07

****************************************************************************
  FLOW PROCESS FROM NODE    615.00 TO NODE    616.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    435.13
  DOWNSTREAM ELEVATION(FEET) =    432.58
  ELEVATION DIFFERENCE(FEET) =      2.55
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.791
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.07
  TOTAL AREA(ACRES) =      0.41   TOTAL RUNOFF(CFS) =      2.07

****************************************************************************
  FLOW PROCESS FROM NODE    616.00 TO NODE    617.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  429.13  DOWNSTREAM ELEVATION(FEET) =  404.00
  STREET LENGTH(FEET) =   717.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 52.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  26.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.79
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.20
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.04
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.25
  STREET FLOW TRAVEL TIME(MIN.) =   2.96   Tc(MIN.) =    5.75
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.417
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    2.48      SUBAREA RUNOFF(CFS) =   11.42
  TOTAL AREA(ACRES) =        2.9        PEAK FLOW RATE(CFS) =      13.31

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.60
  FLOW VELOCITY(FEET/SEC.) =  4.55   DEPTH*VELOCITY(FT*FT/SEC.) =   1.63
  LONGEST FLOWPATH FROM NODE    615.00 TO NODE    617.00 =     802.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    617.00 TO NODE    617.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.75
  RAINFALL INTENSITY(INCH/HR) =   5.42
  TOTAL STREAM AREA(ACRES) =     2.89
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.31

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      278.07    14.27        3.014        114.23
      2       13.31     5.75        5.417          2.89

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      125.37     5.75       5.417
      2      285.48    14.27       3.014

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     285.48   Tc(MIN.) =   14.27
  TOTAL AREA(ACRES) =      117.1
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    617.00 =    7033.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    617.00 TO NODE    618.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   400.00  DOWNSTREAM(FEET) =   379.00
  FLOW LENGTH(FEET) =   662.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  38.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.49
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     285.48
  PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =   14.74
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    618.00 =    7695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    618.00 TO NODE    618.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.74
  RAINFALL INTENSITY(INCH/HR) =   2.95
  TOTAL STREAM AREA(ACRES) =   117.12
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    285.48

****************************************************************************
  FLOW PROCESS FROM NODE    620.00 TO NODE    621.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .5500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    450.00
  DOWNSTREAM ELEVATION(FEET) =    440.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.596
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
```

```
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.38   TOTAL RUNOFF(CFS) =      1.24

****************************************************************************
  FLOW PROCESS FROM NODE    621.00 TO NODE    622.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   400.00  DOWNSTREAM(FEET) =   385.00
  FLOW LENGTH(FEET) =   990.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.44
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.24
  PIPE TRAVEL TIME(MIN.) =   3.71    Tc(MIN.) =    8.31
  LONGEST FLOWPATH FROM NODE    620.00 TO NODE    622.00 =    1090.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    621.00 TO NODE    622.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.272
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    2.89   SUBAREA RUNOFF(CFS) =    6.79
  TOTAL AREA(ACRES) =        3.3   TOTAL RUNOFF(CFS) =       7.68
  TC(MIN.) =    8.31

****************************************************************************
  FLOW PROCESS FROM NODE    622.00 TO NODE    627.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   381.00  DOWNSTREAM(FEET) =   380.00
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.15
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.68
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    8.41
  LONGEST FLOWPATH FROM NODE    620.00 TO NODE    627.00 =    1140.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    627.00 TO NODE    627.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.41
  RAINFALL INTENSITY(INCH/HR) =   4.24
  TOTAL STREAM AREA(ACRES) =     3.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.68

****************************************************************************
  FLOW PROCESS FROM NODE    625.00 TO NODE    626.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  PAVED SURFACE RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    404.85
  DOWNSTREAM ELEVATION(FEET) =    402.05
  ELEVATION DIFFERENCE(FEET) =      2.80
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.730
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    81.47
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      1.71
TOTAL AREA(ACRES) =      0.34   TOTAL RUNOFF(CFS) =      1.71

****************************************************************************
FLOW PROCESS FROM NODE    626.00 TO NODE    627.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  401.38  DOWNSTREAM ELEVATION(FEET) =  383.89
STREET LENGTH(FEET) =   651.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 52.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  26.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.11
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.31
  HALFSTREET FLOOD WIDTH(FEET) =    9.40
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.55
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.12
STREET FLOW TRAVEL TIME(MIN.) =   3.06   Tc(MIN.) =    5.79
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.395
*USER SPECIFIED(SUBAREA):
PAVED SURFACE RUNOFF COEFFICIENT = .8500
AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
SUBAREA AREA(ACRES) =    2.34      SUBAREA RUNOFF(CFS) =   10.73
TOTAL AREA(ACRES) =        2.7        PEAK FLOW RATE(CFS) =      12.29

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.88
FLOW VELOCITY(FEET/SEC.) =  4.02   DEPTH*VELOCITY(FT*FT/SEC.) =   1.46
LONGEST FLOWPATH FROM NODE    625.00 TO NODE    627.00 =     736.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    627.00 TO NODE    618.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =    5.79
RAINFALL INTENSITY(INCH/HR) =   5.40
TOTAL STREAM AREA(ACRES) =     2.68
PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.29

** CONFLUENCE DATA **
STREAM     RUNOFF       Tc      INTENSITY      AREA
NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1      285.48    14.74        2.952        117.12
    2        7.68     8.41        4.239          3.27
    3       12.29     5.79        5.395          2.68

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  3 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1      173.77     5.79       5.395
    2      216.16     8.41       4.239
    3      297.55    14.74       2.952

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     297.55   Tc(MIN.) =   14.74
TOTAL AREA(ACRES) =      123.1
```

```
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    618.00 =    7695.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    618.00 TO NODE    632.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   379.00  DOWNSTREAM(FEET) =   375.00
  FLOW LENGTH(FEET) =   760.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  75.0 INCH PIPE IS  56.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.01
  ESTIMATED PIPE DIAMETER(INCH) =  75.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     297.55
  PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =   15.79
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    632.00 =    8455.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    632.00 TO NODE    632.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.79
  RAINFALL INTENSITY(INCH/HR) =   2.82
  TOTAL STREAM AREA(ACRES) =   123.07
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    297.55

****************************************************************************
  FLOW PROCESS FROM NODE    630.00 TO NODE    631.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    424.00
  DOWNSTREAM ELEVATION(FEET) =    420.60
  ELEVATION DIFFERENCE(FEET) =      3.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.614
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.06
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      1.06

****************************************************************************
  FLOW PROCESS FROM NODE    631.00 TO NODE    632.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   415.00  DOWNSTREAM(FEET) =   375.00
  FLOW LENGTH(FEET) =  1196.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.62
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.06
  PIPE TRAVEL TIME(MIN.) =   3.55    Tc(MIN.) =    6.16
  LONGEST FLOWPATH FROM NODE    630.00 TO NODE    632.00 =    1281.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    631.00 TO NODE    632.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.181
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL AREA RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =   23.58   SUBAREA RUNOFF(CFS) =  103.85
  TOTAL AREA(ACRES) =       23.8   TOTAL RUNOFF(CFS) =     104.77
  TC(MIN.) =    6.16

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    632.00 TO NODE    632.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.16
  RAINFALL INTENSITY(INCH/HR) =   5.18
  TOTAL STREAM AREA(ACRES) =    23.79
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    104.77

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      297.55    15.79        2.823        123.07
      2      104.77     6.16        5.181         23.79

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      266.91     6.16       5.181
      2      354.64    15.79       2.823

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     354.64   Tc(MIN.) =   15.79
  TOTAL AREA(ACRES) =      146.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    632.00 =    8455.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    632.00 TO NODE    578.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   475.00  DOWNSTREAM(FEET) =   474.50
  FLOW LENGTH(FEET) =   167.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  87.0 INCH PIPE IS  69.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.05
  ESTIMATED PIPE DIAMETER(INCH) =  87.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     354.64
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   16.07
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    578.00 =    8622.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    578.00 TO NODE    578.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      354.64    16.07       2.792      146.86
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    578.00 =    8622.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      241.20    15.84       2.818      107.00
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    578.00 =    6424.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     590.80      15.84        2.818
      2     593.62      16.07        2.792

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     593.62   Tc(MIN.) =   16.07
  TOTAL AREA(ACRES) =      253.9

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    578.00 TO NODE    578.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    578.00 TO NODE    259.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   474.50  DOWNSTREAM(FEET) =   470.00
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  60.0 INCH PIPE IS  46.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  36.30
  ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     593.62
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   16.10
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    259.00 =    8692.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    259.00 TO NODE    259.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      593.62    16.10       2.788      253.86
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    259.00 =    8692.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       25.39    11.21       3.521        9.89
  LONGEST FLOWPATH FROM NODE    255.00 TO NODE    259.00 =    2119.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     438.73      11.21        3.521
      2     613.73      16.10        2.788

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     613.73   Tc(MIN.) =   16.10
  TOTAL AREA(ACRES) =      263.8

****************************************************************************
  FLOW PROCESS FROM NODE    259.00 TO NODE    259.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    259.00 TO NODE    260.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   470.00  DOWNSTREAM(FEET) =   277.00
  FLOW LENGTH(FEET) =   733.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  62.76
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     613.73
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   16.30
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    260.00 =    9425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    259.00 TO NODE    260.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.767
  *USER SPECIFIED(SUBAREA):
```

```
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6927
  SUBAREA AREA(ACRES) =   23.73   SUBAREA RUNOFF(CFS) =   32.83
  TOTAL AREA(ACRES) =      287.5   TOTAL RUNOFF(CFS) =     613.73
  TC(MIN.) =   16.30
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      287.5  TC(MIN.) =     16.30
  PEAK FLOW RATE(CFS)   =     613.73
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 3

100-YEAR HYDROLOGIC ANALYSIS

3.4 – Heritage Road Portion Developed Condition AES Model Output

Refer to Exhibit 1.4 in Chapter 7

```
____________________________________________________________________________
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                          2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                    Hunsaker & Associates San Diego, Inc.
                              9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch, Village 2 South                                              *
* 100-year Proposed Condtion Hydrology Model, HERITAGE ROAD PORTION.       *
* W.O. 2807-35,  DLN:  1089                                                *
 ****************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\S\PR100H.DAT
  TIME/DATE OF STUDY: 10:18 06/08/2012
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.250
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150


  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    380.90
  DOWNSTREAM ELEVATION(FEET) =    378.50
  ELEVATION DIFFERENCE(FEET) =      2.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.568
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.24
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  378.50  DOWNSTREAM ELEVATION(FEET) =  364.50
  STREET LENGTH(FEET) =   829.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 22.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  11.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.80
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.86
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
  STREET FLOW TRAVEL TIME(MIN.) =   4.84   Tc(MIN.) =    7.41
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.601
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.852
  SUBAREA AREA(ACRES) =    2.29      SUBAREA RUNOFF(CFS) =    8.96
  TOTAL AREA(ACRES) =        2.5        PEAK FLOW RATE(CFS) =       9.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.90
  FLOW VELOCITY(FEET/SEC.) =  3.23   DEPTH*VELOCITY(FT*FT/SEC.) =   1.18
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =     909.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.41
  RAINFALL INTENSITY(INCH/HR) =   4.60
  TOTAL STREAM AREA(ACRES) =     2.53
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.92

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    384.40
  DOWNSTREAM ELEVATION(FEET) =    383.00
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.21
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.21

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   380.00  DOWNSTREAM(FEET) =   361.00
  FLOW LENGTH(FEET) =   971.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.85
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.21
  PIPE TRAVEL TIME(MIN.) =   3.34    Tc(MIN.) =    6.33
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    106.00 =    1041.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.093
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =   11.91   SUBAREA RUNOFF(CFS) =   51.56
  TOTAL AREA(ACRES) =       12.1   TOTAL RUNOFF(CFS) =      52.60
  TC(MIN.) =    6.33

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   361.00  DOWNSTREAM(FEET) =   360.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.15
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      52.60
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    6.47
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =    1131.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.47
  RAINFALL INTENSITY(INCH/HR) =   5.02
  TOTAL STREAM AREA(ACRES) =    12.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     52.60

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        9.92     7.41        4.601          2.53
      2       52.60     6.47        5.018         12.15

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       61.27     6.47       5.018
      2       58.14     7.41       4.601

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      61.27   Tc(MIN.) =    6.47
  TOTAL AREA(ACRES) =       14.7
```

```
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =    1131.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   360.00  DOWNSTREAM(FEET) =   345.00
  FLOW LENGTH(FEET) =   668.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.11
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      61.27
  PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =    7.26
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    107.00 =    1799.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    360.00
  DOWNSTREAM ELEVATION(FEET) =    358.50
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.093
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.60
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.60

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   355.50  DOWNSTREAM(FEET) =   346.00
  FLOW LENGTH(FEET) =   543.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.80
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.60
  PIPE TRAVEL TIME(MIN.) =   2.38    Tc(MIN.) =    5.47
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    110.00 =     618.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.592
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    2.46   SUBAREA RUNOFF(CFS) =   11.69
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =      12.26
  TC(MIN.) =    5.47

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    113.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   346.00  DOWNSTREAM(FEET) =   345.50
  FLOW LENGTH(FEET) =   400.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.17
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.26
  PIPE TRAVEL TIME(MIN.) =   2.10    Tc(MIN.) =    7.58
  LONGEST FLOWPATH FROM NODE    108.00 TO NODE    113.00 =    1018.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.58
  RAINFALL INTENSITY(INCH/HR) =   4.53
  TOTAL STREAM AREA(ACRES) =     2.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.26

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    370.70
  DOWNSTREAM ELEVATION(FEET) =    369.00
  ELEVATION DIFFERENCE(FEET) =      1.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   366.00  DOWNSTREAM(FEET) =   345.50
  FLOW LENGTH(FEET) =  1010.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.84
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.53
  PIPE TRAVEL TIME(MIN.) =   4.38    Tc(MIN.) =    8.85
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    113.00 =    1095.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.101
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
```

```
  SUBAREA AREA(ACRES) =    9.62   SUBAREA RUNOFF(CFS) =   29.59
  TOTAL AREA(ACRES) =        9.7   TOTAL RUNOFF(CFS) =      29.96
  TC(MIN.) =    8.85

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.85
  RAINFALL INTENSITY(INCH/HR) =   4.10
  TOTAL STREAM AREA(ACRES) =     9.74
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     29.96

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.26     7.58        4.533          2.58
      2       29.96     8.85        4.101          9.74

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       37.91     7.58       4.533
      2       41.05     8.85       4.101

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      41.05   Tc(MIN.) =    8.85
  TOTAL AREA(ACRES) =       12.3
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    113.00 =    1095.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   345.50  DOWNSTREAM(FEET) =   345.00
  FLOW LENGTH(FEET) =   115.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.73
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      41.05
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =    9.14
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    107.00 =    1210.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       41.05     9.14       4.018       12.32
  LONGEST FLOWPATH FROM NODE    111.00 TO NODE    107.00 =    1210.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       61.27     7.26       4.659       14.68
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    107.00 =    1799.00 FEET.

  ** PEAK FLOW RATE TABLE **
```

```
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      93.90       7.26        4.659
      2      93.89       9.14        4.018

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      93.90   Tc(MIN.) =    7.26
  TOTAL AREA(ACRES) =       27.0

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    116.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   345.00  DOWNSTREAM(FEET) =   344.00
  FLOW LENGTH(FEET) =   127.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  34.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.46
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      93.90
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    7.47
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    116.00 =    1926.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    116.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.47
  RAINFALL INTENSITY(INCH/HR) =   4.58
  TOTAL STREAM AREA(ACRES) =    27.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     93.90

****************************************************************************
  FLOW PROCESS FROM NODE    114.00 TO NODE    115.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    363.55
  DOWNSTREAM ELEVATION(FEET) =    361.00
  ELEVATION DIFFERENCE(FEET) =      2.55
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.568
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.98
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.98

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    116.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  361.00  DOWNSTREAM ELEVATION(FEET) =  345.00
  STREET LENGTH(FEET) =   658.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.72
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.98
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.80
  STREET FLOW TRAVEL TIME(MIN.) =   3.68   Tc(MIN.) =    6.25
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.136
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    1.22      SUBAREA RUNOFF(CFS) =    5.45
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       6.30

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.10
  FLOW VELOCITY(FEET/SEC.) =  3.33   DEPTH*VELOCITY(FT*FT/SEC.) =   1.03
  LONGEST FLOWPATH FROM NODE    114.00 TO NODE    116.00 =     743.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    116.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.25
  RAINFALL INTENSITY(INCH/HR) =   5.14
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.30

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       93.90     7.47        4.577         27.00
      2        6.30     6.25        5.136          1.41

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       84.85     6.25       5.136
      2       99.51     7.47       4.577

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      99.51   Tc(MIN.) =    7.47
  TOTAL AREA(ACRES) =       28.4
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    116.00 =    1926.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    119.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   344.00  DOWNSTREAM(FEET) =   326.00
  FLOW LENGTH(FEET) =   765.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.19
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      99.51
  PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =    8.25
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    119.00 =    2691.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    119.00 TO NODE    119.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.25
  RAINFALL INTENSITY(INCH/HR) =   4.29
  TOTAL STREAM AREA(ACRES) =    28.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     99.51

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    118.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    344.20
  DOWNSTREAM ELEVATION(FEET) =    342.50
  ELEVATION DIFFERENCE(FEET) =      1.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.749
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.83
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.83

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    119.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  342.50  DOWNSTREAM ELEVATION(FEET) =  329.00
  STREET LENGTH(FEET) =   640.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.91
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.84
  STREET FLOW TRAVEL TIME(MIN.) =   3.67   Tc(MIN.) =    6.42
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.045
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.759
  SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    7.19
```

```
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       7.89

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.35
  FLOW VELOCITY(FEET/SEC.) =  3.32   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
  LONGEST FLOWPATH FROM NODE    117.00 TO NODE    119.00 =     725.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    119.00 TO NODE    119.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.42
  RAINFALL INTENSITY(INCH/HR) =   5.05
  TOTAL STREAM AREA(ACRES) =     2.06
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.89

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       99.51     8.25        4.291         28.41
      2        7.89     6.42        5.045          2.06

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       92.52     6.42       5.045
      2      106.23     8.25       4.291

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     106.23   Tc(MIN.) =    8.25
  TOTAL AREA(ACRES) =       30.5
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    119.00 =    2691.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    119.00 TO NODE    120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   326.00  DOWNSTREAM(FEET) =   325.00
  FLOW LENGTH(FEET) =    95.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  33.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.06
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     106.23
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    8.38
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    120.00 =    2786.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    123.00 TO NODE    124.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    357.25
  DOWNSTREAM ELEVATION(FEET) =    355.00
```

```
  ELEVATION DIFFERENCE(FEET) =      2.25
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.199
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.42
  TOTAL AREA(ACRES) =      0.32   TOTAL RUNOFF(CFS) =      1.42

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    125.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   352.00  DOWNSTREAM(FEET) =   336.00
  FLOW LENGTH(FEET) =   862.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.98
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.42
  PIPE TRAVEL TIME(MIN.) =   2.88    Tc(MIN.) =    7.08
  LONGEST FLOWPATH FROM NODE    123.00 TO NODE    125.00 =     947.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    125.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.736
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =   11.21   SUBAREA RUNOFF(CFS) =   39.81
  TOTAL AREA(ACRES) =       11.5   TOTAL RUNOFF(CFS) =      40.95
  TC(MIN.) =    7.08

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    130.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.00  DOWNSTREAM(FEET) =   331.00
  FLOW LENGTH(FEET) =   104.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.87
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.95
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    7.19
  LONGEST FLOWPATH FROM NODE    123.00 TO NODE    130.00 =    1051.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.19
  RAINFALL INTENSITY(INCH/HR) =   4.69
  TOTAL STREAM AREA(ACRES) =    11.53
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     40.95

****************************************************************************
  FLOW PROCESS FROM NODE    128.00 TO NODE    129.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
```

```
  UPSTREAM ELEVATION(FEET) =    345.62
  DOWNSTREAM ELEVATION(FEET) =    343.50
  ELEVATION DIFFERENCE(FEET) =      2.12
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.643
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    74.94
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.19
  TOTAL AREA(ACRES) =      0.23   TOTAL RUNOFF(CFS) =      1.19

****************************************************************************
  FLOW PROCESS FROM NODE    129.00 TO NODE    130.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  343.50  DOWNSTREAM ELEVATION(FEET) =  332.00
  STREET LENGTH(FEET) =   440.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.41
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.71
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.78
  STREET FLOW TRAVEL TIME(MIN.) =   2.45   Tc(MIN.) =    5.09
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.860
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    0.87      SUBAREA RUNOFF(CFS) =    4.44
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       5.61

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.51
  FLOW VELOCITY(FEET/SEC.) =  3.33   DEPTH*VELOCITY(FT*FT/SEC.) =   0.99
  LONGEST FLOWPATH FROM NODE    128.00 TO NODE    130.00 =     525.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.09
  RAINFALL INTENSITY(INCH/HR) =   5.86
  TOTAL STREAM AREA(ACRES) =     1.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.61

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       40.95     7.19        4.692         11.53
      2        5.61     5.09        5.860          1.10

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       34.62     5.09       5.860
      2       45.44     7.19       4.692

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      45.44   Tc(MIN.) =    7.19
  TOTAL AREA(ACRES) =       12.6
  LONGEST FLOWPATH FROM NODE    123.00 TO NODE    130.00 =    1051.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   331.00  DOWNSTREAM(FEET) =   325.00
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.79
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      45.44
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    7.24
  LONGEST FLOWPATH FROM NODE    123.00 TO NODE    120.00 =    1121.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       45.44     7.24       4.669       12.63
  LONGEST FLOWPATH FROM NODE    123.00 TO NODE    120.00 =    1121.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      106.23     8.38       4.247       30.47
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    120.00 =    2786.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     137.15       7.24        4.669
      2     147.56       8.38        4.247

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     147.56   Tc(MIN.) =    8.38
  TOTAL AREA(ACRES) =       43.1

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    131.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   325.00  DOWNSTREAM(FEET) =   323.00
  FLOW LENGTH(FEET) =   237.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  38.6 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.12
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     147.56
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =    8.71
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    131.00 =    3023.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    131.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.71
  RAINFALL INTENSITY(INCH/HR) =   4.14
  TOTAL STREAM AREA(ACRES) =    43.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    147.56

****************************************************************************
  FLOW PROCESS FROM NODE    133.00 TO NODE    134.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    343.77
  DOWNSTREAM ELEVATION(FEET) =    342.17
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.67

****************************************************************************
  FLOW PROCESS FROM NODE    134.00 TO NODE    135.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  342.17  DOWNSTREAM ELEVATION(FEET) =  327.11
  STREET LENGTH(FEET) =   883.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.67
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.72
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.03
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.03
  STREET FLOW TRAVEL TIME(MIN.) =   4.86   Tc(MIN.) =    9.33
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.964
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    4.58      SUBAREA RUNOFF(CFS) =   13.61
  TOTAL AREA(ACRES) =        4.7        PEAK FLOW RATE(CFS) =      14.06
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.72
  FLOW VELOCITY(FEET/SEC.) =  3.51   DEPTH*VELOCITY(FT*FT/SEC.) =   1.41
  LONGEST FLOWPATH FROM NODE    133.00 TO NODE    135.00 =     963.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    135.00 TO NODE    131.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   324.00  DOWNSTREAM(FEET) =   323.00
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.04
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.06
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    9.49
  LONGEST FLOWPATH FROM NODE    133.00 TO NODE    131.00 =    1038.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    131.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.49
  RAINFALL INTENSITY(INCH/HR) =   3.92
  TOTAL STREAM AREA(ACRES) =     4.73
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.06

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      147.56     8.71        4.144         43.10
      2       14.06     9.49        3.922          4.73

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      160.47     8.71       4.144
      2      153.70     9.49       3.922

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     160.47   Tc(MIN.) =    8.71
  TOTAL AREA(ACRES) =       47.8
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    131.00 =    3023.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    136.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   323.00  DOWNSTREAM(FEET) =   317.00
  FLOW LENGTH(FEET) =   245.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  33.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.38
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     160.47
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    8.93
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    136.00 =    3268.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    136.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.93
  RAINFALL INTENSITY(INCH/HR) =   4.08
  TOTAL STREAM AREA(ACRES) =    47.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    160.47

****************************************************************************
  FLOW PROCESS FROM NODE    138.00 TO NODE    139.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    340.65
  DOWNSTREAM ELEVATION(FEET) =    340.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.207
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.67

****************************************************************************
  FLOW PROCESS FROM NODE    139.00 TO NODE    140.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  339.43  DOWNSTREAM ELEVATION(FEET) =  321.00
  STREET LENGTH(FEET) =   928.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.97
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.53
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.25
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.09
  STREET FLOW TRAVEL TIME(MIN.) =   4.76   Tc(MIN.) =    7.97
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.388
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.754
  SUBAREA AREA(ACRES) =    4.28      SUBAREA RUNOFF(CFS) =   14.09
  TOTAL AREA(ACRES) =        4.4        PEAK FLOW RATE(CFS) =      14.58

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.53
  FLOW VELOCITY(FEET/SEC.) =  3.74   DEPTH*VELOCITY(FT*FT/SEC.) =   1.48
  LONGEST FLOWPATH FROM NODE    138.00 TO NODE    140.00 =     993.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    136.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   318.00  DOWNSTREAM(FEET) =   317.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.86
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.58
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    8.08
  LONGEST FLOWPATH FROM NODE    138.00 TO NODE    136.00 =    1053.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    136.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.08
  RAINFALL INTENSITY(INCH/HR) =   4.35
  TOTAL STREAM AREA(ACRES) =     4.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.58

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      160.47     8.93        4.077         47.83
      2       14.58     8.08        4.348          4.41

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      165.04     8.08       4.348
      2      174.14     8.93       4.077

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     174.14   Tc(MIN.) =    8.93
  TOTAL AREA(ACRES) =       52.2
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    136.00 =    3268.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    136.00 TO NODE    141.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   317.00  DOWNSTREAM(FEET) =   310.50
  FLOW LENGTH(FEET) =   195.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  34.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.65
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     174.14
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    9.09
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    141.00 =    3463.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    141.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    142.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    348.85
  DOWNSTREAM ELEVATION(FEET) =    347.25
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.07
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.07

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    144.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   344.25  DOWNSTREAM(FEET) =   336.00
  FLOW LENGTH(FEET) =   804.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.71
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.07
  PIPE TRAVEL TIME(MIN.) =   3.61    Tc(MIN.) =    8.08
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    144.00 =     884.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    143.00 TO NODE    144.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.350
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    8.12   SUBAREA RUNOFF(CFS) =   26.49
  TOTAL AREA(ACRES) =        8.4   TOTAL RUNOFF(CFS) =      27.27
  TC(MIN.) =    8.08

****************************************************************************
  FLOW PROCESS FROM NODE    144.00 TO NODE    147.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   336.00  DOWNSTREAM(FEET) =   322.00
  FLOW LENGTH(FEET) =   400.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.32
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.27
  PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =    8.58
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    147.00 =    1284.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    147.00 TO NODE    147.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.58
  RAINFALL INTENSITY(INCH/HR) =   4.18
  TOTAL STREAM AREA(ACRES) =     8.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.27

****************************************************************************
  FLOW PROCESS FROM NODE    145.00 TO NODE    146.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    343.77
  DOWNSTREAM ELEVATION(FEET) =    342.17
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.749
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.57
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.57

****************************************************************************
  FLOW PROCESS FROM NODE    146.00 TO NODE    147.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  342.17  DOWNSTREAM ELEVATION(FEET) =  325.00
  STREET LENGTH(FEET) =  1080.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.05
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.84
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.81
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.91
  STREET FLOW TRAVEL TIME(MIN.) =   6.41   Tc(MIN.) =    9.16
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.011
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.851
  SUBAREA AREA(ACRES) =    1.41      SUBAREA RUNOFF(CFS) =    4.81
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       5.19

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.28
  FLOW VELOCITY(FEET/SEC.) =  3.19   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
  LONGEST FLOWPATH FROM NODE    145.00 TO NODE    147.00 =    1160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    147.00 TO NODE    147.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.16
  RAINFALL INTENSITY(INCH/HR) =   4.01
  TOTAL STREAM AREA(ACRES) =     1.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.19

  ** CONFLUENCE DATA **
```

```
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       27.27     8.58        4.184          8.36
      2        5.19     9.16        4.011          1.52

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       32.13     8.58       4.184
      2       31.34     9.16       4.011

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      32.13   Tc(MIN.) =    8.58
  TOTAL AREA(ACRES) =        9.9
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    147.00 =    1284.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    147.00 TO NODE    150.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   322.00  DOWNSTREAM(FEET) =   311.00
  FLOW LENGTH(FEET) =   421.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.54
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.13
  PIPE TRAVEL TIME(MIN.) =   0.56    Tc(MIN.) =    9.14
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    150.00 =    1705.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.14
  RAINFALL INTENSITY(INCH/HR) =   4.02
  TOTAL STREAM AREA(ACRES) =     9.88
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     32.13

****************************************************************************
  FLOW PROCESS FROM NODE    148.00 TO NODE    149.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    329.60
  DOWNSTREAM ELEVATION(FEET) =    328.00
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.11
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      1.11

****************************************************************************
  FLOW PROCESS FROM NODE    149.00 TO NODE    150.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  328.00  DOWNSTREAM ELEVATION(FEET) =  314.00
  STREET LENGTH(FEET) =   542.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.75
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.19
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.91
  STREET FLOW TRAVEL TIME(MIN.) =   2.83   Tc(MIN.) =    7.31
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.641
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.07      SUBAREA RUNOFF(CFS) =    7.21
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       8.08

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.03
  FLOW VELOCITY(FEET/SEC.) =  3.59   DEPTH*VELOCITY(FT*FT/SEC.) =   1.17
  LONGEST FLOWPATH FROM NODE    148.00 TO NODE    150.00 =     622.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.31
  RAINFALL INTENSITY(INCH/HR) =   4.64
  TOTAL STREAM AREA(ACRES) =     2.32
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.08

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       32.13     9.14        4.017          9.88
      2        8.08     7.31        4.641          2.32

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       35.89     7.31       4.641
      2       39.12     9.14       4.017

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      39.12   Tc(MIN.) =    9.14
  TOTAL AREA(ACRES) =       12.2
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    150.00 =    1705.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    150.00 TO NODE    141.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   311.00  DOWNSTREAM(FEET) =   310.50
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.85
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      39.12
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    9.30
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    141.00 =    1780.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    141.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       39.12     9.30       3.973       12.20
  LONGEST FLOWPATH FROM NODE    141.00 TO NODE    141.00 =    1780.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      174.14     9.09       4.032       52.24
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    141.00 =    3463.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     212.38       9.09        4.032
      2     210.72       9.30        3.973

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     212.38   Tc(MIN.) =    9.09
  TOTAL AREA(ACRES) =       64.4

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    141.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    141.00 TO NODE    155.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   310.50  DOWNSTREAM(FEET) =   280.00
  FLOW LENGTH(FEET) =   938.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.01
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     212.38
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =    9.80
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    155.00 =    4401.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    155.00 TO NODE    155.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.80
  RAINFALL INTENSITY(INCH/HR) =   3.84
  TOTAL STREAM AREA(ACRES) =    64.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    212.38

****************************************************************************
  FLOW PROCESS FROM NODE    153.00 TO NODE    154.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    316.70
  DOWNSTREAM ELEVATION(FEET) =    314.00
  ELEVATION DIFFERENCE(FEET) =      2.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.144
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.93
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      0.93

******************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    155.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  314.00  DOWNSTREAM ELEVATION(FEET) =  283.00
  STREET LENGTH(FEET) =   929.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.04
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.96
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.25
  STREET FLOW TRAVEL TIME(MIN.) =   3.91   Tc(MIN.) =    8.05
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.360
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    4.26      SUBAREA RUNOFF(CFS) =   13.93
  TOTAL AREA(ACRES) =        4.5        PEAK FLOW RATE(CFS) =      14.62

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.16
  FLOW VELOCITY(FEET/SEC.) =  4.58   DEPTH*VELOCITY(FT*FT/SEC.) =   1.69
  LONGEST FLOWPATH FROM NODE    153.00 TO NODE    155.00 =    1019.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    155.00 TO NODE    155.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.05
  RAINFALL INTENSITY(INCH/HR) =   4.36
  TOTAL STREAM AREA(ACRES) =     4.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.62

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      212.38     9.80        3.841         64.44
      2       14.62     8.05        4.360          4.47
```

```
  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      189.07     8.05       4.360
      2      225.26     9.80       3.841

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     225.26   Tc(MIN.) =    9.80
  TOTAL AREA(ACRES) =       68.9
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    155.00 =    4401.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    155.00 TO NODE    156.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   280.00  DOWNSTREAM(FEET) =   279.00
  FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  39.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.14
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     225.26
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    9.84
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    156.00 =    4446.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    158.00 TO NODE    159.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    322.60
  DOWNSTREAM ELEVATION(FEET) =    321.00
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.84
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.84

****************************************************************************
  FLOW PROCESS FROM NODE    159.00 TO NODE    160.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  321.00  DOWNSTREAM ELEVATION(FEET) =  309.00
  STREET LENGTH(FEET) =   363.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.07
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.42
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
  STREET FLOW TRAVEL TIME(MIN.) =   1.77   Tc(MIN.) =    6.24
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.138
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.67      SUBAREA RUNOFF(CFS) =    6.44
  TOTAL AREA(ACRES) =        1.9        PEAK FLOW RATE(CFS) =       7.17

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   8.97
  FLOW VELOCITY(FEET/SEC.) =  3.89   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
  LONGEST FLOWPATH FROM NODE    158.00 TO NODE    160.00 =     443.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    161.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   306.00  DOWNSTREAM(FEET) =   301.00
  FLOW LENGTH(FEET) =   245.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.07
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.17
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =    6.75
  LONGEST FLOWPATH FROM NODE    158.00 TO NODE    161.00 =     688.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    161.00 TO NODE    161.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.75
  RAINFALL INTENSITY(INCH/HR) =   4.89
  TOTAL STREAM AREA(ACRES) =     1.86
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.17

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    164.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    322.60
  DOWNSTREAM ELEVATION(FEET) =    321.00
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.473
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.67
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.67

****************************************************************************
  FLOW PROCESS FROM NODE    164.00 TO NODE    165.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  321.00  DOWNSTREAM ELEVATION(FEET) =  304.00
```

```
  STREET LENGTH(FEET) =   902.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.89
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.59
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.86
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.85
  STREET FLOW TRAVEL TIME(MIN.) =   5.26   Tc(MIN.) =    9.74
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.857
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.84      SUBAREA RUNOFF(CFS) =    8.22
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =       8.65

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.03
  FLOW VELOCITY(FEET/SEC.) =  3.24   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    163.00 TO NODE    165.00 =     982.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    166.00 TO NODE    167.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.857
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7843
  SUBAREA AREA(ACRES) =    1.56   SUBAREA RUNOFF(CFS) =    5.11
  TOTAL AREA(ACRES) =        4.6   TOTAL RUNOFF(CFS) =      13.76
  TC(MIN.) =    9.74

****************************************************************************
  FLOW PROCESS FROM NODE    167.00 TO NODE    161.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   302.00  DOWNSTREAM(FEET) =   301.00
  FLOW LENGTH(FEET) =    59.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.81
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.76
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    9.85
  LONGEST FLOWPATH FROM NODE    163.00 TO NODE    161.00 =    1041.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    161.00 TO NODE    161.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.85
  RAINFALL INTENSITY(INCH/HR) =   3.83
  TOTAL STREAM AREA(ACRES) =     4.55
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.76
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        7.17     6.75        4.886          1.86
      2       13.76     9.85        3.829          4.55

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       16.60     6.75       4.886
      2       19.38     9.85       3.829

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      19.38   Tc(MIN.) =    9.85
  TOTAL AREA(ACRES) =        6.4
  LONGEST FLOWPATH FROM NODE    163.00 TO NODE    161.00 =    1041.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    161.00 TO NODE    170.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   301.00  DOWNSTREAM(FEET) =   279.50
  FLOW LENGTH(FEET) =   764.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.56
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.38
  PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =   10.95
  LONGEST FLOWPATH FROM NODE    163.00 TO NODE    170.00 =    1805.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.95
  RAINFALL INTENSITY(INCH/HR) =   3.58
  TOTAL STREAM AREA(ACRES) =     6.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.38

****************************************************************************
  FLOW PROCESS FROM NODE    168.00 TO NODE    169.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    310.50
  DOWNSTREAM ELEVATION(FEET) =    309.85
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    169.00 TO NODE    170.00 IS CODE =  61
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  309.85  DOWNSTREAM ELEVATION(FEET) =  280.00
  STREET LENGTH(FEET) =   951.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.42
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.78
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.92
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.26
  STREET FLOW TRAVEL TIME(MIN.) =   4.05   Tc(MIN.) =    9.12
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.022
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    5.12      SUBAREA RUNOFF(CFS) =   15.44
  TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =      15.81

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.72
  FLOW VELOCITY(FEET/SEC.) =  4.55   DEPTH*VELOCITY(FT*FT/SEC.) =   1.73
  LONGEST FLOWPATH FROM NODE    168.00 TO NODE    170.00 =    1016.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.12
  RAINFALL INTENSITY(INCH/HR) =   4.02
  TOTAL STREAM AREA(ACRES) =     5.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.81

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       19.38    10.95        3.576          6.41
      2       15.81     9.12        4.022          5.24

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       33.04     9.12       4.022
      2       33.43    10.95       3.576

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      33.43   Tc(MIN.) =   10.95
  TOTAL AREA(ACRES) =       11.6
  LONGEST FLOWPATH FROM NODE    163.00 TO NODE    170.00 =    1805.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    170.00 TO NODE    156.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   279.50  DOWNSTREAM(FEET) =   279.00
  FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  28.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.09
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      33.43
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =   11.67
  LONGEST FLOWPATH FROM NODE    163.00 TO NODE    156.00 =    2025.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       33.43    11.67       3.432       11.65
  LONGEST FLOWPATH FROM NODE    163.00 TO NODE    156.00 =    2025.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      225.26     9.84       3.831       68.91
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    156.00 =    4446.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     253.45       9.84        3.831
      2     235.22      11.67        3.432

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     253.45   Tc(MIN.) =    9.84
  TOTAL AREA(ACRES) =       80.6

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.84
  RAINFALL INTENSITY(INCH/HR) =   3.83
  TOTAL STREAM AREA(ACRES) =    80.56
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    253.45

****************************************************************************
  FLOW PROCESS FROM NODE    173.00 TO NODE    174.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    321.65
  DOWNSTREAM ELEVATION(FEET) =    321.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      1.19
  TOTAL AREA(ACRES) =      0.27   TOTAL RUNOFF(CFS) =      1.19

****************************************************************************
  FLOW PROCESS FROM NODE    174.00 TO NODE    175.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  321.00  DOWNSTREAM ELEVATION(FEET) =  290.00
  STREET LENGTH(FEET) =   862.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.89
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.16
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.30
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.42
  STREET FLOW TRAVEL TIME(MIN.) =   3.34   Tc(MIN.) =    8.42
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.236
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    5.39      SUBAREA RUNOFF(CFS) =   17.13
  TOTAL AREA(ACRES) =        5.7        PEAK FLOW RATE(CFS) =      17.98

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.03
  FLOW VELOCITY(FEET/SEC.) =  4.95   DEPTH*VELOCITY(FT*FT/SEC.) =   1.92
  LONGEST FLOWPATH FROM NODE    173.00 TO NODE    175.00 =     927.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    156.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   287.00  DOWNSTREAM(FEET) =   279.00
  FLOW LENGTH(FEET) =   241.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.71
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.98
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =    8.76
  LONGEST FLOWPATH FROM NODE    173.00 TO NODE    156.00 =    1168.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.76
  RAINFALL INTENSITY(INCH/HR) =   4.13
  TOTAL STREAM AREA(ACRES) =     5.66
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.98

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      253.45     9.84        3.831         80.56
      2       17.98     8.76        4.129          5.66

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      243.63     8.76       4.129
      2      270.13     9.84       3.831

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     270.13   Tc(MIN.) =    9.84
  TOTAL AREA(ACRES) =       86.2
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    156.00 =    4446.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   279.00  DOWNSTREAM(FEET) =   262.00
  FLOW LENGTH(FEET) =   417.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  38.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  24.96
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     270.13
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   10.12
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    180.00 =    4863.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.12
  RAINFALL INTENSITY(INCH/HR) =   3.76
  TOTAL STREAM AREA(ACRES) =    86.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    270.13

****************************************************************************
  FLOW PROCESS FROM NODE    178.00 TO NODE    179.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    277.90
  DOWNSTREAM ELEVATION(FEET) =    277.25
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.57
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.57

****************************************************************************
  FLOW PROCESS FROM NODE    179.00 TO NODE    180.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  277.25  DOWNSTREAM ELEVATION(FEET) =  265.00
  STREET LENGTH(FEET) =   355.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.10
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    5.94
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.29
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.81
  STREET FLOW TRAVEL TIME(MIN.) =   1.80   Tc(MIN.) =    6.88
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.826
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    5.03
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       5.50

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.92
  FLOW VELOCITY(FEET/SEC.) =  3.69   DEPTH*VELOCITY(FT*FT/SEC.) =   1.05
  LONGEST FLOWPATH FROM NODE    178.00 TO NODE    180.00 =     420.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    180.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.88
  RAINFALL INTENSITY(INCH/HR) =   4.83
  TOTAL STREAM AREA(ACRES) =     1.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.50

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      270.13    10.12        3.762        86.22
      2        5.50     6.88        4.826         1.52

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      216.09     6.88       4.826
      2      274.42    10.12       3.762

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     274.42   Tc(MIN.) =   10.12
  TOTAL AREA(ACRES) =       87.7
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    180.00 =    4863.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    185.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   262.00  DOWNSTREAM(FEET) =   249.00
  FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  28.41
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     274.42
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =   10.26
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    185.00 =    5103.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    185.00 TO NODE    185.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.26
  RAINFALL INTENSITY(INCH/HR) =   3.73
  TOTAL STREAM AREA(ACRES) =    87.74
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    274.42

****************************************************************************
  FLOW PROCESS FROM NODE    183.00 TO NODE    184.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    283.15
  DOWNSTREAM ELEVATION(FEET) =    282.50
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.84
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.84

****************************************************************************
  FLOW PROCESS FROM NODE    184.00 TO NODE    185.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  282.50  DOWNSTREAM ELEVATION(FEET) =  253.00
  STREET LENGTH(FEET) =   580.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.16
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.72
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.42
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.24
  STREET FLOW TRAVEL TIME(MIN.) =   2.19   Tc(MIN.) =    7.26
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.659
*USER SPECIFIED(SUBAREA):
USER-SPECIFIED RUNOFF COEFFICIENT = .7500
AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
SUBAREA AREA(ACRES) =    1.32      SUBAREA RUNOFF(CFS) =    4.61
TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       5.28

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.72
FLOW VELOCITY(FEET/SEC.) =  4.96   DEPTH*VELOCITY(FT*FT/SEC.) =   1.59
LONGEST FLOWPATH FROM NODE    183.00 TO NODE    185.00 =     645.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    185.00 TO NODE    185.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =    7.26
RAINFALL INTENSITY(INCH/HR) =   4.66
TOTAL STREAM AREA(ACRES) =     1.51
PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.28

** CONFLUENCE DATA **
STREAM     RUNOFF       Tc      INTENSITY      AREA
NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1      274.42    10.26        3.729         87.74
    2        5.28     7.26        4.659          1.51

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1      224.93     7.26       4.659
    2      278.65    10.26       3.729

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     278.65   Tc(MIN.) =   10.26
TOTAL AREA(ACRES) =       89.2
LONGEST FLOWPATH FROM NODE    104.00 TO NODE    185.00 =    5103.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    185.00 TO NODE    186.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   249.00  DOWNSTREAM(FEET) =   248.00
FLOW LENGTH(FEET) =    55.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  57.0 INCH PIPE IS  44.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  18.67
ESTIMATED PIPE DIAMETER(INCH) =  57.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     278.65
PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   10.31
LONGEST FLOWPATH FROM NODE    104.00 TO NODE    186.00 =    5158.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    186.00 TO NODE    186.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   10.31
RAINFALL INTENSITY(INCH/HR) =   3.72
TOTAL STREAM AREA(ACRES) =    89.25
PEAK FLOW RATE(CFS) AT CONFLUENCE =    278.65
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    188.00 TO NODE    189.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    291.65
  DOWNSTREAM ELEVATION(FEET) =    291.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.62
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.62

****************************************************************************
  FLOW PROCESS FROM NODE    189.00 TO NODE    190.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  291.60  DOWNSTREAM ELEVATION(FEET) =  261.00
  STREET LENGTH(FEET) =   746.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.90
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    8.97
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.28
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.31
  STREET FLOW TRAVEL TIME(MIN.) =   2.90   Tc(MIN.) =    7.98
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.384
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    4.37      SUBAREA RUNOFF(CFS) =   14.37
  TOTAL AREA(ACRES) =        4.5        PEAK FLOW RATE(CFS) =      14.83

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.72
  FLOW VELOCITY(FEET/SEC.) =  4.97   DEPTH*VELOCITY(FT*FT/SEC.) =   1.79
  LONGEST FLOWPATH FROM NODE    188.00 TO NODE    190.00 =     811.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    190.00 TO NODE    186.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   258.00  DOWNSTREAM(FEET) =   248.00
  FLOW LENGTH(FEET) =   244.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.48
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.83
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =    8.31
  LONGEST FLOWPATH FROM NODE    188.00 TO NODE    186.00 =    1055.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    186.00 TO NODE    186.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.31
  RAINFALL INTENSITY(INCH/HR) =   4.27
  TOTAL STREAM AREA(ACRES) =     4.51
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.83

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      278.65    10.31        3.718         89.25
      2       14.83     8.31        4.272          4.51

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      257.29     8.31       4.272
      2      291.55    10.31       3.718

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     291.55   Tc(MIN.) =   10.31
  TOTAL AREA(ACRES) =       93.8
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    186.00 =    5158.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    186.00 TO NODE    195.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   248.00  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =    76.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  63.0 INCH PIPE IS  46.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.88
  ESTIMATED PIPE DIAMETER(INCH) =  63.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     291.55
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   10.38
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    195.00 =    5234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.38
  RAINFALL INTENSITY(INCH/HR) =   3.70
  TOTAL STREAM AREA(ACRES) =    93.76
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    291.55

****************************************************************************
  FLOW PROCESS FROM NODE    193.00 TO NODE    194.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    262.65
  DOWNSTREAM ELEVATION(FEET) =    262.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
```

```
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.57
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.57

****************************************************************************
  FLOW PROCESS FROM NODE    194.00 TO NODE    195.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  262.00  DOWNSTREAM ELEVATION(FEET) =  250.50
  STREET LENGTH(FEET) =   364.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.00
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    5.99
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.15
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.77
  STREET FLOW TRAVEL TIME(MIN.) =   1.93   Tc(MIN.) =    7.01
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.768
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.35      SUBAREA RUNOFF(CFS) =    4.83
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       5.29

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.92
  FLOW VELOCITY(FEET/SEC.) =  3.55   DEPTH*VELOCITY(FT*FT/SEC.) =   1.01
  LONGEST FLOWPATH FROM NODE    193.00 TO NODE    195.00 =     429.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.01
  RAINFALL INTENSITY(INCH/HR) =   4.77
  TOTAL STREAM AREA(ACRES) =     1.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.29

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      291.55    10.38        3.700         93.76
      2        5.29     7.01        4.768          1.48

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
```

```
     1      231.54     7.01       4.768
     2      295.66    10.38       3.700

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     295.66   Tc(MIN.) =   10.38
  TOTAL AREA(ACRES) =       95.2
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    195.00 =    5234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    200.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.00  DOWNSTREAM(FEET) =   237.00
  FLOW LENGTH(FEET) =   390.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  43.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.41
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     295.66
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =   10.69
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    200.00 =    5624.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.69
  RAINFALL INTENSITY(INCH/HR) =   3.63
  TOTAL STREAM AREA(ACRES) =    95.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    295.66

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    199.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    95.00
  UPSTREAM ELEVATION(FEET) =    257.95
  DOWNSTREAM ELEVATION(FEET) =    253.20
  ELEVATION DIFFERENCE(FEET) =      4.75
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.360
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.24

****************************************************************************
  FLOW PROCESS FROM NODE    199.00 TO NODE    200.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  253.20  DOWNSTREAM ELEVATION(FEET) =  238.25
  STREET LENGTH(FEET) =   481.60   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.51
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.09
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.56
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.03
  STREET FLOW TRAVEL TIME(MIN.) =   2.25   Tc(MIN.) =    4.61
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.763
  SUBAREA AREA(ACRES) =    1.92      SUBAREA RUNOFF(CFS) =    8.54
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =       9.77

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.41
  FLOW VELOCITY(FEET/SEC.) =  4.07   DEPTH*VELOCITY(FT*FT/SEC.) =   1.36
  LONGEST FLOWPATH FROM NODE    198.00 TO NODE    200.00 =     576.60 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    200.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.61
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     2.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.77

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      295.66    10.69        3.632         95.24
      2        9.77     4.61        5.928          2.16

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      190.91     4.61       5.928
      2      301.64    10.69       3.632

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     301.64   Tc(MIN.) =   10.69
  TOTAL AREA(ACRES) =       97.4
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    200.00 =    5624.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   237.00  DOWNSTREAM(FEET) =   233.50
  FLOW LENGTH(FEET) =   102.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  39.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  24.49
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     301.64
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   10.76
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    201.00 =    5726.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.76
  RAINFALL INTENSITY(INCH/HR) =   3.62
  TOTAL STREAM AREA(ACRES) =    97.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    301.64

******************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    263.20
  DOWNSTREAM ELEVATION(FEET) =    261.00
  ELEVATION DIFFERENCE(FEET) =      2.20
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.035
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    74.44
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.28   TOTAL RUNOFF(CFS) =      1.24

******************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  260.00  DOWNSTREAM ELEVATION(FEET) =  237.00
  STREET LENGTH(FEET) =   515.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.96
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.72
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.17
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.17
  STREET FLOW TRAVEL TIME(MIN.) =   2.06   Tc(MIN.) =    6.09
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.219
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.40      SUBAREA RUNOFF(CFS) =    9.39
  TOTAL AREA(ACRES) =        2.7        PEAK FLOW RATE(CFS) =      10.49

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =   9.97
  FLOW VELOCITY(FEET/SEC.) =  4.72   DEPTH*VELOCITY(FT*FT/SEC.) =   1.54
  LONGEST FLOWPATH FROM NODE    203.00 TO NODE    205.00 =     605.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    201.00 IS CODE =  31
------------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   234.00  DOWNSTREAM(FEET) =   233.50
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.28
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.49
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    6.25
  LONGEST FLOWPATH FROM NODE    203.00 TO NODE    201.00 =     665.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.25
  RAINFALL INTENSITY(INCH/HR) =   5.13
  TOTAL STREAM AREA(ACRES) =     2.68
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.49

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      301.64    10.76        3.617         97.40
      2       10.49     6.25        5.133          2.68

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      223.04     6.25       5.133
      2      309.04    10.76       3.617

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     309.04   Tc(MIN.) =   10.76
  TOTAL AREA(ACRES) =      100.1
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    201.00 =    5726.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    210.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   233.50  DOWNSTREAM(FEET) =   224.50
  FLOW LENGTH(FEET) =   311.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  54.0 INCH PIPE IS  43.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.74
  ESTIMATED PIPE DIAMETER(INCH) =  54.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     309.04
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   10.98
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    210.00 =    6037.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.98
  RAINFALL INTENSITY(INCH/HR) =   3.57
  TOTAL STREAM AREA(ACRES) =   100.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    309.04
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    209.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    240.65
  DOWNSTREAM ELEVATION(FEET) =    240.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.57
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.57

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    210.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  240.00  DOWNSTREAM ELEVATION(FEET) =  227.40
  STREET LENGTH(FEET) =   315.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.89
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.21
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.83
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.04
  STREET FLOW TRAVEL TIME(MIN.) =   1.37   Tc(MIN.) =    6.45
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.031
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.28      SUBAREA RUNOFF(CFS) =    8.60
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       9.09

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.59
  FLOW VELOCITY(FEET/SEC.) =  4.38   DEPTH*VELOCITY(FT*FT/SEC.) =   1.39
  LONGEST FLOWPATH FROM NODE    208.00 TO NODE    210.00 =     380.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.45
  RAINFALL INTENSITY(INCH/HR) =   5.03
  TOTAL STREAM AREA(ACRES) =     2.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.09
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      309.04    10.98        3.568        100.08
      2        9.09     6.45        5.031          2.41

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      228.30     6.45       5.031
      2      315.49    10.98       3.568

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     315.49   Tc(MIN.) =   10.98
  TOTAL AREA(ACRES) =      102.5
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    210.00 =    6037.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    362.50
  DOWNSTREAM ELEVATION(FEET) =    361.00
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.586
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.52
  TOTAL AREA(ACRES) =      0.32   TOTAL RUNOFF(CFS) =      1.52

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  361.00  DOWNSTREAM ELEVATION(FEET) =  347.50
  STREET LENGTH(FEET) =   820.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.88
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.63
```

```
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.81
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
  STREET FLOW TRAVEL TIME(MIN.) =   4.87   Tc(MIN.) =    8.45
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.225
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.755
  SUBAREA AREA(ACRES) =    2.68      SUBAREA RUNOFF(CFS) =    8.49
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =       9.57

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.84
  FLOW VELOCITY(FEET/SEC.) =  3.15   DEPTH*VELOCITY(FT*FT/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    305.00 =     895.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    310.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   343.50  DOWNSTREAM(FEET) =   334.00
  FLOW LENGTH(FEET) =   475.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.57
  PIPE TRAVEL TIME(MIN.) =   0.92    Tc(MIN.) =    9.38
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    310.00 =    1370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    310.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.38
  RAINFALL INTENSITY(INCH/HR) =   3.95
  TOTAL STREAM AREA(ACRES) =     3.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.57

****************************************************************************
  FLOW PROCESS FROM NODE    308.00 TO NODE    309.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    346.50
  DOWNSTREAM ELEVATION(FEET) =    345.00
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.184
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.33
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.33

****************************************************************************
  FLOW PROCESS FROM NODE    309.00 TO NODE    310.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  345.00  DOWNSTREAM ELEVATION(FEET) =  338.00
  STREET LENGTH(FEET) =   358.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.31
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.70
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
  STREET FLOW TRAVEL TIME(MIN.) =   2.21   Tc(MIN.) =    6.39
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.060
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.15      SUBAREA RUNOFF(CFS) =    4.36
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       5.50

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   8.97
  FLOW VELOCITY(FEET/SEC.) =  2.98   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    308.00 TO NODE    310.00 =     433.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    310.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.39
  RAINFALL INTENSITY(INCH/HR) =   5.06
  TOTAL STREAM AREA(ACRES) =     1.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.50

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        9.57     9.38        3.951          3.00
      2        5.50     6.39        5.060          1.45

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       12.03     6.39       5.060
      2       13.87     9.38       3.951

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.87   Tc(MIN.) =    9.38
  TOTAL AREA(ACRES) =        4.4
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    310.00 =    1370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    310.00 TO NODE    315.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   334.00  DOWNSTREAM(FEET) =   313.50
  FLOW LENGTH(FEET) =   496.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.35
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.87
  PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =   10.05
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    315.00 =    1866.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.05
  RAINFALL INTENSITY(INCH/HR) =   3.78
  TOTAL STREAM AREA(ACRES) =     4.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.87

****************************************************************************
  FLOW PROCESS FROM NODE    313.00 TO NODE    314.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    360.50
  DOWNSTREAM ELEVATION(FEET) =    355.50
  ELEVATION DIFFERENCE(FEET) =      5.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.297
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    90.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.17
  TOTAL AREA(ACRES) =      0.42   TOTAL RUNOFF(CFS) =      2.17

****************************************************************************
  FLOW PROCESS FROM NODE    314.00 TO NODE    315.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  355.50  DOWNSTREAM ELEVATION(FEET) =  316.50
  STREET LENGTH(FEET) =   754.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.64
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.37
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.67
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.37
  STREET FLOW TRAVEL TIME(MIN.) =   2.69   Tc(MIN.) =    4.99
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8000
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.811
```

```
  SUBAREA AREA(ACRES) =    2.31      SUBAREA RUNOFF(CFS) =   10.96
  TOTAL AREA(ACRES) =        2.7        PEAK FLOW RATE(CFS) =      13.12

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.59
  FLOW VELOCITY(FEET/SEC.) =  5.30   DEPTH*VELOCITY(FT*FT/SEC.) =   1.79
  LONGEST FLOWPATH FROM NODE    313.00 TO NODE    315.00 =     854.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.99
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     2.73
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.12

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       13.87    10.05        3.779          4.45
      2       13.12     4.99        5.928          2.73

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       21.96     4.99       5.928
      2       22.24    10.05       3.779

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      22.24   Tc(MIN.) =   10.05
  TOTAL AREA(ACRES) =        7.2
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    315.00 =    1866.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    316.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   313.50  DOWNSTREAM(FEET) =   305.83
  FLOW LENGTH(FEET) =   438.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.01
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.24
  PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =   10.78
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    316.00 =    2304.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    316.00 TO NODE    316.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.78
  RAINFALL INTENSITY(INCH/HR) =   3.61
  TOTAL STREAM AREA(ACRES) =     7.18
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     22.24

****************************************************************************
  FLOW PROCESS FROM NODE    318.00 TO NODE    319.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    339.70
  DOWNSTREAM ELEVATION(FEET) =    338.00
  ELEVATION DIFFERENCE(FEET) =      1.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.223
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    80.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.737
  SUBAREA RUNOFF(CFS) =      0.22
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.22

******************************************************************************
  FLOW PROCESS FROM NODE    319.00 TO NODE    320.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    338.00  DOWNSTREAM(FEET) =    321.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   821.00   CHANNEL SLOPE =  0.0207
  CHANNEL BASE(FEET) =   15.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.889
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .3000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.50
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.73
  AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   5.02
  Tc(MIN.) =   15.24
  SUBAREA AREA(ACRES) =     7.47       SUBAREA RUNOFF(CFS) =    6.47
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        7.7         PEAK FLOW RATE(CFS) =       6.65

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.12   FLOW VELOCITY(FEET/SEC.) =   3.27
  LONGEST FLOWPATH FROM NODE    318.00 TO NODE    320.00 =     906.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    320.00 TO NODE    316.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   318.00  DOWNSTREAM(FEET) =   305.83
  FLOW LENGTH(FEET) =    82.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.28
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.65
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   15.32
  LONGEST FLOWPATH FROM NODE    318.00 TO NODE    316.00 =     988.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    316.00 TO NODE    316.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.32
  RAINFALL INTENSITY(INCH/HR) =   2.88
  TOTAL STREAM AREA(ACRES) =     7.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.65
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       22.24    10.78        3.612          7.18
      2        6.65    15.32        2.879          7.67

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       26.91    10.78       3.612
      2       24.37    15.32       2.879

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.91   Tc(MIN.) =   10.78
  TOTAL AREA(ACRES) =       14.8
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    316.00 =    2304.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    316.00 TO NODE    321.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   305.83  DOWNSTREAM(FEET) =   290.00
  FLOW LENGTH(FEET) =   358.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.75
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.91
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =   11.18
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    321.00 =    2662.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    321.00 TO NODE    321.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.18
  RAINFALL INTENSITY(INCH/HR) =   3.53
  TOTAL STREAM AREA(ACRES) =    14.85
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     26.91

****************************************************************************
  FLOW PROCESS FROM NODE    323.00 TO NODE    324.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    326.50
  DOWNSTREAM ELEVATION(FEET) =    325.00
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.093
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.96
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.96

****************************************************************************
  FLOW PROCESS FROM NODE    324.00 TO NODE    325.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   322.00  DOWNSTREAM(FEET) =   307.00
```

```
  FLOW LENGTH(FEET) =   800.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.43
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.96
  PIPE TRAVEL TIME(MIN.) =   3.01    Tc(MIN.) =    6.10
  LONGEST FLOWPATH FROM NODE    323.00 TO NODE    325.00 =     875.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    324.00 TO NODE    325.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.215
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    7.73   SUBAREA RUNOFF(CFS) =   34.26
  TOTAL AREA(ACRES) =        7.9   TOTAL RUNOFF(CFS) =      35.11
  TC(MIN.) =    6.10

****************************************************************************
  FLOW PROCESS FROM NODE    325.00 TO NODE    321.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   307.00  DOWNSTREAM(FEET) =   290.00
  FLOW LENGTH(FEET) =    95.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  26.69
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      35.11
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    6.16
  LONGEST FLOWPATH FROM NODE    323.00 TO NODE    321.00 =     970.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    321.00 TO NODE    321.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.16
  RAINFALL INTENSITY(INCH/HR) =   5.18
  TOTAL STREAM AREA(ACRES) =     7.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     35.11

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       26.91    11.18        3.528         14.85
      2       35.11     6.16        5.182          7.92

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       53.42     6.16       5.182
      2       50.81    11.18       3.528

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      53.42   Tc(MIN.) =    6.16
  TOTAL AREA(ACRES) =       22.8
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    321.00 =    2662.00 FEET.

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    321.00 TO NODE    330.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   290.00  DOWNSTREAM(FEET) =   289.00
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.07
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.42
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    6.27
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    330.00 =    2737.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.27
  RAINFALL INTENSITY(INCH/HR) =   5.12
  TOTAL STREAM AREA(ACRES) =    22.77
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.42

****************************************************************************
  FLOW PROCESS FROM NODE    328.00 TO NODE    329.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    314.50
  DOWNSTREAM ELEVATION(FEET) =    313.00
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.749
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.52
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.52

****************************************************************************
  FLOW PROCESS FROM NODE    329.00 TO NODE    330.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  313.00  DOWNSTREAM ELEVATION(FEET) =  293.00
  STREET LENGTH(FEET) =   691.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.28
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.51
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.34
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.92
  STREET FLOW TRAVEL TIME(MIN.) =   3.45   Tc(MIN.) =    6.20
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.161
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    0.78      SUBAREA RUNOFF(CFS) =    3.50
  TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       3.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.70
  FLOW VELOCITY(FEET/SEC.) =  3.73   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
  LONGEST FLOWPATH FROM NODE    328.00 TO NODE    330.00 =     766.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    330.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.20
  RAINFALL INTENSITY(INCH/HR) =   5.16
  TOTAL STREAM AREA(ACRES) =     0.88
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.95

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       53.42     6.27        5.122         22.77
      2        3.95     6.20        5.161          0.88

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       56.97     6.20       5.161
      2       57.34     6.27       5.122

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      57.34   Tc(MIN.) =    6.27
  TOTAL AREA(ACRES) =       23.6
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    330.00 =    2737.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    330.00 TO NODE    331.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   289.00  DOWNSTREAM(FEET) =   288.00
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.14
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      57.34
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    6.39
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    331.00 =    2817.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    331.00 TO NODE    331.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.39
  RAINFALL INTENSITY(INCH/HR) =   5.06
```

```
  TOTAL STREAM AREA(ACRES) =    23.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     57.34

****************************************************************************
  FLOW PROCESS FROM NODE    333.00 TO NODE    334.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    330.00
  DOWNSTREAM ELEVATION(FEET) =    327.45
  ELEVATION DIFFERENCE(FEET) =      2.55
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.384
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.98
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.98

****************************************************************************
  FLOW PROCESS FROM NODE    334.00 TO NODE    335.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  327.45  DOWNSTREAM ELEVATION(FEET) =  295.00
  STREET LENGTH(FEET) =   960.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.31
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.44
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.80
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.12
  STREET FLOW TRAVEL TIME(MIN.) =   4.21   Tc(MIN.) =    6.60
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.957
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.758
  SUBAREA AREA(ACRES) =    2.80      SUBAREA RUNOFF(CFS) =   10.41
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =      11.23

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.90
  FLOW VELOCITY(FEET/SEC.) =  4.30   DEPTH*VELOCITY(FT*FT/SEC.) =   1.48
  LONGEST FLOWPATH FROM NODE    333.00 TO NODE    335.00 =    1035.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    335.00 TO NODE    331.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   288.00  DOWNSTREAM(FEET) =   287.00
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.48
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.23
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    6.78
```

```
  LONGEST FLOWPATH FROM NODE    333.00 TO NODE    331.00 =    1115.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    331.00 TO NODE    331.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.78
  RAINFALL INTENSITY(INCH/HR) =   4.87
  TOTAL STREAM AREA(ACRES) =     2.99
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.23

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       57.34     6.39        5.060         23.65
      2       11.23     6.78        4.872          2.99

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       67.93     6.39       5.060
      2       66.45     6.78       4.872

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      67.93   Tc(MIN.) =    6.39
  TOTAL AREA(ACRES) =       26.6
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    331.00 =    2817.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    331.00 TO NODE    340.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   287.00  DOWNSTREAM(FEET) =   264.00
  FLOW LENGTH(FEET) =   651.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.92
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      67.93
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =    7.03
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    340.00 =    3468.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.03
  RAINFALL INTENSITY(INCH/HR) =   4.76
  TOTAL STREAM AREA(ACRES) =    26.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     67.93

****************************************************************************
  FLOW PROCESS FROM NODE    338.00 TO NODE    339.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    293.80
```

```
  DOWNSTREAM ELEVATION(FEET) =    293.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.88
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE    339.00 TO NODE    340.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  293.15  DOWNSTREAM ELEVATION(FEET) =  267.00
  STREET LENGTH(FEET) =   571.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.08
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.38
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.89
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
  STREET FLOW TRAVEL TIME(MIN.) =   2.45   Tc(MIN.) =    7.53
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.553
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.86      SUBAREA RUNOFF(CFS) =    6.35
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       7.03

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.31
  FLOW VELOCITY(FEET/SEC.) =  4.35   DEPTH*VELOCITY(FT*FT/SEC.) =   1.27
  LONGEST FLOWPATH FROM NODE    338.00 TO NODE    340.00 =     636.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    340.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.53
  RAINFALL INTENSITY(INCH/HR) =   4.55
  TOTAL STREAM AREA(ACRES) =     2.06
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.03

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       67.93     7.03        4.757         26.64
      2        7.03     7.53        4.553          2.06

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       74.51     7.03       4.757
      2       72.05     7.53       4.553

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      74.51   Tc(MIN.) =    7.03
  TOTAL AREA(ACRES) =       28.7
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    340.00 =    3468.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    340.00 TO NODE    345.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   364.00  DOWNSTREAM(FEET) =   227.00
  FLOW LENGTH(FEET) =   795.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  31.75
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      74.51
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =    7.45
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    345.00 =    4263.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    345.00 TO NODE    345.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.45
  RAINFALL INTENSITY(INCH/HR) =   4.58
  TOTAL STREAM AREA(ACRES) =    28.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     74.51

****************************************************************************
  FLOW PROCESS FROM NODE    343.00 TO NODE    344.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    266.05
  DOWNSTREAM ELEVATION(FEET) =    265.40
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      1.58
  TOTAL AREA(ACRES) =      0.36   TOTAL RUNOFF(CFS) =      1.58

****************************************************************************
  FLOW PROCESS FROM NODE    344.00 TO NODE    345.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  265.40  DOWNSTREAM ELEVATION(FEET) =  230.00
  STREET LENGTH(FEET) =   677.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.18
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.63
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.34
  STREET FLOW TRAVEL TIME(MIN.) =   2.44   Tc(MIN.) =    7.52
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.557
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    3.25      SUBAREA RUNOFF(CFS) =   11.11
  TOTAL AREA(ACRES) =        3.6        PEAK FLOW RATE(CFS) =      12.34

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.35
  FLOW VELOCITY(FEET/SEC.) =  5.19   DEPTH*VELOCITY(FT*FT/SEC.) =   1.73
  LONGEST FLOWPATH FROM NODE    343.00 TO NODE    345.00 =     742.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    345.00 TO NODE    345.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.52
  RAINFALL INTENSITY(INCH/HR) =   4.56
  TOTAL STREAM AREA(ACRES) =     3.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.34

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       74.51     7.45        4.584         28.70
      2       12.34     7.52        4.557          3.61

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       86.74     7.45       4.584
      2       86.42     7.52       4.557

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      86.74   Tc(MIN.) =    7.45
  TOTAL AREA(ACRES) =       32.3
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    345.00 =    4263.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    345.00 TO NODE    346.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   227.00  DOWNSTREAM(FEET) =   226.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.70
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      86.74
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    7.52
```

```
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    346.00 =    4323.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    346.00 TO NODE    346.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    348.00 TO NODE    349.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    290.50
  DOWNSTREAM ELEVATION(FEET) =    286.00
  ELEVATION DIFFERENCE(FEET) =      4.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.297
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.96
  TOTAL AREA(ACRES) =      0.38   TOTAL RUNOFF(CFS) =      1.96

****************************************************************************
  FLOW PROCESS FROM NODE    349.00 TO NODE    350.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  286.00  DOWNSTREAM ELEVATION(FEET) =  280.00
  STREET LENGTH(FEET) =   296.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.45
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.87
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.83
  STREET FLOW TRAVEL TIME(MIN.) =   1.72   Tc(MIN.) =    4.02
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.780
  SUBAREA AREA(ACRES) =    1.12      SUBAREA RUNOFF(CFS) =    4.98
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       6.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.90
  FLOW VELOCITY(FEET/SEC.) =  3.16   DEPTH*VELOCITY(FT*FT/SEC.) =   1.02
  LONGEST FLOWPATH FROM NODE    348.00 TO NODE    350.00 =     386.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    350.00 TO NODE    351.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   277.00  DOWNSTREAM(FEET) =   276.00
```

```
  FLOW LENGTH(FEET) =    71.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.94
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    4.19
  LONGEST FLOWPATH FROM NODE    348.00 TO NODE    351.00 =     457.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    351.00 TO NODE    351.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.19
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     1.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.94

****************************************************************************
  FLOW PROCESS FROM NODE    353.00 TO NODE    354.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    316.20
  DOWNSTREAM ELEVATION(FEET) =    311.70
  ELEVATION DIFFERENCE(FEET) =      4.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.495
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.38
  TOTAL AREA(ACRES) =      0.31   TOTAL RUNOFF(CFS) =      1.38

****************************************************************************
  FLOW PROCESS FROM NODE    354.00 TO NODE    355.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  311.70  DOWNSTREAM ELEVATION(FEET) =  282.50
  STREET LENGTH(FEET) =   560.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.64
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.37
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.67
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.37
  STREET FLOW TRAVEL TIME(MIN.) =   2.00   Tc(MIN.) =    5.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.577
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.99      SUBAREA RUNOFF(CFS) =   12.51
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =      13.80
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.82
  FLOW VELOCITY(FEET/SEC.) =  5.35   DEPTH*VELOCITY(FT*FT/SEC.) =   1.83
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    355.00 =     650.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    351.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   277.00  DOWNSTREAM(FEET) =   276.00
  FLOW LENGTH(FEET) =    94.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.29
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.80
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    5.71
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    351.00 =     744.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    351.00 TO NODE    351.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.71
  RAINFALL INTENSITY(INCH/HR) =   5.44
  TOTAL STREAM AREA(ACRES) =     3.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.80

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.94     4.19        5.928          1.50
      2       13.80     5.71        5.441          3.30

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.06     4.19       5.928
      2       20.17     5.71       5.441

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.17   Tc(MIN.) =    5.71
  TOTAL AREA(ACRES) =        4.8
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    351.00 =     744.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    351.00 TO NODE    356.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   276.00  DOWNSTREAM(FEET) =   272.00
  FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.47
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.17
  PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =    6.15
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    356.00 =     994.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    356.00 TO NODE    356.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.15
  RAINFALL INTENSITY(INCH/HR) =   5.19
  TOTAL STREAM AREA(ACRES) =     4.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     20.17

******************************************************************************
  FLOW PROCESS FROM NODE    358.00 TO NODE    359.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    313.20
  DOWNSTREAM ELEVATION(FEET) =    312.55
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.97
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      0.97

******************************************************************************
  FLOW PROCESS FROM NODE    359.00 TO NODE    360.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  312.55  DOWNSTREAM ELEVATION(FEET) =  278.00
  STREET LENGTH(FEET) =   773.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.99
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.71
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.20
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.18
  STREET FLOW TRAVEL TIME(MIN.) =   3.07   Tc(MIN.) =    8.14
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.328
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    3.06      SUBAREA RUNOFF(CFS) =    9.93
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =      10.65

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.04
  FLOW VELOCITY(FEET/SEC.) =  4.73   DEPTH*VELOCITY(FT*FT/SEC.) =   1.55
  LONGEST FLOWPATH FROM NODE    358.00 TO NODE    360.00 =     838.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    360.00 TO NODE    356.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   273.00  DOWNSTREAM(FEET) =   272.00
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.13
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.65
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    8.27
  LONGEST FLOWPATH FROM NODE    358.00 TO NODE    356.00 =     898.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    356.00 TO NODE    356.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.27
  RAINFALL INTENSITY(INCH/HR) =   4.29
  TOTAL STREAM AREA(ACRES) =     3.28
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.65

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       20.17     6.15        5.187          4.80
      2       10.65     8.27        4.286          3.28

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       28.09     6.15       5.187
      2       27.32     8.27       4.286

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      28.09   Tc(MIN.) =    6.15
  TOTAL AREA(ACRES) =        8.1
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    356.00 =     994.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    356.00 TO NODE    365.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   272.00  DOWNSTREAM(FEET) =   267.00
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.56
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      28.09
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =    6.34
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    365.00 =    1144.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    365.00 TO NODE    365.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.34
  RAINFALL INTENSITY(INCH/HR) =   5.09
  TOTAL STREAM AREA(ACRES) =     8.08
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     28.09

****************************************************************************
  FLOW PROCESS FROM NODE    363.00 TO NODE    364.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    280.80
  DOWNSTREAM ELEVATION(FEET) =    280.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.66
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.66

******************************************************************************
  FLOW PROCESS FROM NODE    364.00 TO NODE    365.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  280.15  DOWNSTREAM ELEVATION(FEET) =  271.80
  STREET LENGTH(FEET) =   325.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.49
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.31
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.88
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
  STREET FLOW TRAVEL TIME(MIN.) =   1.88   Tc(MIN.) =    6.96
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.789
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8000
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.787
  SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    1.65
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       2.19

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.58
  FLOW VELOCITY(FEET/SEC.) =  3.16   DEPTH*VELOCITY(FT*FT/SEC.) =   0.88
  LONGEST FLOWPATH FROM NODE    363.00 TO NODE    365.00 =     390.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    365.00 TO NODE    365.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.96
  RAINFALL INTENSITY(INCH/HR) =   4.79
  TOTAL STREAM AREA(ACRES) =     0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.19

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       28.09     6.34        5.089          8.08
```

```
      2        2.19     6.96        4.789          0.58

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       30.08     6.34       5.089
      2       28.62     6.96       4.789

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      30.08   Tc(MIN.) =    6.34
  TOTAL AREA(ACRES) =        8.7
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    365.00 =    1144.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    365.00 TO NODE    366.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   267.00  DOWNSTREAM(FEET) =   266.00
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.07
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      30.08
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    6.39
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    366.00 =    1185.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    366.00 TO NODE    366.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.39
  RAINFALL INTENSITY(INCH/HR) =   5.06
  TOTAL STREAM AREA(ACRES) =     8.66
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     30.08

****************************************************************************
  FLOW PROCESS FROM NODE    368.00 TO NODE    369.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    305.85
  DOWNSTREAM ELEVATION(FEET) =    305.20
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.88
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE    369.00 TO NODE    370.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  305.20  DOWNSTREAM ELEVATION(FEET) =  278.50
  STREET LENGTH(FEET) =   400.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.45
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.05
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.60
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.14
  STREET FLOW TRAVEL TIME(MIN.) =   1.45   Tc(MIN.) =    6.53
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.991
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    7.11
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       7.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   7.97
  FLOW VELOCITY(FEET/SEC.) =  5.21   DEPTH*VELOCITY(FT*FT/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE    368.00 TO NODE    370.00 =     465.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    370.00 TO NODE    366.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   275.00  DOWNSTREAM(FEET) =   266.00
  FLOW LENGTH(FEET) =   214.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.81
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.86
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =    6.86
  LONGEST FLOWPATH FROM NODE    368.00 TO NODE    366.00 =     679.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    366.00 TO NODE    366.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.86
  RAINFALL INTENSITY(INCH/HR) =   4.83
  TOTAL STREAM AREA(ACRES) =     2.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.86

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       30.08     6.39        5.060          8.66
      2        7.86     6.86        4.835          2.10

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
```

```
      1       37.41     6.39       5.060
      2       36.61     6.86       4.835

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      37.41   Tc(MIN.) =    6.39
  TOTAL AREA(ACRES) =       10.8
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    366.00 =    1185.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    366.00 TO NODE    371.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   266.00  DOWNSTREAM(FEET) =   260.00
  FLOW LENGTH(FEET) =   388.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.88
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      37.41
  PIPE TRAVEL TIME(MIN.) =   0.59    Tc(MIN.) =    6.99
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    371.00 =    1573.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    371.00 TO NODE    371.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    373.00 TO NODE    374.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    300.05
  DOWNSTREAM ELEVATION(FEET) =    299.40
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.88
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.88

****************************************************************************
  FLOW PROCESS FROM NODE    374.00 TO NODE    375.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  299.40  DOWNSTREAM ELEVATION(FEET) =  270.50
  STREET LENGTH(FEET) =   580.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.69
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
```

```
    HALFSTREET FLOOD WIDTH(FEET) =    7.38
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.29
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.18
  STREET FLOW TRAVEL TIME(MIN.) =   2.25   Tc(MIN.) =    7.33
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.632
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.74      SUBAREA RUNOFF(CFS) =    9.52
  TOTAL AREA(ACRES) =        2.9        PEAK FLOW RATE(CFS) =      10.21

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.63
  FLOW VELOCITY(FEET/SEC.) =  4.88   DEPTH*VELOCITY(FT*FT/SEC.) =   1.56
  LONGEST FLOWPATH FROM NODE    373.00 TO NODE    375.00 =     645.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    375.00 TO NODE    376.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   268.00  DOWNSTREAM(FEET) =   267.00
  FLOW LENGTH(FEET) =   163.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.51
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.21
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =    7.82
  LONGEST FLOWPATH FROM NODE    373.00 TO NODE    376.00 =     808.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    376.00 TO NODE    376.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.82
  RAINFALL INTENSITY(INCH/HR) =   4.44
  TOTAL STREAM AREA(ACRES) =     2.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.21

****************************************************************************
  FLOW PROCESS FROM NODE    378.00 TO NODE    379.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    278.00
  DOWNSTREAM ELEVATION(FEET) =    277.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.45
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
  FLOW PROCESS FROM NODE    379.00 TO NODE    380.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   276.00  DOWNSTREAM(FEET) =   275.00
```

```
  FLOW LENGTH(FEET) =   206.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.45
  PIPE TRAVEL TIME(MIN.) =   1.55    Tc(MIN.) =    5.03
  LONGEST FLOWPATH FROM NODE    378.00 TO NODE    380.00 =     271.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    379.00 TO NODE    380.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.903
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    0.73   SUBAREA RUNOFF(CFS) =    3.66
  TOTAL AREA(ACRES) =        0.8   TOTAL RUNOFF(CFS) =       4.11
  TC(MIN.) =    5.03

****************************************************************************
  FLOW PROCESS FROM NODE    380.00 TO NODE    376.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   275.00  DOWNSTREAM(FEET) =   267.00
  FLOW LENGTH(FEET) =    55.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.07
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.11
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    5.10
  LONGEST FLOWPATH FROM NODE    378.00 TO NODE    376.00 =     326.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    376.00 TO NODE    376.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.10
  RAINFALL INTENSITY(INCH/HR) =   5.85
  TOTAL STREAM AREA(ACRES) =     0.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.11

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.21     7.82        4.441          2.94
      2        4.11     5.10        5.855          0.82

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       10.77     5.10       5.855
      2       13.33     7.82       4.441

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.33   Tc(MIN.) =    7.82
  TOTAL AREA(ACRES) =        3.8
  LONGEST FLOWPATH FROM NODE    373.00 TO NODE    376.00 =     808.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    376.00 TO NODE    371.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   267.00  DOWNSTREAM(FEET) =   260.00
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.09
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.33
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    7.89
  LONGEST FLOWPATH FROM NODE    373.00 TO NODE    371.00 =     878.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    371.00 TO NODE    371.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       13.33     7.89       4.416        3.76
  LONGEST FLOWPATH FROM NODE    373.00 TO NODE    371.00 =     878.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       37.41     6.99       4.778       10.76
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    371.00 =    1573.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      49.21       6.99        4.778
      2      47.91       7.89        4.416

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      49.21   Tc(MIN.) =    6.99
  TOTAL AREA(ACRES) =       14.5

****************************************************************************
  FLOW PROCESS FROM NODE    371.00 TO NODE    371.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    371.00 TO NODE    385.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   260.00  DOWNSTREAM(FEET) =   233.00
  FLOW LENGTH(FEET) =   565.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.80
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      49.21
  PIPE TRAVEL TIME(MIN.) =   0.53    Tc(MIN.) =    7.52
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    385.00 =    2138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    385.00 TO NODE    385.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.52
  RAINFALL INTENSITY(INCH/HR) =   4.56
  TOTAL STREAM AREA(ACRES) =    14.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     49.21

****************************************************************************
  FLOW PROCESS FROM NODE    383.00 TO NODE    384.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    274.06
  DOWNSTREAM ELEVATION(FEET) =    270.46
  ELEVATION DIFFERENCE(FEET) =      3.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.091
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    85.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.64
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.64

****************************************************************************
  FLOW PROCESS FROM NODE    384.00 TO NODE    385.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  270.46  DOWNSTREAM ELEVATION(FEET) =  236.50
  STREET LENGTH(FEET) =   905.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.95
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.17
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.14
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.28
  STREET FLOW TRAVEL TIME(MIN.) =   3.64   Tc(MIN.) =    5.73
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.429
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.755
  SUBAREA AREA(ACRES) =    3.51      SUBAREA RUNOFF(CFS) =   14.29
  TOTAL AREA(ACRES) =        3.6        PEAK FLOW RATE(CFS) =      14.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.99
  FLOW VELOCITY(FEET/SEC.) =  4.78   DEPTH*VELOCITY(FT*FT/SEC.) =   1.75
  LONGEST FLOWPATH FROM NODE    383.00 TO NODE    385.00 =     995.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    385.00 TO NODE    385.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.73
  RAINFALL INTENSITY(INCH/HR) =   5.43
  TOTAL STREAM AREA(ACRES) =     3.63
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       49.21     7.52        4.558         14.52
      2       14.88     5.73        5.429          3.63

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       52.40     5.73       5.429
      2       61.70     7.52       4.558

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      61.70   Tc(MIN.) =    7.52
  TOTAL AREA(ACRES) =       18.1
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    385.00 =    2138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    385.00 TO NODE    386.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   233.00  DOWNSTREAM(FEET) =   232.00
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.59
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      61.70
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    7.62
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    386.00 =    2213.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    386.00 TO NODE    386.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    388.00 TO NODE    389.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    279.75
  DOWNSTREAM ELEVATION(FEET) =    276.15
  ELEVATION DIFFERENCE(FEET) =      3.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.091
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    85.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.01
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      1.01

****************************************************************************
  FLOW PROCESS FROM NODE    389.00 TO NODE    390.00 IS CODE =  61
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  276.15  DOWNSTREAM ELEVATION(FEET) =  250.00
  STREET LENGTH(FEET) =   727.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.24
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.90
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.21
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.36
  STREET FLOW TRAVEL TIME(MIN.) =   2.88   Tc(MIN.) =    4.97
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.757
  SUBAREA AREA(ACRES) =    3.70      SUBAREA RUNOFF(CFS) =   16.45
  TOTAL AREA(ACRES) =        3.9        PEAK FLOW RATE(CFS) =      17.46

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.85
  FLOW VELOCITY(FEET/SEC.) =  4.93   DEPTH*VELOCITY(FT*FT/SEC.) =   1.89
  LONGEST FLOWPATH FROM NODE    388.00 TO NODE    390.00 =     817.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    390.00 TO NODE    391.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.46
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    5.08
  LONGEST FLOWPATH FROM NODE    388.00 TO NODE    391.00 =     897.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    391.00 TO NODE    391.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.08
  RAINFALL INTENSITY(INCH/HR) =   5.87
  TOTAL STREAM AREA(ACRES) =     3.89
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.46

****************************************************************************
  FLOW PROCESS FROM NODE    393.00 TO NODE    394.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    280.80
  DOWNSTREAM ELEVATION(FEET) =    280.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.57
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.57

****************************************************************************
  FLOW PROCESS FROM NODE    394.00 TO NODE    395.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  280.15  DOWNSTREAM ELEVATION(FEET) =  249.00
  STREET LENGTH(FEET) =   857.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.65
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.80
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.08
  STREET FLOW TRAVEL TIME(MIN.) =   3.76   Tc(MIN.) =    8.84
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.106
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    3.24      SUBAREA RUNOFF(CFS) =    9.98
  TOTAL AREA(ACRES) =        3.4        PEAK FLOW RATE(CFS) =      10.38

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.35
  FLOW VELOCITY(FEET/SEC.) =  4.36   DEPTH*VELOCITY(FT*FT/SEC.) =   1.45
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    395.00 =     922.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    395.00 TO NODE    391.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   246.00  DOWNSTREAM(FEET) =   244.00
  FLOW LENGTH(FEET) =    89.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.13
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.38
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    9.00
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    391.00 =    1011.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    391.00 TO NODE    391.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.00
  RAINFALL INTENSITY(INCH/HR) =   4.06
  TOTAL STREAM AREA(ACRES) =     3.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.38

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       17.46     5.08        5.868          3.89
      2       10.38     9.00        4.058          3.37

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       23.32     5.08       5.868
      2       22.45     9.00       4.058

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      23.32   Tc(MIN.) =    5.08
  TOTAL AREA(ACRES) =        7.3
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    391.00 =    1011.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    391.00 TO NODE    396.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   244.00  DOWNSTREAM(FEET) =   238.00
  FLOW LENGTH(FEET) =   210.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.98
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.32
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    5.37
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    396.00 =    1221.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    396.00 TO NODE    396.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.37
  RAINFALL INTENSITY(INCH/HR) =   5.66
  TOTAL STREAM AREA(ACRES) =     7.26
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.32

****************************************************************************
  FLOW PROCESS FROM NODE    398.00 TO NODE    399.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    280.80
  DOWNSTREAM ELEVATION(FEET) =    280.15
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.44
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
  FLOW PROCESS FROM NODE    399.00 TO NODE    400.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  280.15  DOWNSTREAM ELEVATION(FEET) =  242.00
  STREET LENGTH(FEET) =   918.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.65
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.64
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.12
  STREET FLOW TRAVEL TIME(MIN.) =   3.80   Tc(MIN.) =    8.88
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.092
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    3.33      SUBAREA RUNOFF(CFS) =   10.22
  TOTAL AREA(ACRES) =        3.4        PEAK FLOW RATE(CFS) =      10.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.12
  FLOW VELOCITY(FEET/SEC.) =  4.61   DEPTH*VELOCITY(FT*FT/SEC.) =   1.51
  LONGEST FLOWPATH FROM NODE    398.00 TO NODE    400.00 =     983.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    396.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   239.00  DOWNSTREAM(FEET) =   238.00
  FLOW LENGTH(FEET) =    76.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.34
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.53
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    9.06
  LONGEST FLOWPATH FROM NODE    398.00 TO NODE    396.00 =    1059.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    396.00 TO NODE    396.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.06
  RAINFALL INTENSITY(INCH/HR) =   4.04
  TOTAL STREAM AREA(ACRES) =     3.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.53

  ** CONFLUENCE DATA **
```

```
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       23.32     5.37        5.660          7.26
      2       10.53     9.06        4.042          3.43

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       29.57     5.37       5.660
      2       27.18     9.06       4.042

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      29.57   Tc(MIN.) =    5.37
  TOTAL AREA(ACRES) =       10.7
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    396.00 =    1221.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    396.00 TO NODE    405.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   238.00  DOWNSTREAM(FEET) =   233.00
  FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.00
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      29.57
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    5.50
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    405.00 =    1333.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    405.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.50
  RAINFALL INTENSITY(INCH/HR) =   5.58
  TOTAL STREAM AREA(ACRES) =    10.69
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     29.57

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    250.40
  DOWNSTREAM ELEVATION(FEET) =    249.75
  ELEVATION DIFFERENCE(FEET) =      0.65
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.868
  SUBAREA RUNOFF(CFS) =      0.44
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    405.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
```

```
==============================================================================
  UPSTREAM ELEVATION(FEET) =  249.75  DOWNSTREAM ELEVATION(FEET) =  236.50
  STREET LENGTH(FEET) =   347.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.56
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.19
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.31
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.76
  STREET FLOW TRAVEL TIME(MIN.) =   1.75   Tc(MIN.) =    6.83
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.849
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.16      SUBAREA RUNOFF(CFS) =    4.22
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       4.58

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.04
  FLOW VELOCITY(FEET/SEC.) =  3.73   DEPTH*VELOCITY(FT*FT/SEC.) =   1.00
  LONGEST FLOWPATH FROM NODE    403.00 TO NODE    405.00 =     412.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    405.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.83
  RAINFALL INTENSITY(INCH/HR) =   4.85
  TOTAL STREAM AREA(ACRES) =     1.26
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.58

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       29.57     5.50        5.577         10.69
      2        4.58     6.83        4.849          1.26

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       33.26     5.50       5.577
      2       30.29     6.83       4.849

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      33.26   Tc(MIN.) =    5.50
  TOTAL AREA(ACRES) =       12.0
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    405.00 =    1333.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    386.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   233.00  DOWNSTREAM(FEET) =   232.00
  FLOW LENGTH(FEET) =   105.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.72
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      33.26
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    5.70
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    386.00 =    1438.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    386.00 TO NODE    386.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       33.26     5.70       5.450       11.95
  LONGEST FLOWPATH FROM NODE    393.00 TO NODE    386.00 =    1438.00 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       61.70     7.62       4.516       18.15
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    386.00 =    2213.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      79.37       5.70        5.450
      2      89.26       7.62        4.516

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      89.26   Tc(MIN.) =    7.62
  TOTAL AREA(ACRES) =       30.1

****************************************************************************
  FLOW PROCESS FROM NODE    386.00 TO NODE    386.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    386.00 TO NODE    346.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   232.00  DOWNSTREAM(FEET) =   226.00
  FLOW LENGTH(FEET) =   212.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.87
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      89.26
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =    7.83
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    346.00 =    2425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    346.00 TO NODE    346.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       89.26     7.83       4.438       30.10
  LONGEST FLOWPATH FROM NODE    353.00 TO NODE    346.00 =    2425.00 FEET.
```

```
  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       86.74     7.52       4.555       32.31
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    346.00 =    4323.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     172.47       7.52        4.555
      2     173.77       7.83        4.438

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     173.77   Tc(MIN.) =    7.83
  TOTAL AREA(ACRES) =       62.4

****************************************************************************
  FLOW PROCESS FROM NODE    346.00 TO NODE    346.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    346.00 TO NODE    211.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   226.00  DOWNSTREAM(FEET) =   224.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.16
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     173.77
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    7.92
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    211.00 =    4413.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      173.77     7.92       4.408       62.41
  LONGEST FLOWPATH FROM NODE    303.00 TO NODE    211.00 =    4413.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      315.49    10.98       3.568      102.49
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    211.00 =    6037.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     401.11       7.92        4.408
      2     456.15      10.98        3.568

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     456.15   Tc(MIN.) =   10.98
  TOTAL AREA(ACRES) =      164.9

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    347.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   224.00  DOWNSTREAM(FEET) =   146.00
  FLOW LENGTH(FEET) =   304.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  57.15
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     456.15
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   11.07
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    347.00 =    6341.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    347.00 TO NODE    347.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    503.00 TO NODE    504.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    430.00
  DOWNSTREAM ELEVATION(FEET) =    390.00
  ELEVATION DIFFERENCE(FEET) =     40.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.81
  TOTAL AREA(ACRES) =      0.79   TOTAL RUNOFF(CFS) =      2.81

****************************************************************************
  FLOW PROCESS FROM NODE    504.00 TO NODE    505.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  381.67  DOWNSTREAM ELEVATION(FEET) =  377.04
  STREET LENGTH(FEET) =   463.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.06
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.19
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.51
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.93
  STREET FLOW TRAVEL TIME(MIN.) =   3.07   Tc(MIN.) =    7.25
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.665
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.793
  SUBAREA AREA(ACRES) =    2.66      SUBAREA RUNOFF(CFS) =   10.55
  TOTAL AREA(ACRES) =        3.5        PEAK FLOW RATE(CFS) =      12.76
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.67
  FLOW VELOCITY(FEET/SEC.) =  2.81   DEPTH*VELOCITY(FT*FT/SEC.) =   1.18
  LONGEST FLOWPATH FROM NODE    503.00 TO NODE    505.00 =     563.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    510.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   375.00  DOWNSTREAM(FEET) =   362.00
  FLOW LENGTH(FEET) =   568.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.76
  PIPE TRAVEL TIME(MIN.) =   0.99    Tc(MIN.) =    8.24
  LONGEST FLOWPATH FROM NODE    503.00 TO NODE    510.00 =    1131.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    510.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.24
  RAINFALL INTENSITY(INCH/HR) =   4.30
  TOTAL STREAM AREA(ACRES) =     3.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.76

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    509.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =    377.04
  DOWNSTREAM ELEVATION(FEET) =    376.44
  ELEVATION DIFFERENCE(FEET) =      0.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.486
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.12
  TOTAL AREA(ACRES) =      0.42   TOTAL RUNOFF(CFS) =      2.12

****************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    510.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  376.44  DOWNSTREAM ELEVATION(FEET) =  365.00
  STREET LENGTH(FEET) =   473.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.37
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.05
  STREET FLOW TRAVEL TIME(MIN.) =   2.34   Tc(MIN.) =    5.83
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.371
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.850
  SUBAREA AREA(ACRES) =    1.93      SUBAREA RUNOFF(CFS) =    8.81
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =      10.73

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.47
  FLOW VELOCITY(FEET/SEC.) =  3.74   DEPTH*VELOCITY(FT*FT/SEC.) =   1.33
  LONGEST FLOWPATH FROM NODE    508.00 TO NODE    510.00 =     533.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    510.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.83
  RAINFALL INTENSITY(INCH/HR) =   5.37
  TOTAL STREAM AREA(ACRES) =     2.35
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.73

****************************************************************************
  FLOW PROCESS FROM NODE    513.00 TO NODE    514.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    396.90
  DOWNSTREAM ELEVATION(FEET) =    395.50
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.26
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      1.26

****************************************************************************
  FLOW PROCESS FROM NODE    514.00 TO NODE    515.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   392.00  DOWNSTREAM(FEET) =   370.00
  FLOW LENGTH(FEET) =  1169.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.83
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.26
  PIPE TRAVEL TIME(MIN.) =   4.03    Tc(MIN.) =    7.02
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    515.00 =    1239.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    514.00 TO NODE    515.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.763
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
```

```
  SUBAREA AREA(ACRES) =   13.32   SUBAREA RUNOFF(CFS) =   53.92
  TOTAL AREA(ACRES) =       13.6   TOTAL RUNOFF(CFS) =      54.94
  TC(MIN.) =    7.02

****************************************************************************
  FLOW PROCESS FROM NODE    515.00 TO NODE    510.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.02
  RAINFALL INTENSITY(INCH/HR) =   4.76
  TOTAL STREAM AREA(ACRES) =    13.57
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     54.94

****************************************************************************
  FLOW PROCESS FROM NODE    518.00 TO NODE    519.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    430.00
  DOWNSTREAM ELEVATION(FEET) =    390.00
  ELEVATION DIFFERENCE(FEET) =     40.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      3.73
  TOTAL AREA(ACRES) =      1.05   TOTAL RUNOFF(CFS) =      3.73

****************************************************************************
  FLOW PROCESS FROM NODE    519.00 TO NODE    520.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   385.00  DOWNSTREAM(FEET) =   371.00
  FLOW LENGTH(FEET) =   816.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.73
  PIPE TRAVEL TIME(MIN.) =   2.14    Tc(MIN.) =    6.31
  LONGEST FLOWPATH FROM NODE    518.00 TO NODE    520.00 =     916.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    519.00 TO NODE    520.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.100
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8152
  SUBAREA AREA(ACRES) =    6.50   SUBAREA RUNOFF(CFS) =   28.18
  TOTAL AREA(ACRES) =        7.6   TOTAL RUNOFF(CFS) =      31.39
  TC(MIN.) =    6.31

****************************************************************************
  FLOW PROCESS FROM NODE    520.00 TO NODE    510.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  4 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =    6.31
  RAINFALL INTENSITY(INCH/HR) =   5.10
  TOTAL STREAM AREA(ACRES) =     7.55
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     31.39

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.76     8.24        4.296          3.45
      2       10.73     5.83        5.371          2.35
      3       54.94     7.02        4.763         13.57
      4       31.39     6.31        5.100          7.55

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  4 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       94.32     5.83       5.371
      2      100.76     6.31       5.100
      3      104.64     7.02       4.763
      4       97.32     8.24       4.296

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     104.64   Tc(MIN.) =    7.02
  TOTAL AREA(ACRES) =       26.9
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    510.00 =    1239.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    525.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   362.00  DOWNSTREAM(FEET) =   322.00
  FLOW LENGTH(FEET) =   638.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  23.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.66
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     104.64
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    7.47
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    525.00 =    1877.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    525.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.47
  RAINFALL INTENSITY(INCH/HR) =   4.58
  TOTAL STREAM AREA(ACRES) =    26.92
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    104.64

****************************************************************************
  FLOW PROCESS FROM NODE    523.00 TO NODE    524.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    365.00
  DOWNSTREAM ELEVATION(FEET) =    361.95
  ELEVATION DIFFERENCE(FEET) =      3.05
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.577
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.26
```

```
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      1.26

****************************************************************************
  FLOW PROCESS FROM NODE    524.00 TO NODE    525.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  361.95  DOWNSTREAM ELEVATION(FEET) =  325.00
  STREET LENGTH(FEET) =   530.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.56
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.79
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.22
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.47
  STREET FLOW TRAVEL TIME(MIN.) =   1.69   Tc(MIN.) =    4.27
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8300
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.832
  SUBAREA AREA(ACRES) =    2.56      SUBAREA RUNOFF(CFS) =   12.60
  TOTAL AREA(ACRES) =        2.8        PEAK FLOW RATE(CFS) =      13.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.19
  FLOW VELOCITY(FEET/SEC.) =  5.99   DEPTH*VELOCITY(FT*FT/SEC.) =   1.98
  LONGEST FLOWPATH FROM NODE    523.00 TO NODE    525.00 =     610.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    525.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.27
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     2.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.86

****************************************************************************
  FLOW PROCESS FROM NODE    528.00 TO NODE    529.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    352.90
  DOWNSTREAM ELEVATION(FEET) =    351.50
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.16
  TOTAL AREA(ACRES) =      0.23   TOTAL RUNOFF(CFS) =      1.16

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    529.00 TO NODE    530.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   349.00  DOWNSTREAM(FEET) =   340.00
  FLOW LENGTH(FEET) =   461.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.77
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.16
  PIPE TRAVEL TIME(MIN.) =   1.61    Tc(MIN.) =    4.60
  LONGEST FLOWPATH FROM NODE    528.00 TO NODE    530.00 =     531.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    529.00 TO NODE    530.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    4.13   SUBAREA RUNOFF(CFS) =   20.81
  TOTAL AREA(ACRES) =        4.4   TOTAL RUNOFF(CFS) =      21.97
  TC(MIN.) =    4.60

****************************************************************************
  FLOW PROCESS FROM NODE    530.00 TO NODE    525.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   340.00  DOWNSTREAM(FEET) =   322.00
  FLOW LENGTH(FEET) =   155.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.43
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.97
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    4.73
  LONGEST FLOWPATH FROM NODE    528.00 TO NODE    525.00 =     686.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    525.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.73
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     4.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     21.97

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      104.64     7.47        4.576         26.92
      2       13.86     4.27        5.928          2.81
      3       21.97     4.73        5.928          4.36

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      114.47     4.27       5.928
```

```
     2      116.59     4.73       5.928
     3      132.29     7.47       4.576

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     132.29   Tc(MIN.) =    7.47
  TOTAL AREA(ACRES) =       34.1
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    525.00 =    1877.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    525.00 TO NODE    535.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   322.00  DOWNSTREAM(FEET) =   290.00
  FLOW LENGTH(FEET) =   415.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  26.69
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     132.29
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    7.73
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    535.00 =    2292.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    535.00 TO NODE    535.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.73
  RAINFALL INTENSITY(INCH/HR) =   4.48
  TOTAL STREAM AREA(ACRES) =    34.09
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    132.29

****************************************************************************
  FLOW PROCESS FROM NODE    533.00 TO NODE    534.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8400
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    325.00
  DOWNSTREAM ELEVATION(FEET) =    318.44
  ELEVATION DIFFERENCE(FEET) =      6.56
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.290
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.44
  TOTAL AREA(ACRES) =      0.49   TOTAL RUNOFF(CFS) =      2.44

****************************************************************************
  FLOW PROCESS FROM NODE    534.00 TO NODE    535.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  318.44  DOWNSTREAM ELEVATION(FEET) =  293.00
  STREET LENGTH(FEET) =   416.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.13
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.75
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.17
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.56
  STREET FLOW TRAVEL TIME(MIN.) =   1.34   Tc(MIN.) =    3.63
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8000
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.806
  SUBAREA AREA(ACRES) =    2.82      SUBAREA RUNOFF(CFS) =   13.37
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =      15.81

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.07
  FLOW VELOCITY(FEET/SEC.) =  5.89   DEPTH*VELOCITY(FT*FT/SEC.) =   2.05
  LONGEST FLOWPATH FROM NODE    533.00 TO NODE    535.00 =     506.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    535.00 TO NODE    535.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.63
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     3.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.81

****************************************************************************
  FLOW PROCESS FROM NODE    538.00 TO NODE    539.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    325.40
  DOWNSTREAM ELEVATION(FEET) =    324.00
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.21
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      1.21

****************************************************************************
  FLOW PROCESS FROM NODE    539.00 TO NODE    540.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   321.00  DOWNSTREAM(FEET) =   313.00
  FLOW LENGTH(FEET) =   410.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.83
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.21
  PIPE TRAVEL TIME(MIN.) =   1.41    Tc(MIN.) =    4.40
  LONGEST FLOWPATH FROM NODE    538.00 TO NODE    540.00 =     480.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    539.00 TO NODE    540.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
```

```
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    3.23   SUBAREA RUNOFF(CFS) =   16.28
  TOTAL AREA(ACRES) =        3.5   TOTAL RUNOFF(CFS) =      17.49
  TC(MIN.) =    4.40

****************************************************************************
  FLOW PROCESS FROM NODE    540.00 TO NODE    535.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   313.00  DOWNSTREAM(FEET) =   290.00
  FLOW LENGTH(FEET) =   152.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.49
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    4.52
  LONGEST FLOWPATH FROM NODE    538.00 TO NODE    535.00 =     632.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    535.00 TO NODE    535.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.52
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     3.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.49

****************************************************************************
  FLOW PROCESS FROM NODE    543.00 TO NODE    544.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    373.40
  DOWNSTREAM ELEVATION(FEET) =    372.00
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      3.63
  TOTAL AREA(ACRES) =      0.72   TOTAL RUNOFF(CFS) =      3.63

****************************************************************************
  FLOW PROCESS FROM NODE    544.00 TO NODE    545.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   369.00  DOWNSTREAM(FEET) =   353.00
  FLOW LENGTH(FEET) =   907.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.39
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.63
  PIPE TRAVEL TIME(MIN.) =   2.37    Tc(MIN.) =    5.36
  LONGEST FLOWPATH FROM NODE    543.00 TO NODE    545.00 =     977.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    544.00 TO NODE    545.00 IS CODE =  81
```

```
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.671
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    7.41   SUBAREA RUNOFF(CFS) =   35.72
  TOTAL AREA(ACRES) =        8.1   TOTAL RUNOFF(CFS) =      39.19
  TC(MIN.) =    5.36

****************************************************************************
  FLOW PROCESS FROM NODE    545.00 TO NODE    535.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   353.00  DOWNSTREAM(FEET) =   290.00
  FLOW LENGTH(FEET) =   238.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  31.96
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      39.19
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    5.48
  LONGEST FLOWPATH FROM NODE    543.00 TO NODE    535.00 =    1215.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    535.00 TO NODE    535.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  4 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.48
  RAINFALL INTENSITY(INCH/HR) =   5.59
  TOTAL STREAM AREA(ACRES) =     8.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     39.19

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      132.29     7.73        4.476         34.09
      2       15.81     3.63        5.928          3.31
      3       17.49     4.52        5.928          3.47
      4       39.19     5.48        5.588          8.13

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  4 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      155.73     3.63       5.928
      2      165.52     4.52       5.928
      3      176.55     5.48       5.588
      4      188.83     7.73       4.476

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     188.83   Tc(MIN.) =    7.73
  TOTAL AREA(ACRES) =       49.0
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    535.00 =    2292.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    535.00 TO NODE    546.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   290.00  DOWNSTREAM(FEET) =   283.00
  FLOW LENGTH(FEET) =   114.00   MANNING'S N =  0.013
```

```
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  26.66
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     188.83
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    7.80
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    546.00 =    2406.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    546.00 TO NODE    546.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.80
  RAINFALL INTENSITY(INCH/HR) =   4.45
  TOTAL STREAM AREA(ACRES) =    49.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    188.83

****************************************************************************
  FLOW PROCESS FROM NODE    548.00 TO NODE    549.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    320.00
  DOWNSTREAM ELEVATION(FEET) =    312.50
  ELEVATION DIFFERENCE(FEET) =      7.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.062
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    95.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.81
  TOTAL AREA(ACRES) =      0.35   TOTAL RUNOFF(CFS) =      1.81

****************************************************************************
  FLOW PROCESS FROM NODE    549.00 TO NODE    550.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  312.50  DOWNSTREAM ELEVATION(FEET) =  288.00
  STREET LENGTH(FEET) =   508.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 26.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.40
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.60
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.40
  STREET FLOW TRAVEL TIME(MIN.) =   1.84   Tc(MIN.) =    3.90
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7000
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.717
```

```
  SUBAREA AREA(ACRES) =    3.18      SUBAREA RUNOFF(CFS) =   13.20
  TOTAL AREA(ACRES) =        3.5        PEAK FLOW RATE(CFS) =      15.00

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.43
  FLOW VELOCITY(FEET/SEC.) =  5.27   DEPTH*VELOCITY(FT*FT/SEC.) =   1.87
  LONGEST FLOWPATH FROM NODE    548.00 TO NODE    550.00 =     608.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    550.00 TO NODE    546.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   284.00  DOWNSTREAM(FEET) =   283.00
  FLOW LENGTH(FEET) =   105.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.25
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.00
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =    4.14
  LONGEST FLOWPATH FROM NODE    548.00 TO NODE    546.00 =     713.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    546.00 TO NODE    546.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.14
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     3.53
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      188.83     7.80        4.450         49.00
      2       15.00     4.14        5.928          3.53

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      156.74     4.14       5.928
      2      200.09     7.80       4.450

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     200.09   Tc(MIN.) =    7.80
  TOTAL AREA(ACRES) =       52.5
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    546.00 =    2406.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    546.00 TO NODE    551.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   283.00  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =   565.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  28.00
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     200.09
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =    8.14
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    551.00 =    2971.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    551.00 TO NODE    551.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.14
  RAINFALL INTENSITY(INCH/HR) =   4.33
  TOTAL STREAM AREA(ACRES) =    52.53
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    200.09

****************************************************************************
  FLOW PROCESS FROM NODE    553.00 TO NODE    554.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    294.40
  DOWNSTREAM ELEVATION(FEET) =    293.00
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.16
  TOTAL AREA(ACRES) =      0.23   TOTAL RUNOFF(CFS) =      1.16

****************************************************************************
  FLOW PROCESS FROM NODE    554.00 TO NODE    555.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   290.00  DOWNSTREAM(FEET) =   285.00
  FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.50
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.16
  PIPE TRAVEL TIME(MIN.) =   1.11    Tc(MIN.) =    4.10
  LONGEST FLOWPATH FROM NODE    553.00 TO NODE    555.00 =     370.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    554.00 TO NODE    555.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    2.01   SUBAREA RUNOFF(CFS) =   10.13
  TOTAL AREA(ACRES) =        2.2   TOTAL RUNOFF(CFS) =      11.29
  TC(MIN.) =    4.10

****************************************************************************
  FLOW PROCESS FROM NODE    555.00 TO NODE    551.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   285.00  DOWNSTREAM(FEET) =   247.00
  FLOW LENGTH(FEET) =   195.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.85
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =      11.29
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    4.25
  LONGEST FLOWPATH FROM NODE    553.00 TO NODE    551.00 =     565.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    551.00 TO NODE    551.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.25
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     2.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.29

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      200.09     8.14        4.330         52.53
      2       11.29     4.25        5.928          2.24

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      157.45     4.25       5.928
      2      208.33     8.14       4.330

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     208.33   Tc(MIN.) =    8.14
  TOTAL AREA(ACRES) =       54.8
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    551.00 =    2971.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    551.00 TO NODE    560.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   247.00  DOWNSTREAM(FEET) =   237.00
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  29.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  34.01
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     208.33
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    8.18
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    560.00 =    3061.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.18
  RAINFALL INTENSITY(INCH/HR) =   4.32
  TOTAL STREAM AREA(ACRES) =    54.77
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    208.33

****************************************************************************
  FLOW PROCESS FROM NODE    558.00 TO NODE    559.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    288.50
  DOWNSTREAM ELEVATION(FEET) =    284.00
  ELEVATION DIFFERENCE(FEET) =      4.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.997
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.40
  TOTAL AREA(ACRES) =      0.45   TOTAL RUNOFF(CFS) =      2.40

****************************************************************************
  FLOW PROCESS FROM NODE    559.00 TO NODE    560.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  284.00  DOWNSTREAM ELEVATION(FEET) =  240.50
  STREET LENGTH(FEET) =   650.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.94
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =    9.95
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.84
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.90
  STREET FLOW TRAVEL TIME(MIN.) =   1.86   Tc(MIN.) =    3.85
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.763
  SUBAREA AREA(ACRES) =    4.74      SUBAREA RUNOFF(CFS) =   21.07
  TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =      23.48

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.83
  FLOW VELOCITY(FEET/SEC.) =  6.65   DEPTH*VELOCITY(FT*FT/SEC.) =   2.55
  LONGEST FLOWPATH FROM NODE    558.00 TO NODE    560.00 =     740.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.85
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     5.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.48

****************************************************************************
  FLOW PROCESS FROM NODE    563.00 TO NODE    564.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    324.40
  DOWNSTREAM ELEVATION(FEET) =    323.00
```

```
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.988
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.97
  TOTAL AREA(ACRES) =      0.39   TOTAL RUNOFF(CFS) =      1.97

****************************************************************************
  FLOW PROCESS FROM NODE    564.00 TO NODE    565.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   320.00  DOWNSTREAM(FEET) =   309.00
  FLOW LENGTH(FEET) =   562.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.97
  PIPE TRAVEL TIME(MIN.) =   1.68    Tc(MIN.) =    4.67
  LONGEST FLOWPATH FROM NODE    563.00 TO NODE    565.00 =     632.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    564.00 TO NODE    565.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    5.10   SUBAREA RUNOFF(CFS) =   25.70
  TOTAL AREA(ACRES) =        5.5   TOTAL RUNOFF(CFS) =      27.66
  TC(MIN.) =    4.67

****************************************************************************
  FLOW PROCESS FROM NODE    565.00 TO NODE    560.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   309.00  DOWNSTREAM(FEET) =   237.00
  FLOW LENGTH(FEET) =   255.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  30.29
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.66
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    4.81
  LONGEST FLOWPATH FROM NODE    563.00 TO NODE    560.00 =     887.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    560.00 TO NODE    560.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.81
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     5.49
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.66

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      208.33     8.18        4.315         54.77
      2       23.48     3.85        5.928          5.19
```

```
      3       27.66     4.81        5.928          5.49

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      197.28     3.85       5.928
      2      202.79     4.81       5.928
      3      245.56     8.18       4.315

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     245.56   Tc(MIN.) =    8.18
  TOTAL AREA(ACRES) =       65.4
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    560.00 =    3061.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   5650.00 TO NODE    570.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   237.00  DOWNSTREAM(FEET) =   203.00
  FLOW LENGTH(FEET) =   390.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  33.00
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     245.56
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    8.38
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    570.00 =    3451.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    570.00 TO NODE    570.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.38
  RAINFALL INTENSITY(INCH/HR) =   4.25
  TOTAL STREAM AREA(ACRES) =    65.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    245.56

****************************************************************************
  FLOW PROCESS FROM NODE    568.00 TO NODE    569.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    241.00
  DOWNSTREAM ELEVATION(FEET) =    235.00
  ELEVATION DIFFERENCE(FEET) =      6.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.087
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.06
  TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      2.06

****************************************************************************
  FLOW PROCESS FROM NODE    569.00 TO NODE    570.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  235.00  DOWNSTREAM ELEVATION(FEET) =  204.00
  STREET LENGTH(FEET) =   394.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.81
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.32
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.44
  STREET FLOW TRAVEL TIME(MIN.) =   1.24   Tc(MIN.) =    3.32
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    1.84      SUBAREA RUNOFF(CFS) =    9.49
  TOTAL AREA(ACRES) =        2.2        PEAK FLOW RATE(CFS) =      11.55

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.15
  FLOW VELOCITY(FEET/SEC.) =  6.05   DEPTH*VELOCITY(FT*FT/SEC.) =   1.87
  LONGEST FLOWPATH FROM NODE    568.00 TO NODE    570.00 =     484.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    570.00 TO NODE    570.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.32
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     2.24
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.55

****************************************************************************
  FLOW PROCESS FROM NODE    573.00 TO NODE    574.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    284.50
  DOWNSTREAM ELEVATION(FEET) =    280.00
  ELEVATION DIFFERENCE(FEET) =      4.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.992
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.275
  SUBAREA RUNOFF(CFS) =      1.21
  TOTAL AREA(ACRES) =      0.46   TOTAL RUNOFF(CFS) =      1.21

****************************************************************************
  FLOW PROCESS FROM NODE    574.00 TO NODE    575.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   280.00  DOWNSTREAM(FEET) =   205.00
  FLOW LENGTH(FEET) =   862.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.19
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.21
  PIPE TRAVEL TIME(MIN.) =   1.75    Tc(MIN.) =    7.75
```

```
  LONGEST FLOWPATH FROM NODE    573.00 TO NODE    575.00 =     952.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    574.00 TO NODE    575.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.470
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5000
  SUBAREA AREA(ACRES) =    2.42   SUBAREA RUNOFF(CFS) =    5.41
  TOTAL AREA(ACRES) =        2.9   TOTAL RUNOFF(CFS) =       6.44
  TC(MIN.) =    7.75

****************************************************************************
  FLOW PROCESS FROM NODE    575.00 TO NODE    570.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.75
  RAINFALL INTENSITY(INCH/HR) =   4.47
  TOTAL STREAM AREA(ACRES) =     2.88
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.44

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      245.56     8.38        4.250         65.45
      2       11.55     3.32        5.928          2.24
      3        6.44     7.75        4.470          2.88

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      190.34     3.32       5.928
      2      248.62     7.75       4.470
      3      259.96     8.38       4.250

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     259.96   Tc(MIN.) =    8.38
  TOTAL AREA(ACRES) =       70.6
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    570.00 =    3451.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    570.00 TO NODE    580.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   202.00  DOWNSTREAM(FEET) =   154.00
  FLOW LENGTH(FEET) =   717.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  30.30
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     259.96
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    8.77
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    580.00 =    4168.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.77
  RAINFALL INTENSITY(INCH/HR) =   4.13
  TOTAL STREAM AREA(ACRES) =    70.57
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    259.96

****************************************************************************
  FLOW PROCESS FROM NODE    578.00 TO NODE    579.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    202.00
  DOWNSTREAM ELEVATION(FEET) =    195.00
  ELEVATION DIFFERENCE(FEET) =      7.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.281
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    94.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      3.12
  TOTAL AREA(ACRES) =      0.62   TOTAL RUNOFF(CFS) =      3.12

****************************************************************************
  FLOW PROCESS FROM NODE    579.00 TO NODE    580.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  195.00  DOWNSTREAM ELEVATION(FEET) =  156.00
  STREET LENGTH(FEET) =   730.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.36
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.27
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.27
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.75
  STREET FLOW TRAVEL TIME(MIN.) =   2.31   Tc(MIN.) =    4.59
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .7300
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.745
  SUBAREA AREA(ACRES) =    4.27      SUBAREA RUNOFF(CFS) =   18.48
  TOTAL AREA(ACRES) =        4.9        PEAK FLOW RATE(CFS) =      21.60

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.99
  FLOW VELOCITY(FEET/SEC.) =  5.98   DEPTH*VELOCITY(FT*FT/SEC.) =   2.31
  LONGEST FLOWPATH FROM NODE    578.00 TO NODE    580.00 =     830.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    580.00 TO NODE    580.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.59
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     4.89
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     21.60

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      259.96     8.77        4.125         70.57
      2       21.60     4.59        5.928          4.89

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      202.51     4.59       5.928
      2      274.99     8.77       4.125

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     274.99   Tc(MIN.) =    8.77
  TOTAL AREA(ACRES) =       75.5
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    580.00 =    4168.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    580.00 TO NODE    581.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   153.00  DOWNSTREAM(FEET) =   144.00
  FLOW LENGTH(FEET) =   155.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  36.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  28.53
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     274.99
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    8.86
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    581.00 =    4323.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    581.00 TO NODE    581.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .9000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    290.00
  DOWNSTREAM ELEVATION(FEET) =    288.60
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.391
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.49
  TOTAL AREA(ACRES) =      0.28   TOTAL RUNOFF(CFS) =      1.49

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    604.00 TO NODE    605.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  288.60  DOWNSTREAM ELEVATION(FEET) =  272.00
  STREET LENGTH(FEET) =   521.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.14
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.06
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.80
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.17
  STREET FLOW TRAVEL TIME(MIN.) =   2.29   Tc(MIN.) =    4.68
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.856
  SUBAREA AREA(ACRES) =    2.24      SUBAREA RUNOFF(CFS) =   11.29
  TOTAL AREA(ACRES) =        2.5        PEAK FLOW RATE(CFS) =      12.78

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  11.61
  FLOW VELOCITY(FEET/SEC.) =  4.36   DEPTH*VELOCITY(FT*FT/SEC.) =   1.56
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    605.00 =     591.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   269.00  DOWNSTREAM(FEET) =   259.00
  FLOW LENGTH(FEET) =   200.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.04
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.78
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =    4.93
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    606.00 =     791.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    606.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7370
  SUBAREA AREA(ACRES) =    1.26   SUBAREA RUNOFF(CFS) =    3.73
  TOTAL AREA(ACRES) =        3.8   TOTAL RUNOFF(CFS) =      16.52
  TC(MIN.) =    4.93

****************************************************************************
  FLOW PROCESS FROM NODE    606.00 TO NODE    610.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   259.00  DOWNSTREAM(FEET) =   241.00
  FLOW LENGTH(FEET) =   425.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.91
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.52
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =    5.48
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    610.00 =    1216.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    610.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.48
  RAINFALL INTENSITY(INCH/HR) =   5.59
  TOTAL STREAM AREA(ACRES) =     3.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.52

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    609.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    270.40
  DOWNSTREAM ELEVATION(FEET) =    269.00
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.749
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.13
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      1.13

****************************************************************************
  FLOW PROCESS FROM NODE    609.00 TO NODE    610.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  269.00  DOWNSTREAM ELEVATION(FEET) =  244.00
  STREET LENGTH(FEET) =   526.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.72
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.22
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.17
  STREET FLOW TRAVEL TIME(MIN.) =   2.08   Tc(MIN.) =    4.82
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.852
  SUBAREA AREA(ACRES) =    1.82      SUBAREA RUNOFF(CFS) =    9.17
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =      10.31

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.74
  FLOW VELOCITY(FEET/SEC.) =  4.83   DEPTH*VELOCITY(FT*FT/SEC.) =   1.55
  LONGEST FLOWPATH FROM NODE    608.00 TO NODE    610.00 =     596.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    610.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.82
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     2.04
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.31

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       16.52     5.48        5.588          3.78
      2       10.31     4.82        5.928          2.04

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       24.84     4.82       5.928
      2       26.23     5.48       5.588

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      26.23   Tc(MIN.) =    5.48
  TOTAL AREA(ACRES) =        5.8
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    610.00 =    1216.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    611.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   241.00  DOWNSTREAM(FEET) =   234.00
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.45
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.23
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    5.63
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    611.00 =    1356.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    612.00 TO NODE   6100.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.491
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .5000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7534
  SUBAREA AREA(ACRES) =    0.55   SUBAREA RUNOFF(CFS) =    1.51
```

```
  TOTAL AREA(ACRES) =        6.4   TOTAL RUNOFF(CFS) =      26.35
  TC(MIN.) =    5.63

****************************************************************************
  FLOW PROCESS FROM NODE    611.00 TO NODE    615.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   234.00  DOWNSTREAM(FEET) =   210.00
  FLOW LENGTH(FEET) =   527.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.89
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      26.35
  PIPE TRAVEL TIME(MIN.) =   0.59    Tc(MIN.) =    6.22
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    615.00 =    1883.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    615.00 TO NODE    615.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.22
  RAINFALL INTENSITY(INCH/HR) =   5.15
  TOTAL STREAM AREA(ACRES) =     6.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     26.35

****************************************************************************
  FLOW PROCESS FROM NODE    613.00 TO NODE    614.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    244.50
  DOWNSTREAM ELEVATION(FEET) =    240.00
  ELEVATION DIFFERENCE(FEET) =      4.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.297
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.34
  TOTAL AREA(ACRES) =      0.26   TOTAL RUNOFF(CFS) =      1.34

****************************************************************************
  FLOW PROCESS FROM NODE    614.00 TO NODE    615.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  240.00  DOWNSTREAM ELEVATION(FEET) =  212.00
  STREET LENGTH(FEET) =   530.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.14
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.10
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.61
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.33
  STREET FLOW TRAVEL TIME(MIN.) =   1.92   Tc(MIN.) =    4.21
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.852
  SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =   11.59
  TOTAL AREA(ACRES) =        2.6        PEAK FLOW RATE(CFS) =      12.93

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.48
  FLOW VELOCITY(FEET/SEC.) =  5.32   DEPTH*VELOCITY(FT*FT/SEC.) =   1.79
  LONGEST FLOWPATH FROM NODE    613.00 TO NODE    615.00 =     620.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    616.00 TO NODE    615.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7870
  SUBAREA AREA(ACRES) =    0.89   SUBAREA RUNOFF(CFS) =    3.17
  TOTAL AREA(ACRES) =        3.4   TOTAL RUNOFF(CFS) =      16.10
  TC(MIN.) =    4.21

****************************************************************************
  FLOW PROCESS FROM NODE    615.00 TO NODE    615.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.21
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     3.45
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.10

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       26.35     6.22        5.149          6.37
      2       16.10     4.21        5.928          3.45

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       38.98     4.21       5.928
      2       40.33     6.22       5.149

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      40.33   Tc(MIN.) =    6.22
  TOTAL AREA(ACRES) =        9.8
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    615.00 =    1883.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    615.00 TO NODE    617.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   210.00  DOWNSTREAM(FEET) =   192.00
  FLOW LENGTH(FEET) =   255.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.9 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.68
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.33
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =    6.44
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    617.00 =    2138.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    618.00 TO NODE    617.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.037
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7501
  SUBAREA AREA(ACRES) =    0.99   SUBAREA RUNOFF(CFS) =    2.99
  TOTAL AREA(ACRES) =       10.8   TOTAL RUNOFF(CFS) =      40.84
  TC(MIN.) =    6.44

****************************************************************************
  FLOW PROCESS FROM NODE    617.00 TO NODE    625.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   192.00  DOWNSTREAM(FEET) =   167.00
  FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.83
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.84
  PIPE TRAVEL TIME(MIN.) =   0.29    Tc(MIN.) =    6.73
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    625.00 =    2488.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    625.00 TO NODE    625.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.73
  RAINFALL INTENSITY(INCH/HR) =   4.89
  TOTAL STREAM AREA(ACRES) =    10.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     40.84

****************************************************************************
  FLOW PROCESS FROM NODE    623.00 TO NODE    624.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    213.00
  DOWNSTREAM ELEVATION(FEET) =    206.50
  ELEVATION DIFFERENCE(FEET) =      6.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.032
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.70
  TOTAL AREA(ACRES) =      0.33   TOTAL RUNOFF(CFS) =      1.70

****************************************************************************
  FLOW PROCESS FROM NODE    624.00 TO NODE    625.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  206.50  DOWNSTREAM ELEVATION(FEET) =  170.00
  STREET LENGTH(FEET) =   500.00   CURB HEIGHT(INCHES) =  6.0
```

```
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.43
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.10
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.44
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.57
  STREET FLOW TRAVEL TIME(MIN.) =   1.53   Tc(MIN.) =    3.56
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.852
  SUBAREA AREA(ACRES) =    2.67      SUBAREA RUNOFF(CFS) =   13.45
  TOTAL AREA(ACRES) =        3.0        PEAK FLOW RATE(CFS) =      15.16

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.48
  FLOW VELOCITY(FEET/SEC.) =  6.23   DEPTH*VELOCITY(FT*FT/SEC.) =   2.09
  LONGEST FLOWPATH FROM NODE    623.00 TO NODE    625.00 =     590.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    625.00 TO NODE    625.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.56
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     3.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.16

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       40.84     6.73        4.894         10.81
      2       15.16     3.56        5.928          3.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       48.87     3.56       5.928
      2       53.35     6.73       4.894

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      53.35   Tc(MIN.) =    6.73
  TOTAL AREA(ACRES) =       13.8
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    625.00 =    2488.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    625.00 TO NODE    626.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   167.00  DOWNSTREAM(FEET) =   147.00
```

```
  FLOW LENGTH(FEET) =   518.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.48
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.35
  PIPE TRAVEL TIME(MIN.) =   0.52    Tc(MIN.) =    7.26
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    626.00 =    3006.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    626.00 TO NODE    626.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.26
  RAINFALL INTENSITY(INCH/HR) =   4.66
  TOTAL STREAM AREA(ACRES) =    13.81
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.35

****************************************************************************
  FLOW PROCESS FROM NODE    628.00 TO NODE    629.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    166.50
  DOWNSTREAM ELEVATION(FEET) =    160.00
  ELEVATION DIFFERENCE(FEET) =      6.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.032
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.50
  TOTAL AREA(ACRES) =      0.29   TOTAL RUNOFF(CFS) =      1.50
****************************************************************************
  FLOW PROCESS FROM NODE    629.00 TO NODE    626.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  160.00  DOWNSTREAM ELEVATION(FEET) =  150.70
  STREET LENGTH(FEET) =   408.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 32.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.88
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    8.95
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.20
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   2.13   Tc(MIN.) =    4.16
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
  SUBAREA AREA(ACRES) =    1.70      SUBAREA RUNOFF(CFS) =    8.77
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =      10.26

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.38
  FLOW VELOCITY(FEET/SEC.) =  3.63   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
  LONGEST FLOWPATH FROM NODE    628.00 TO NODE    626.00 =     498.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    631.00 TO NODE    626.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7472
  SUBAREA AREA(ACRES) =    1.66   SUBAREA RUNOFF(CFS) =    5.90
  TOTAL AREA(ACRES) =        3.7   TOTAL RUNOFF(CFS) =      16.17
  TC(MIN.) =    4.16

****************************************************************************
  FLOW PROCESS FROM NODE    626.00 TO NODE    626.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.16
  RAINFALL INTENSITY(INCH/HR) =   5.93
  TOTAL STREAM AREA(ACRES) =     3.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.17

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       53.35     7.26        4.663         13.81
      2       16.17     4.16        5.928          3.65

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       58.13     4.16       5.928
      2       66.07     7.26       4.663

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      66.07   Tc(MIN.) =    7.26
  TOTAL AREA(ACRES) =       17.5
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    626.00 =    3006.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    626.00 TO NODE    347.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   147.00  DOWNSTREAM(FEET) =   146.00
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.44
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      66.07
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.29
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    347.00 =    3036.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    347.00 TO NODE    347.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================
```

```
  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       66.07     7.29       4.650       17.46
  LONGEST FLOWPATH FROM NODE    603.00 TO NODE    347.00 =    3036.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      456.15    11.07       3.550      164.90
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    347.00 =    6341.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     366.21       7.29        4.650
      2     506.59      11.07        3.550

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     506.59   Tc(MIN.) =   11.07
  TOTAL AREA(ACRES) =      182.4
****************************************************************************
  FLOW PROCESS FROM NODE    347.00 TO NODE    347.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    347.00 TO NODE    581.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   146.00  DOWNSTREAM(FEET) =   144.00
  FLOW LENGTH(FEET) =   205.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  81.0 INCH PIPE IS  62.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.25
  ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     506.59
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   11.27
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    581.00 =    6546.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    581.00 TO NODE    581.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      506.59    11.27       3.509      182.36
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    581.00 =    6546.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      274.99     8.86       4.098       75.46
  LONGEST FLOWPATH FROM NODE    513.00 TO NODE    581.00 =    4323.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     673.32       8.86        4.098
      2     742.08      11.27        3.509

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     742.08   Tc(MIN.) =   11.27
  TOTAL AREA(ACRES) =      257.8
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    581.00 TO NODE    581.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================
****************************************************************************
  FLOW PROCESS FROM NODE    648.00 TO NODE    649.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    175.00
  DOWNSTREAM ELEVATION(FEET) =    154.08
  ELEVATION DIFFERENCE(FEET) =     20.92
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.24
  TOTAL AREA(ACRES) =      0.35   TOTAL RUNOFF(CFS) =      1.24

****************************************************************************
  FLOW PROCESS FROM NODE    649.00 TO NODE    650.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  154.08  DOWNSTREAM ELEVATION(FEET) =  142.00
  STREET LENGTH(FEET) =   875.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 44.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.69
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.79
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   5.23   Tc(MIN.) =    9.41
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.943
  *USER SPECIFIED(SUBAREA):
  USER-SPECIFIED RUNOFF COEFFICIENT = .8700
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.847
  SUBAREA AREA(ACRES) =    3.74      SUBAREA RUNOFF(CFS) =   12.83
  TOTAL AREA(ACRES) =        4.1        PEAK FLOW RATE(CFS) =      13.66

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.19
  FLOW VELOCITY(FEET/SEC.) =  3.20   DEPTH*VELOCITY(FT*FT/SEC.) =   1.31
  LONGEST FLOWPATH FROM NODE    648.00 TO NODE    650.00 =     975.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        4.1  TC(MIN.) =      9.41
  PEAK FLOW RATE(CFS)   =      13.66
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 4

DETENTION BASIN ANALYSIS

RATIONAL METHOD HYDROGRAPH PROGRAM
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RUN DATE 2/27/2013
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 16 MIN.
6 HOUR RAINFALL 2.25 INCHES
BASIN AREA 287.5 ACRES
RUNOFF COEFFICIENT 0.69
PEAK DISCHARGE 613.73 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 16	DISCHARGE (CFS) = 26.5
TIME (MIN) = 32	DISCHARGE (CFS) = 28.1
TIME (MIN) = 48	DISCHARGE (CFS) = 29
TIME (MIN) = 64	DISCHARGE (CFS) = 31.1
TIME (MIN) = 80	DISCHARGE (CFS) = 32.3
TIME (MIN) = 96	DISCHARGE (CFS) = 35.1
TIME (MIN) = 112	DISCHARGE (CFS) = 36.8
TIME (MIN) = 128	DISCHARGE (CFS) = 40.8
TIME (MIN) = 144	DISCHARGE (CFS) = 43.3
TIME (MIN) = 160	DISCHARGE (CFS) = 49.6
TIME (MIN) = 176	DISCHARGE (CFS) = 53.8
TIME (MIN) = 192	DISCHARGE (CFS) = 65.8
TIME (MIN) = 208	DISCHARGE (CFS) = 74.9
TIME (MIN) = 224	DISCHARGE (CFS) = 110
TIME (MIN) = 240	DISCHARGE (CFS) = 96.6
TIME (MIN) = 256	DISCHARGE (CFS) = 613.73
TIME (MIN) = 272	DISCHARGE (CFS) = 88.2
TIME (MIN) = 288	DISCHARGE (CFS) = 59
TIME (MIN) = 304	DISCHARGE (CFS) = 46.2
TIME (MIN) = 320	DISCHARGE (CFS) = 38.7
TIME (MIN) = 336	DISCHARGE (CFS) = 33.7
TIME (MIN) = 352	DISCHARGE (CFS) = 30
TIME (MIN) = 368	DISCHARGE (CFS) = 27.3
TIME (MIN) = 384	DISCHARGE (CFS) = 0

Hydraflow Table of Contents

1089-HH.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, Feb 27, 2013

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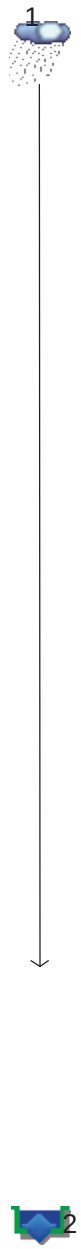
Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8



Legend

Hyd.	Origin	Description
1	Manual	Detention Basin
2	Reservoir	Q FROM SOUTH DETENTION

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Manual	------	-------	-------	-------	-------	-------	-------	-------	613.73	Detention Basin
2	Reservoir	1	-------	-------	-------	-------	-------	-------	-------	399.09	Q FROM SOUTH DETENTION

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	613.73	16	256	1,622,909	------	------	------	Detention Basin
2	Reservoir	399.09	16	272	1,622,872	1	297.32	455,308	Q FROM SOUTH DETENTION

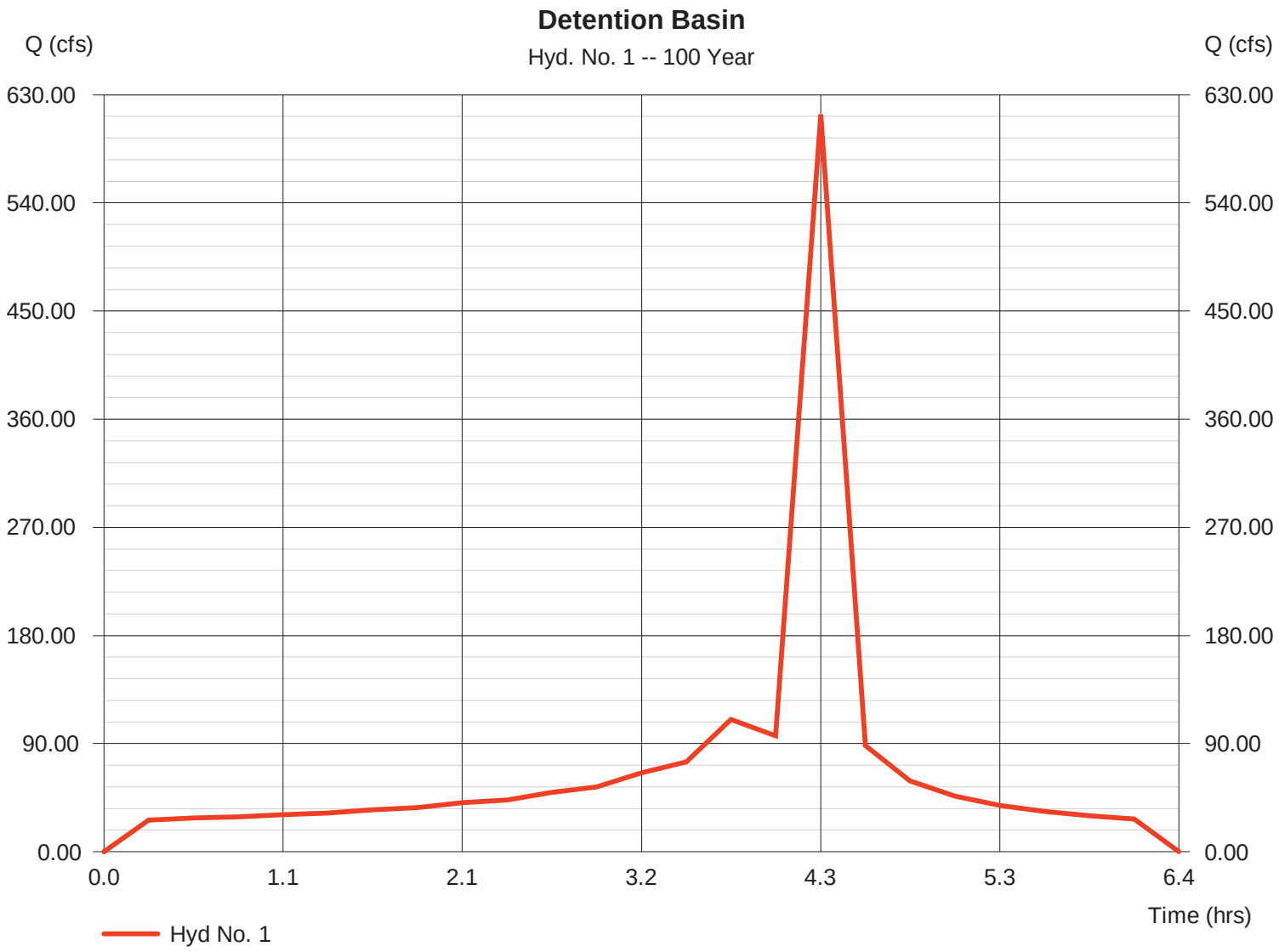
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Wednesday, Feb 27, 2013

Hyd. No. 1

Detention Basin

Hydrograph type	= Manual	Peak discharge	= 613.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.27 hrs
Time interval	= 16 min	Hyd. volume	= 1,622,909 cuft



Hydrograph Report

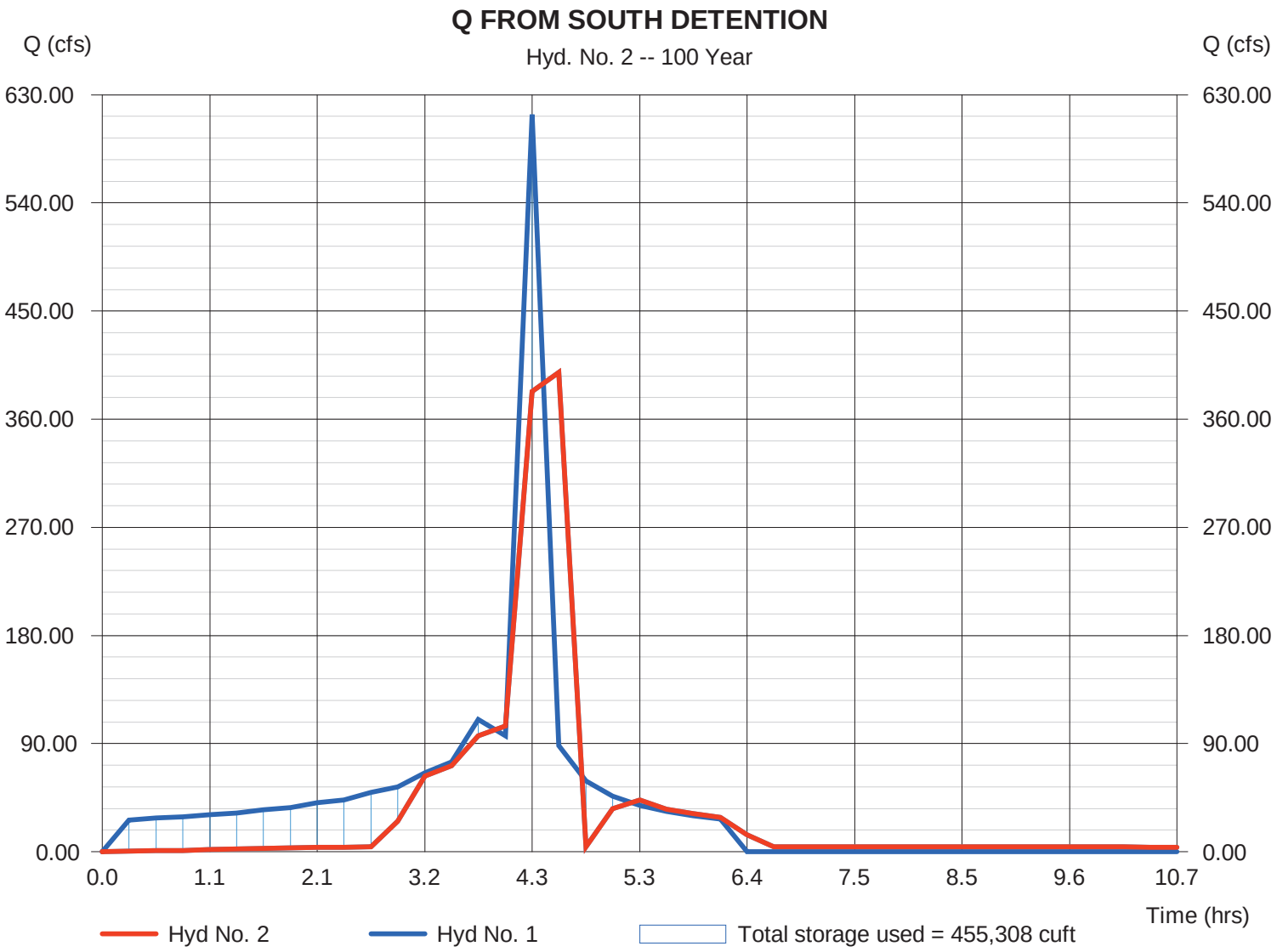
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Wednesday, Feb 27, 2013

Hyd. No. 2

Q FROM SOUTH DETENTION

Hydrograph type	=	Reservoir	Peak discharge	=	399.09 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.53 hrs
Time interval	=	16 min	Hyd. volume	=	1,622,872 cuft
Inflow hyd. No.	=	1 - Detention Basin	Max. Elevation	=	297.32 ft
Reservoir name	=	SOUTH POND	Max. Storage	=	455,308 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8 Wednesday, Feb 27, 2013

Pond No. 2 - SOUTH POND

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	280.00	n/a	0	0
1.00	281.00	n/a	21,968	21,968
2.00	282.00	n/a	23,170	45,138
3.00	283.00	n/a	24,404	69,542
4.00	284.00	n/a	25,669	95,211
5.00	285.00	n/a	26,967	122,178
6.00	286.00	n/a	28,297	150,475
7.00	287.00	n/a	29,658	180,133
8.00	288.00	n/a	31,052	211,185
9.00	289.00	n/a	32,478	243,663
10.00	290.00	n/a	33,935	277,598
11.00	291.00	n/a	35,426	313,024
12.00	292.00	n/a	36,947	349,971
13.00	293.00	n/a	38,500	388,471
14.00	294.00	n/a	40,086	428,557
15.00	295.00	n/a	41,704	470,261
16.00	296.00	n/a	43,354	513,615
17.00	297.00	n/a	45,035	558,650
18.00	298.00	n/a	46,749	605,399
19.00	299.00	n/a	48,495	653,894
20.00	300.00	n/a	50,273	704,167

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 72.00	3.00	3.00	0.00
Span (in)	= 72.00	3.00	3.00	0.00
No. Barrels	= 1	3	3	0
Invert El. (ft)	= 273.00	280.00	283.00	0.00
Length (ft)	= 128.00	0.50	0.50	0.00
Slope (%)	= 2.00	1.00	1.00	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)	= 24.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 291.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.500 (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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	280.00	0.00	0.00	0.00	---	0.00	---	---	---	0.000	---	0.000
0.10	2,197	280.10	272.25 ic	0.06 ic	0.00	---	0.00	---	---	---	0.000	---	0.060
0.20	4,394	280.20	272.25 ic	0.19 ic	0.00	---	0.00	---	---	---	0.000	---	0.192
0.30	6,590	280.30	272.25 ic	0.30 ic	0.00	---	0.00	---	---	---	0.000	---	0.297
0.40	8,787	280.40	272.25 ic	0.37 ic	0.00	---	0.00	---	---	---	0.000	---	0.372
0.50	10,984	280.50	272.25 ic	0.43 ic	0.00	---	0.00	---	---	---	0.000	---	0.434
0.60	13,181	280.60	272.25 ic	0.49 ic	0.00	---	0.00	---	---	---	0.000	---	0.489
0.70	15,378	280.70	272.25 ic	0.54 ic	0.00	---	0.00	---	---	---	0.000	---	0.538
0.80	17,574	280.80	272.25 ic	0.58 ic	0.00	---	0.00	---	---	---	0.000	---	0.583
0.90	19,771	280.90	272.25 ic	0.62 ic	0.00	---	0.00	---	---	---	0.000	---	0.624
1.00	21,968	281.00	272.25 ic	0.66 ic	0.00	---	0.00	---	---	---	0.000	---	0.663
1.10	24,285	281.10	272.25 ic	0.70 ic	0.00	---	0.00	---	---	---	0.000	---	0.700
1.20	26,602	281.20	272.25 ic	0.74 ic	0.00	---	0.00	---	---	---	0.000	---	0.735
1.30	28,919	281.30	272.25 ic	0.77 ic	0.00	---	0.00	---	---	---	0.000	---	0.769
1.40	31,236	281.40	272.25 ic	0.80 ic	0.00	---	0.00	---	---	---	0.000	---	0.801
1.50	33,553	281.50	272.25 ic	0.83 ic	0.00	---	0.00	---	---	---	0.000	---	0.831
1.60	35,870	281.60	272.25 ic	0.86 ic	0.00	---	0.00	---	---	---	0.000	---	0.861
1.70	38,187	281.70	272.25 ic	0.89 ic	0.00	---	0.00	---	---	---	0.000	---	0.890
1.80	40,504	281.80	272.25 ic	0.92 ic	0.00	---	0.00	---	---	---	0.000	---	0.918
1.90	42,821	281.90	272.25 ic	0.94 ic	0.00	---	0.00	---	---	---	0.000	---	0.945
2.00	45,138	282.00	272.25 ic	0.97 ic	0.00	---	0.00	---	---	---	0.000	---	0.971
2.10	47,578	282.10	272.25 ic	1.00 ic	0.00	---	0.00	---	---	---	0.000	---	0.996
2.20	50,019	282.20	272.25 ic	1.02 ic	0.00	---	0.00	---	---	---	0.000	---	1.021

Continues on next page...

SOUTH POND

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
2.30	52,459	282.30	272.25 ic	1.05 ic	0.00	---	0.00	---	---	---	0.000	---	1.046
2.40	54,900	282.40	272.25 ic	1.07 ic	0.00	---	0.00	---	---	---	0.000	---	1.069
2.50	57,340	282.50	272.25 ic	1.09 ic	0.00	---	0.00	---	---	---	0.000	---	1.093
2.60	59,780	282.60	272.25 ic	1.12 ic	0.00	---	0.00	---	---	---	0.000	---	1.115
2.70	62,221	282.70	272.25 ic	1.14 ic	0.00	---	0.00	---	---	---	0.000	---	1.138
2.80	64,661	282.80	272.25 ic	1.16 ic	0.00	---	0.00	---	---	---	0.000	---	1.160
2.90	67,102	282.90	272.25 ic	1.18 ic	0.00	---	0.00	---	---	---	0.000	---	1.181
3.00	69,542	283.00	272.25 ic	1.20 ic	0.00	---	0.00	---	---	---	0.000	---	1.202
3.10	72,109	283.10	272.25 ic	1.22 ic	0.06 ic	---	0.00	---	---	---	0.000	---	1.283
3.20	74,676	283.20	272.25 ic	1.24 ic	0.19 ic	---	0.00	---	---	---	0.000	---	1.436
3.30	77,243	283.30	272.25 ic	1.26 ic	0.30 ic	---	0.00	---	---	---	0.000	---	1.560
3.40	79,810	283.40	272.25 ic	1.28 ic	0.37 ic	---	0.00	---	---	---	0.000	---	1.655
3.50	82,376	283.50	272.25 ic	1.30 ic	0.43 ic	---	0.00	---	---	---	0.000	---	1.737
3.60	84,943	283.60	272.25 ic	1.32 ic	0.49 ic	---	0.00	---	---	---	0.000	---	1.810
3.70	87,510	283.70	272.25 ic	1.34 ic	0.54 ic	---	0.00	---	---	---	0.000	---	1.878
3.80	90,077	283.80	272.25 ic	1.36 ic	0.58 ic	---	0.00	---	---	---	0.000	---	1.942
3.90	92,644	283.90	272.25 ic	1.38 ic	0.62 ic	---	0.00	---	---	---	0.000	---	2.002
4.00	95,211	284.00	272.25 ic	1.40 ic	0.66 ic	---	0.00	---	---	---	0.000	---	2.059
4.10	97,908	284.10	272.25 ic	1.41 ic	0.70 ic	---	0.00	---	---	---	0.000	---	2.114
4.20	100,604	284.20	272.25 ic	1.43 ic	0.74 ic	---	0.00	---	---	---	0.000	---	2.166
4.30	103,301	284.30	272.25 ic	1.45 ic	0.77 ic	---	0.00	---	---	---	0.000	---	2.217
4.40	105,998	284.40	272.25 ic	1.47 ic	0.80 ic	---	0.00	---	---	---	0.000	---	2.266
4.50	108,695	284.50	272.25 ic	1.48 ic	0.83 ic	---	0.00	---	---	---	0.000	---	2.314
4.60	111,391	284.60	272.25 ic	1.50 ic	0.86 ic	---	0.00	---	---	---	0.000	---	2.361
4.70	114,088	284.70	272.25 ic	1.52 ic	0.89 ic	---	0.00	---	---	---	0.000	---	2.406
4.80	116,785	284.80	272.25 ic	1.53 ic	0.92 ic	---	0.00	---	---	---	0.000	---	2.451
4.90	119,481	284.90	272.25 ic	1.55 ic	0.94 ic	---	0.00	---	---	---	0.000	---	2.494
5.00	122,178	285.00	272.25 ic	1.57 ic	0.97 ic	---	0.00	---	---	---	0.000	---	2.536
5.10	125,008	285.10	272.25 ic	1.58 ic	1.00 ic	---	0.00	---	---	---	0.000	---	2.578
5.20	127,837	285.20	272.25 ic	1.60 ic	1.02 ic	---	0.00	---	---	---	0.000	---	2.618
5.30	130,667	285.30	272.25 ic	1.61 ic	1.05 ic	---	0.00	---	---	---	0.000	---	2.658
5.40	133,497	285.40	272.25 ic	1.63 ic	1.07 ic	---	0.00	---	---	---	0.000	---	2.698
5.50	136,327	285.50	272.25 ic	1.64 ic	1.09 ic	---	0.00	---	---	---	0.000	---	2.736
5.60	139,156	285.60	272.25 ic	1.66 ic	1.12 ic	---	0.00	---	---	---	0.000	---	2.774
5.70	141,986	285.70	272.25 ic	1.67 ic	1.14 ic	---	0.00	---	---	---	0.000	---	2.812
5.80	144,816	285.80	272.25 ic	1.69 ic	1.16 ic	---	0.00	---	---	---	0.000	---	2.849
5.90	147,645	285.90	272.25 ic	1.70 ic	1.18 ic	---	0.00	---	---	---	0.000	---	2.885
6.00	150,475	286.00	272.25 ic	1.72 ic	1.20 ic	---	0.00	---	---	---	0.000	---	2.921
6.10	153,441	286.10	272.25 ic	1.73 ic	1.22 ic	---	0.00	---	---	---	0.000	---	2.956
6.20	156,407	286.20	272.25 ic	1.75 ic	1.24 ic	---	0.00	---	---	---	0.000	---	2.991
6.30	159,372	286.30	272.25 ic	1.76 ic	1.26 ic	---	0.00	---	---	---	0.000	---	3.025
6.40	162,338	286.40	272.25 ic	1.78 ic	1.28 ic	---	0.00	---	---	---	0.000	---	3.059
6.50	165,304	286.50	272.25 ic	1.79 ic	1.30 ic	---	0.00	---	---	---	0.000	---	3.093
6.60	168,270	286.60	272.25 ic	1.80 ic	1.32 ic	---	0.00	---	---	---	0.000	---	3.126
6.70	171,236	286.70	272.25 ic	1.82 ic	1.34 ic	---	0.00	---	---	---	0.000	---	3.158
6.80	174,201	286.80	272.25 ic	1.83 ic	1.36 ic	---	0.00	---	---	---	0.000	---	3.191
6.90	177,167	286.90	272.25 ic	1.85 ic	1.38 ic	---	0.00	---	---	---	0.000	---	3.223
7.00	180,133	287.00	272.25 ic	1.86 ic	1.40 ic	---	0.00	---	---	---	0.000	---	3.255
7.10	183,238	287.10	272.25 ic	1.87 ic	1.41 ic	---	0.00	---	---	---	0.000	---	3.286
7.20	186,343	287.20	272.25 ic	1.89 ic	1.43 ic	---	0.00	---	---	---	0.000	---	3.317
7.30	189,449	287.30	272.25 ic	1.90 ic	1.45 ic	---	0.00	---	---	---	0.000	---	3.348
7.40	192,554	287.40	272.25 ic	1.91 ic	1.47 ic	---	0.00	---	---	---	0.000	---	3.378
7.50	195,659	287.50	272.25 ic	1.93 ic	1.48 ic	---	0.00	---	---	---	0.000	---	3.408
7.60	198,764	287.60	272.25 ic	1.94 ic	1.50 ic	---	0.00	---	---	---	0.000	---	3.438
7.70	201,869	287.70	272.25 ic	1.95 ic	1.52 ic	---	0.00	---	---	---	0.000	---	3.468
7.80	204,975	287.80	272.25 ic	1.96 ic	1.53 ic	---	0.00	---	---	---	0.000	---	3.497
7.90	208,080	287.90	272.25 ic	1.98 ic	1.55 ic	---	0.00	---	---	---	0.000	---	3.526
8.00	211,185	288.00	272.25 ic	1.99 ic	1.57 ic	---	0.00	---	---	---	0.000	---	3.555
8.10	214,433	288.10	272.25 ic	2.00 ic	1.58 ic	---	0.00	---	---	---	0.000	---	3.583
8.20	217,681	288.20	272.25 ic	2.01 ic	1.60 ic	---	0.00	---	---	---	0.000	---	3.612
8.30	220,928	288.30	272.25 ic	2.03 ic	1.61 ic	---	0.00	---	---	---	0.000	---	3.640
8.40	224,176	288.40	272.25 ic	2.04 ic	1.63 ic	---	0.00	---	---	---	0.000	---	3.668
8.50	227,424	288.50	272.25 ic	2.05 ic	1.64 ic	---	0.00	---	---	---	0.000	---	3.695
8.60	230,672	288.60	272.25 ic	2.06 ic	1.66 ic	---	0.00	---	---	---	0.000	---	3.723
8.70	233,920	288.70	272.25 ic	2.08 ic	1.67 ic	---	0.00	---	---	---	0.000	---	3.750
8.80	237,167	288.80	272.25 ic	2.09 ic	1.69 ic	---	0.00	---	---	---	0.000	---	3.777
8.90	240,415	288.90	272.25 ic	2.10 ic	1.70 ic	---	0.00	---	---	---	0.000	---	3.804
9.00	243,663	289.00	272.25 ic	2.11 ic	1.72 ic	---	0.00	---	---	---	0.000	---	3.831
9.10	247,057	289.10	272.25 ic	2.12 ic	1.73 ic	---	0.00	---	---	---	0.000	---	3.857
9.20	250,450	289.20	272.25 ic	2.14 ic	1.75 ic	---	0.00	---	---	---	0.000	---	3.883
9.30	253,844	289.30	272.25 ic	2.15 ic	1.76 ic	---	0.00	---	---	---	0.000	---	3.909
9.40	257,237	289.40	272.25 ic	2.16 ic	1.78 ic	---	0.00	---	---	---	0.000	---	3.935

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Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
9.50	260,631	289.50	272.25 ic	2.17 ic	1.79 ic	---	0.00	---	---	---	0.000	---	3.961
9.60	264,024	289.60	272.25 ic	2.18 ic	1.80 ic	---	0.00	---	---	---	0.000	---	3.986
9.70	267,418	289.70	272.25 ic	2.19 ic	1.82 ic	---	0.00	---	---	---	0.000	---	4.012
9.80	270,811	289.80	272.25 ic	2.21 ic	1.83 ic	---	0.00	---	---	---	0.000	---	4.037
9.90	274,205	289.90	272.25 ic	2.22 ic	1.85 ic	---	0.00	---	---	---	0.000	---	4.062
10.00	277,598	290.00	272.25 ic	2.23 ic	1.86 ic	---	0.00	---	---	---	0.000	---	4.087
10.10	281,141	290.10	272.25 ic	2.24 ic	1.87 ic	---	0.00	---	---	---	0.000	---	4.112
10.20	284,683	290.20	272.25 ic	2.25 ic	1.89 ic	---	0.00	---	---	---	0.000	---	4.136
10.30	288,226	290.30	272.25 ic	2.26 ic	1.90 ic	---	0.00	---	---	---	0.000	---	4.161
10.40	291,768	290.40	272.25 ic	2.27 ic	1.91 ic	---	0.00	---	---	---	0.000	---	4.185
10.50	295,311	290.50	272.25 ic	2.28 ic	1.93 ic	---	0.00	---	---	---	0.000	---	4.209
10.60	298,854	290.60	272.25 ic	2.29 ic	1.94 ic	---	0.00	---	---	---	0.000	---	4.233
10.70	302,396	290.70	272.25 ic	2.31 ic	1.95 ic	---	0.00	---	---	---	0.000	---	4.257
10.80	305,939	290.80	272.25 ic	2.32 ic	1.96 ic	---	0.00	---	---	---	0.000	---	4.281
10.90	309,481	290.90	272.25 ic	2.33 ic	1.98 ic	---	0.00	---	---	---	0.000	---	4.304
11.00	313,024	291.00	272.25 ic	2.34 ic	1.99 ic	---	0.00	---	---	---	0.000	---	4.328
11.10	316,719	291.10	272.25 ic	2.35 ic	2.00 ic	---	2.53	---	---	---	0.000	---	6.878
11.20	320,413	291.20	272.25 ic	2.36 ic	2.01 ic	---	7.15	---	---	---	0.000	---	11.52
11.30	324,108	291.30	272.25 ic	2.37 ic	2.03 ic	---	13.13	---	---	---	0.000	---	17.53
11.40	327,803	291.40	272.25 ic	2.38 ic	2.04 ic	---	20.22	---	---	---	0.000	---	24.64
11.50	331,497	291.50	272.25 ic	2.39 ic	2.05 ic	---	28.26	---	---	---	0.000	---	32.70
11.60	335,192	291.60	272.25 ic	2.40 ic	2.06 ic	---	37.15	---	---	---	0.000	---	41.61
11.70	338,887	291.70	272.25 ic	2.41 ic	2.08 ic	---	46.81	---	---	---	0.000	---	51.30
11.80	342,582	291.80	272.25 ic	2.42 ic	2.09 ic	---	57.19	---	---	---	0.000	---	61.70
11.90	346,276	291.90	272.25 ic	2.43 ic	2.10 ic	---	68.24	---	---	---	0.000	---	72.78
12.00	349,971	292.00	272.25 ic	2.44 ic	2.11 ic	---	79.92	---	---	---	0.000	---	84.48
12.10	353,821	292.10	272.25 ic	2.45 ic	2.12 ic	---	92.20	---	---	---	0.000	---	96.78
12.20	357,671	292.20	272.25 ic	2.46 ic	2.14 ic	---	105.06	---	---	---	0.000	---	109.66
12.30	361,521	292.30	272.25 ic	2.47 ic	2.15 ic	---	118.46	---	---	---	0.000	---	123.08
12.40	365,371	292.40	272.25 ic	2.48 ic	2.16 ic	---	132.39	---	---	---	0.000	---	137.03
12.50	369,221	292.50	272.25 ic	2.49 ic	2.17 ic	---	146.83	---	---	---	0.000	---	151.49
12.60	373,071	292.60	272.25 ic	2.50 ic	2.18 ic	---	161.75	---	---	---	0.000	---	166.44
12.70	376,921	292.70	272.25 ic	2.51 ic	2.19 ic	---	177.15	---	---	---	0.000	---	181.86
12.80	380,771	292.80	272.25 ic	2.52 ic	2.21 ic	---	193.01	---	---	---	0.000	---	197.74
12.90	384,621	292.90	272.25 ic	2.53 ic	2.22 ic	---	209.32	---	---	---	0.000	---	214.07
13.00	388,471	293.00	272.25 ic	2.54 ic	2.23 ic	---	226.05	---	---	---	0.000	---	230.82
13.10	392,480	293.10	272.25 ic	2.55 ic	2.24 ic	---	243.21	---	---	---	0.000	---	248.01
13.20	396,488	293.20	272.25 ic	2.56 ic	2.25 ic	---	260.79	---	---	---	0.000	---	265.61
13.30	400,497	293.30	283.59 ic	2.55 ic	2.26 ic	---	278.77	---	---	---	0.000	---	283.59
13.40	404,505	293.40	301.93 ic	2.50 ic	2.27 ic	---	297.15	---	---	---	0.000	---	301.93
13.50	408,514	293.50	320.65 ic	2.45 ic	2.28 ic	---	315.92	---	---	---	0.000	---	320.65
13.60	412,523	293.60	339.75 ic	2.39 ic	2.29 ic	---	335.06	---	---	---	0.000	---	339.75
13.70	416,531	293.70	359.21 ic	2.32 ic	2.31 ic	---	354.58	---	---	---	0.000	---	359.21
13.80	420,540	293.80	378.96 ic	2.25 ic	2.25 ic	---	374.46	---	---	---	0.000	---	378.95
13.90	424,548	293.90	399.02 ic	2.16 ic	2.16 ic	---	394.70	---	---	---	0.000	---	399.02
14.00	428,557	294.00	419.41 ic	2.07 ic	2.07 ic	---	415.28	---	---	---	0.000	---	419.41
14.10	432,727	294.10	419.16 ic	2.08 ic	2.08 ic	---	340.80 ic	---	---	---	0.000	---	344.96
14.20	436,898	294.20	418.92 ic	2.09 ic	2.09 ic	---	346.26 ic	---	---	---	0.000	---	350.44
14.30	441,068	294.30	418.67 ic	2.11 ic	2.11 ic	---	351.62 ic	---	---	---	0.000	---	355.84
14.40	445,239	294.40	418.43 ic	2.12 ic	2.12 ic	---	356.91 ic	---	---	---	0.000	---	361.15
14.50	449,409	294.50	418.19 ic	2.13 ic	2.13 ic	---	362.12 ic	---	---	---	0.000	---	366.39
14.60	453,579	294.60	417.94 ic	2.15 ic	2.15 ic	---	367.26 ic	---	---	---	0.000	---	371.55
14.70	457,750	294.70	417.70 ic	2.16 ic	2.16 ic	---	372.33 ic	---	---	---	0.000	---	376.65
14.80	461,920	294.80	417.45 ic	2.17 ic	2.17 ic	---	377.32 ic	---	---	---	0.000	---	381.67
14.90	466,091	294.90	417.21 ic	2.19 ic	2.19 ic	---	382.26 ic	---	---	---	0.000	---	386.63
15.00	470,261	295.00	416.96 ic	2.20 ic	2.20 ic	---	387.12 ic	---	---	---	0.000	---	391.52
15.10	474,596	295.10	416.72 ic	2.21 ic	2.21 ic	---	391.93 ic	---	---	---	0.000	---	396.36
15.20	478,932	295.20	416.48 ic	2.22 ic	2.22 ic	---	396.68 ic	---	---	---	0.000	---	401.13
15.30	483,267	295.30	416.23 ic	2.24 ic	2.24 ic	---	401.38 ic	---	---	---	0.000	---	405.85
15.40	487,603	295.40	415.98 ic	2.25 ic	2.25 ic	---	406.02 ic	---	---	---	0.000	---	410.52
15.50	491,938	295.50	415.74 ic	2.26 ic	2.26 ic	---	410.61 ic	---	---	---	0.000	---	415.13
15.60	496,273	295.60	419.65 ic	2.25 ic	2.25 ic	---	415.15 ic	---	---	---	0.000	---	419.65
15.70	500,609	295.70	424.12 ic	2.24 ic	2.24 ic	---	419.63 ic	---	---	---	0.000	---	424.12
15.80	504,944	295.80	428.54 ic	2.23 ic	2.23 ic	---	424.08 ic	---	---	---	0.000	---	428.53
15.90	509,280	295.90	432.91 ic	2.22 ic	2.22 ic	---	428.47 ic	---	---	---	0.000	---	432.91
16.00	513,615	296.00	437.23 ic	2.21 ic	2.21 ic	---	432.82 ic	---	---	---	0.000	---	437.23
16.10	518,119	296.10	441.51 ic	2.19 ic	2.19 ic	---	437.12 ic	---	---	---	0.000	---	441.51
16.20	522,622	296.20	445.76 ic	2.18 ic	2.18 ic	---	441.39 ic	---	---	---	0.000	---	445.76
16.30	527,126	296.30	449.96 ic	2.17 ic	2.17 ic	---	445.61 ic	---	---	---	0.000	---	449.96
16.40	531,629	296.40	454.12 ic	2.16 ic	2.16 ic	---	449.80 ic	---	---	---	0.000	---	454.12
16.50	536,133	296.50	458.24 ic	2.15 ic	2.15 ic	---	453.94 ic	---	---	---	0.000	---	458.24
16.60	540,636	296.60	462.32 ic	2.13 ic	2.13 ic	---	458.05 ic	---	---	---	0.000	---	462.32

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Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
16.70	545,140	296.70	466.37 ic	2.12 ic	2.12 ic	---	462.12 ic	---	---	---	0.000	---	466.37
16.80	549,643	296.80	470.38 ic	2.11 ic	2.11 ic	---	466.16 ic	---	---	---	0.000	---	470.38
16.90	554,147	296.90	474.36 ic	2.10 ic	2.10 ic	---	470.16 ic	---	---	---	0.000	---	474.36
17.00	558,650	297.00	478.30 ic	2.09 ic	2.09 ic	---	474.13 ic	---	---	---	0.000	---	478.30
17.10	563,325	297.10	482.21 ic	2.07 ic	2.07 ic	---	478.06 ic	---	---	---	0.000	---	482.21
17.20	568,000	297.20	486.09 ic	2.06 ic	2.06 ic	---	481.97 ic	---	---	---	0.000	---	486.09
17.30	572,675	297.30	489.94 ic	2.05 ic	2.05 ic	---	485.84 ic	---	---	---	0.000	---	489.93
17.40	577,350	297.40	493.75 ic	2.04 ic	2.04 ic	---	489.68 ic	---	---	---	0.000	---	493.75
17.50	582,024	297.50	497.54 ic	2.02 ic	2.02 ic	---	493.49 ic	---	---	---	0.000	---	497.54
17.60	586,699	297.60	501.29 ic	2.01 ic	2.01 ic	---	497.27 ic	---	---	---	0.000	---	501.29
17.70	591,374	297.70	505.02 ic	2.00 ic	2.00 ic	---	501.02 ic	---	---	---	0.000	---	505.02
17.80	596,049	297.80	508.72 ic	1.98 ic	1.98 ic	---	504.75 ic	---	---	---	0.000	---	508.72
17.90	600,724	297.90	512.39 ic	1.97 ic	1.97 ic	---	508.45 ic	---	---	---	0.000	---	512.39
18.00	605,399	298.00	516.03 ic	1.96 ic	1.96 ic	---	512.12 ic	---	---	---	0.000	---	516.03
18.10	610,249	298.10	519.65 ic	1.95 ic	1.95 ic	---	515.76 ic	---	---	---	0.000	---	519.65
18.20	615,098	298.20	523.25 ic	1.93 ic	1.93 ic	---	519.38 ic	---	---	---	0.000	---	523.25
18.30	619,948	298.30	526.81 ic	1.92 ic	1.92 ic	---	522.98 ic	---	---	---	0.000	---	526.81
18.40	624,797	298.40	637.73 ic	0.48 ic	0.48 ic	---	636.73 s	---	---	---	0.000	---	637.69
18.50	629,647	298.50	639.39 ic	0.47 ic	0.47 ic	---	638.44 s	---	---	---	0.000	---	639.38
18.60	634,496	298.60	641.04 ic	0.46 ic	0.46 ic	---	640.10 s	---	---	---	0.000	---	641.02
18.70	639,346	298.70	642.68 ic	0.45 ic	0.45 ic	---	641.73 s	---	---	---	0.000	---	642.64
18.80	644,195	298.80	644.30 ic	0.45 ic	0.45 ic	---	643.35 s	---	---	---	0.000	---	644.24
18.90	649,045	298.90	645.91 ic	0.44 ic	0.44 ic	---	645.02 s	---	---	---	0.000	---	645.90
19.00	653,894	299.00	647.50 ic	0.43 ic	0.43 ic	---	646.63 s	---	---	---	0.000	---	647.50
19.10	658,921	299.10	649.09 ic	0.43 ic	0.43 ic	---	648.21 s	---	---	---	0.000	---	649.06
19.20	663,949	299.20	650.67 ic	0.42 ic	0.42 ic	---	649.80 s	---	---	---	0.000	---	650.64
19.30	668,976	299.30	652.24 ic	0.41 ic	0.41 ic	---	651.34 s	---	---	---	0.000	---	652.17
19.40	674,003	299.40	653.79 ic	0.41 ic	0.41 ic	---	652.94 s	---	---	---	0.000	---	653.75
19.50	679,031	299.50	655.34 ic	0.40 ic	0.40 ic	---	654.51 s	---	---	---	0.000	---	655.31
19.60	684,058	299.60	656.88 ic	0.40 ic	0.40 ic	---	656.00 s	---	---	---	0.000	---	656.80
19.70	689,085	299.70	658.41 ic	0.39 ic	0.39 ic	---	657.61 s	---	---	---	0.000	---	658.39
19.80	694,113	299.80	659.93 ic	0.39 ic	0.39 ic	---	659.09 s	---	---	---	0.000	---	659.87
19.90	699,140	299.90	661.44 ic	0.38 ic	0.38 ic	---	660.64 s	---	---	---	0.000	---	661.40
20.00	704,167	300.00	662.95 ic	0.38 ic	0.38 ic	---	662.11 s	---	---	---	0.000	---	662.87

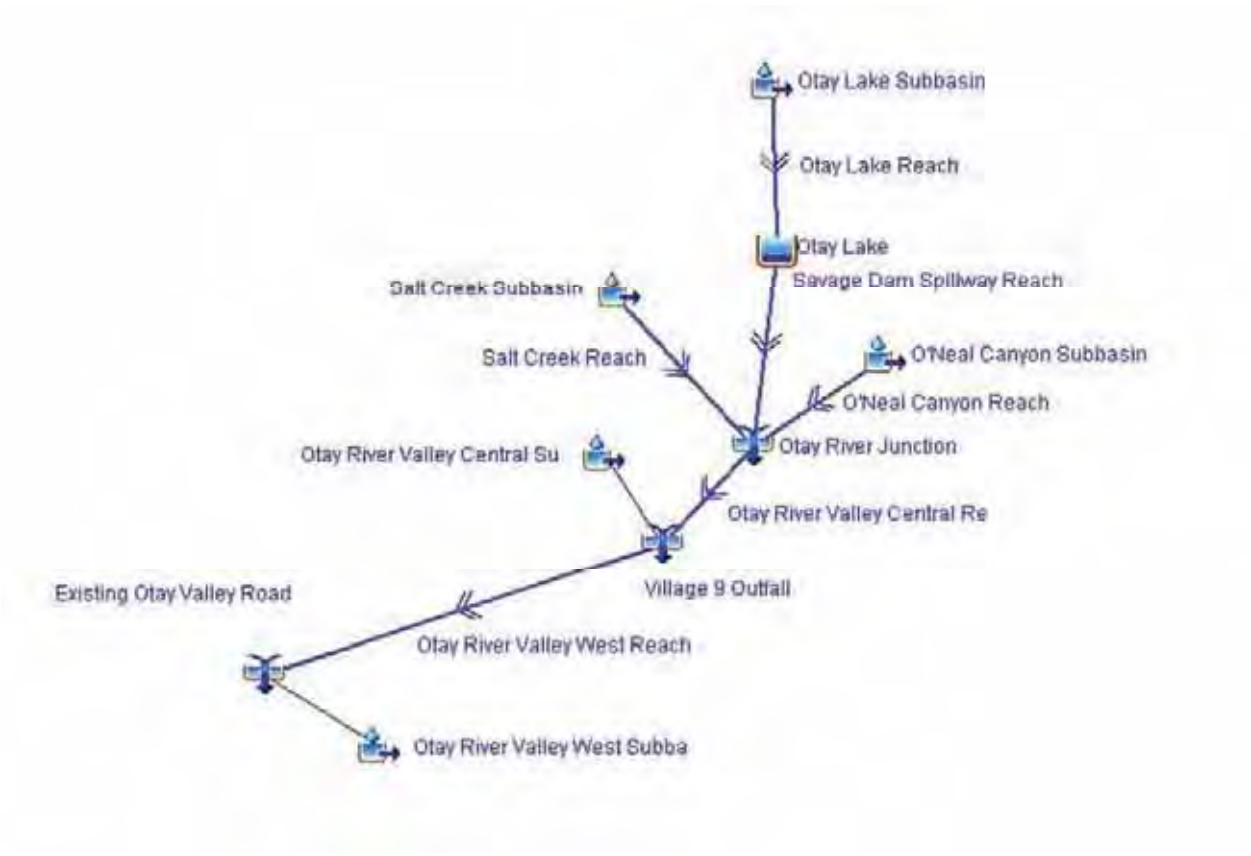
...End

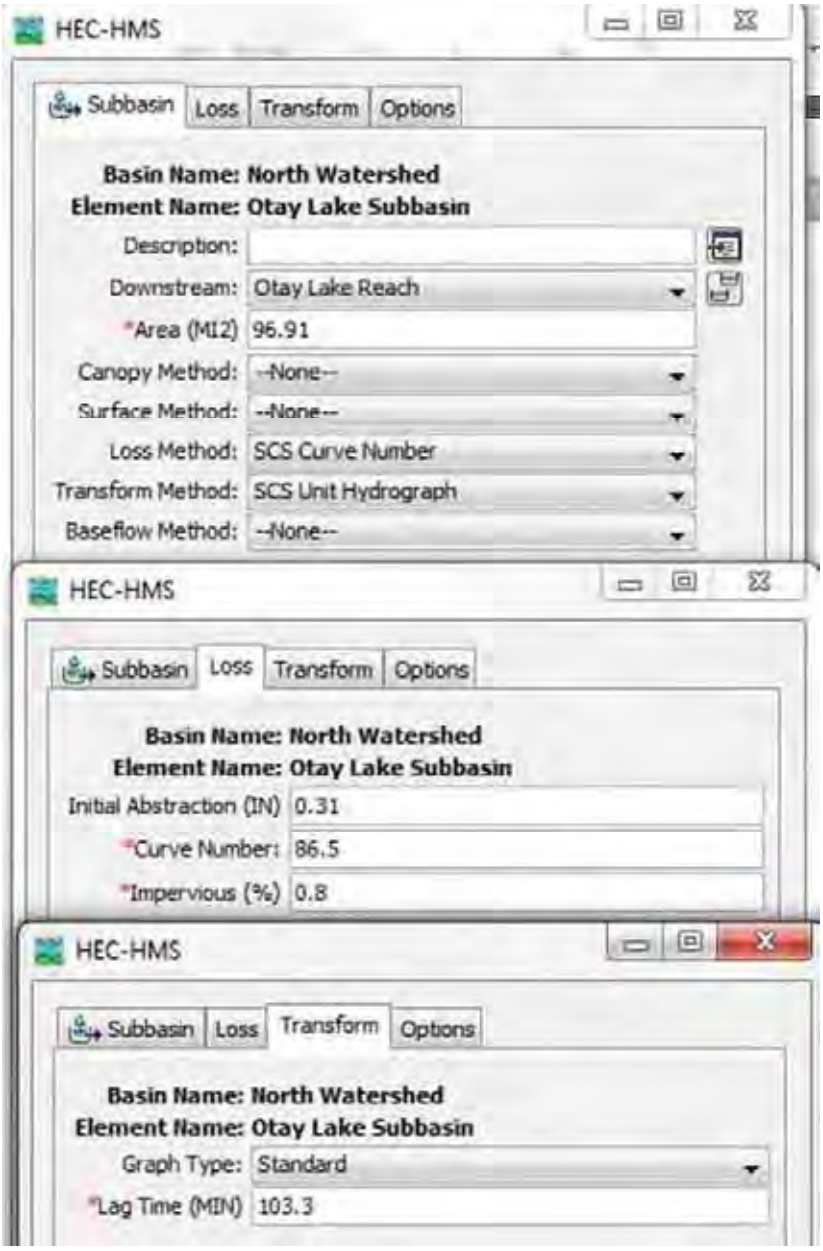
CHAPTER 5

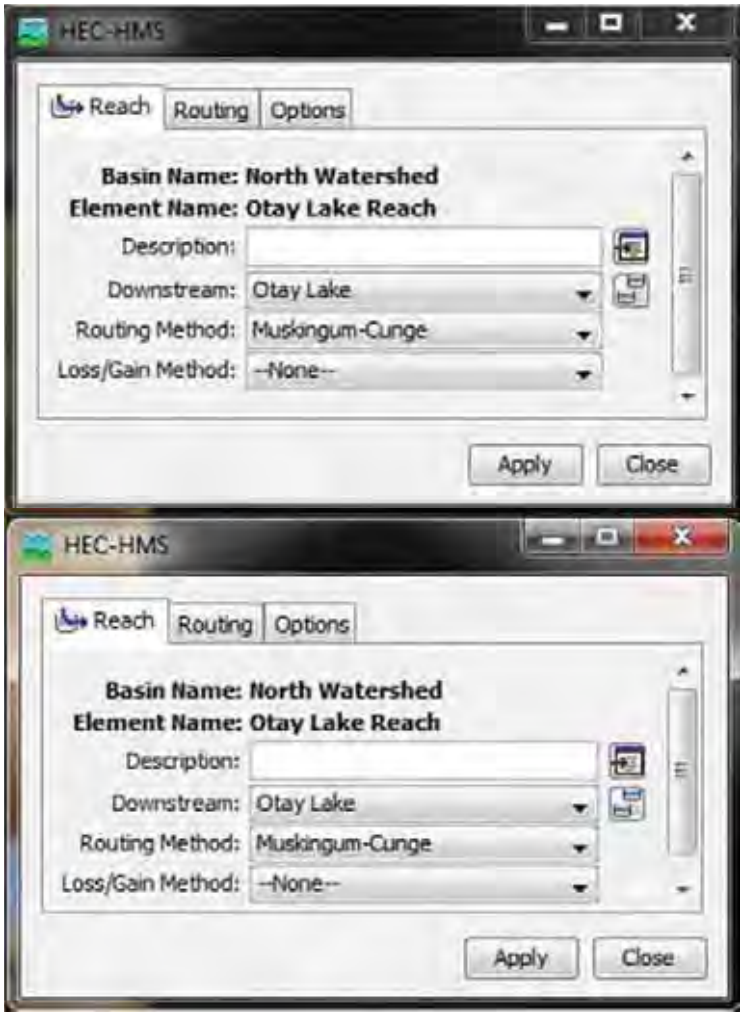
HEC-HMS STUDY FOR OTAY RIVER WATERSHED FOR TIME TO PEAK DETERMINATION FOR 100-YEAR, 24-HOUR STORM EVENT

Refer to Exhibits 1.5 and 1.6 in Chapter 7

Otay River Valley Existing Condition HEC HMS Analysis




HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay Lake Subbasin
Description:
Downstream: Otay Lake Reach
*Area (MI2) 96.91
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay Lake Subbasin
Initial Abstraction (IN) 0.31
*Curve Number: 86.5
*Impervious (%) 0.8
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay Lake Subbasin
Graph Type: Standard
*Lag Time (MIN) 103.3


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay Lake Reach
Description:
Downstream: Otay Lake
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
Apply
Close
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay Lake Reach
Description:
Downstream: Otay Lake
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
Apply
Close

OTAY RANCH VILLAGE 9 Otay River Analysis
Otay Lake Subbasin & Reach

Existing Conditions

DRAINAGE AREA	62024.0 acres	
	96.913	mi^2

98	0	acres	(Major Arterials)
92	0	acres	(Commercial Development)
91	0	acres	(Mixed Use - Schools, Hospital)
90	0	acres	(High Density Residential Development)
87	1024	acres	(Single-Family Residential Development)
81	61000	acres	(Open Space)

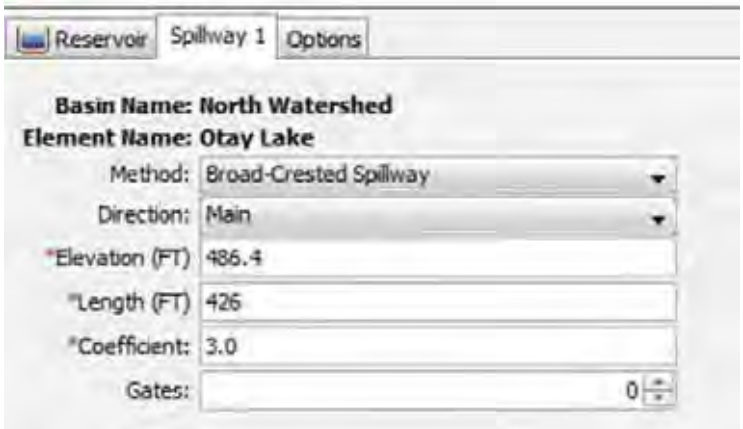
CURVE NUMBER =	81.1	AMC=2.0
	86.5	AMC=2.5

Average n	0.035	
m	0.38	
L	13.51	miles
Lc	6.755	miles
U/S Elev.	3060	feet
D/S Elev.	486.4	feet
S	190	ft/mile

LAG TIME =	1.722	hours
	103.3	min

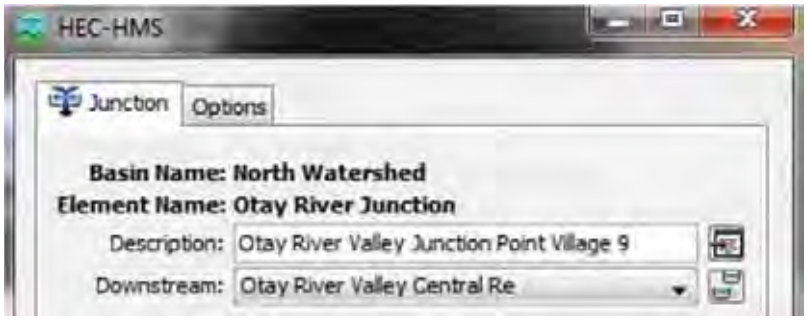
SOIL GROUP D ASSUMED

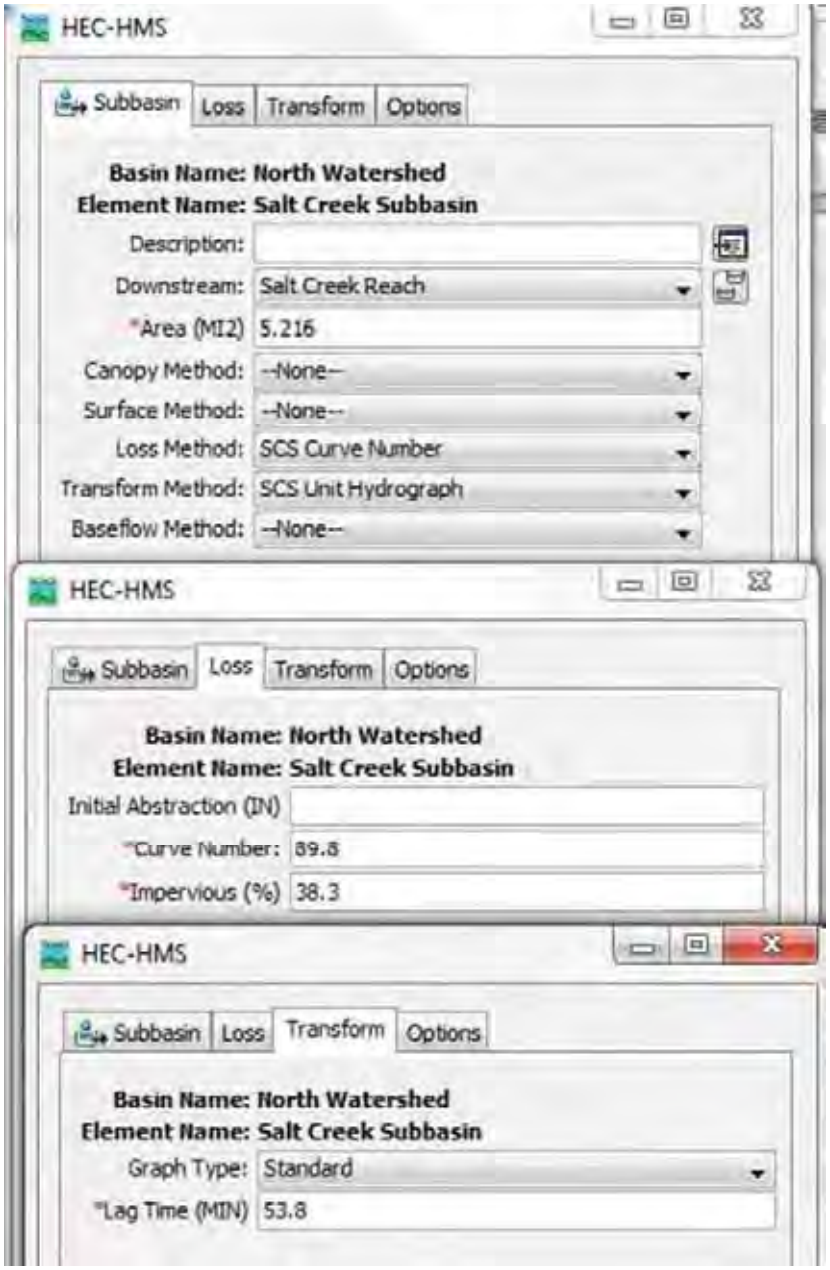
HEC-HMS
Reservoir
Options
Basin Name: North Watershed
Element Name: Otay Lake
Description: Lower Otay Reservoir
Downstream: Savage Dam Spillway Reach
Method: Outflow Structures
Storage Method: Elevation-Area
*Elev-Area Function: Reservoir Elev-Area
Initial Condition: Elevation
*Initial Elevation (FT) 486.4
Main Tailwater: Assume None
Auxiliary: --None--
Time Step Method: Automatic Adaption
Outlets: 0
Spillways: 1
Dam Tops: 0
Pumps: 0
Dam Break: No
Dam Seepage: No
Release: No
Evaporation: No
Apply
Close

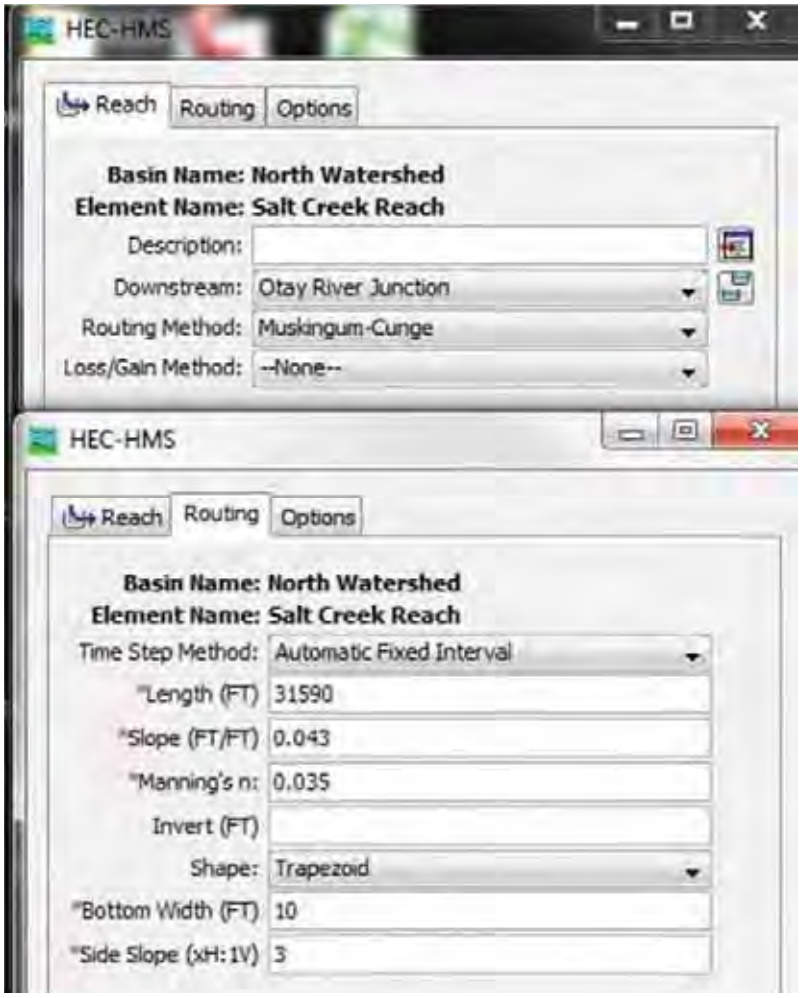

Reservoir
Spillway 1
Options
Basin Name: North Watershed
Element Name: Otay Lake
Method: Broad-Crested Spillway
Direction: Main
*Elevation (FT) 486.4
*Length (FT) 426
*Coefficient: 3.0
Gates: 0

HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Savage Dam Spillway Reach
Description: Channel from Reservoir to Otay River Valle
Downstream: Otay River Junction
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
Apply
Close

HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Savage Dam Spillway Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 10920
*Slope (FT/FT) 0.023
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 10
*Side Slope (xH:1V) 3
Apply
Close


HEC-HMS
Junction
Options
Basin Name: North Watershed
Element Name: Otay River Junction
Description: Otay River Valley Junction Point Village 9
Downstream: Otay River Valley Central Re


HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Salt Creek Subbasin
Description:
Downstream: Salt Creek Reach
*Area (MI2) 5.216
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Salt Creek Subbasin
Initial Abstraction (IN)
*Curve Number: 89.8
*Impervious (%) 38.3
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Salt Creek Subbasin
Graph Type: Standard
*Lag Time (MIN) 53.8


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Salt Creek Reach
Description:
Downstream: Otay River Junction
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Salt Creek Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 31590
*Slope (FT/FT) 0.043
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 10
*Side Slope (xH:1V) 3

OTAY RANCH VILLAGE 9 Otay River Analysis
Salt Creek Subbasin & Reach

Existing Conditions

DRAINAGE	3338.0 acres
AREA	5.216 mi^2

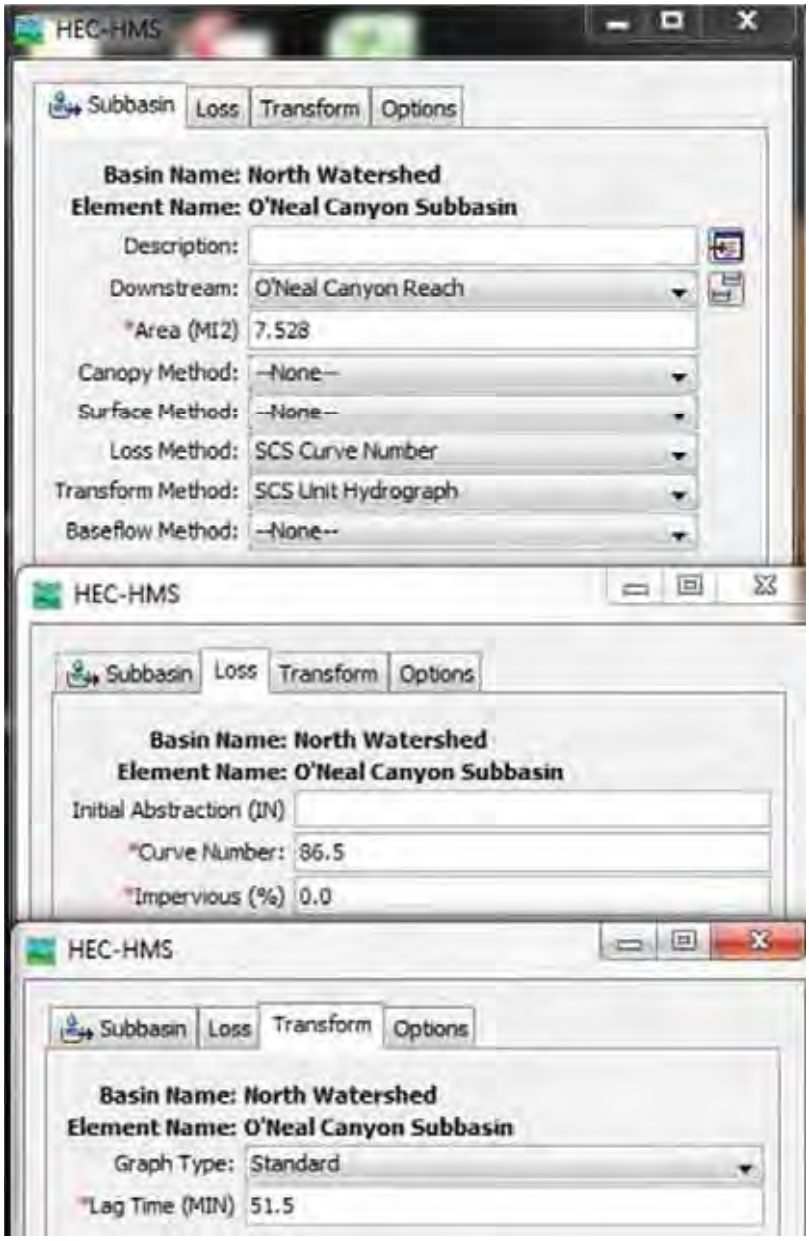
Curve Number			
98	0	acres	(Major Arterials)
92	0	acres	(Commercial Development)
91	0	acres	(Mixed Use - Schools, Hospital)
90	0	acres	(High Density Residential Development)
87	2556	acres	(Single-Family Residential Development)
81	782	acres	(Open Space)

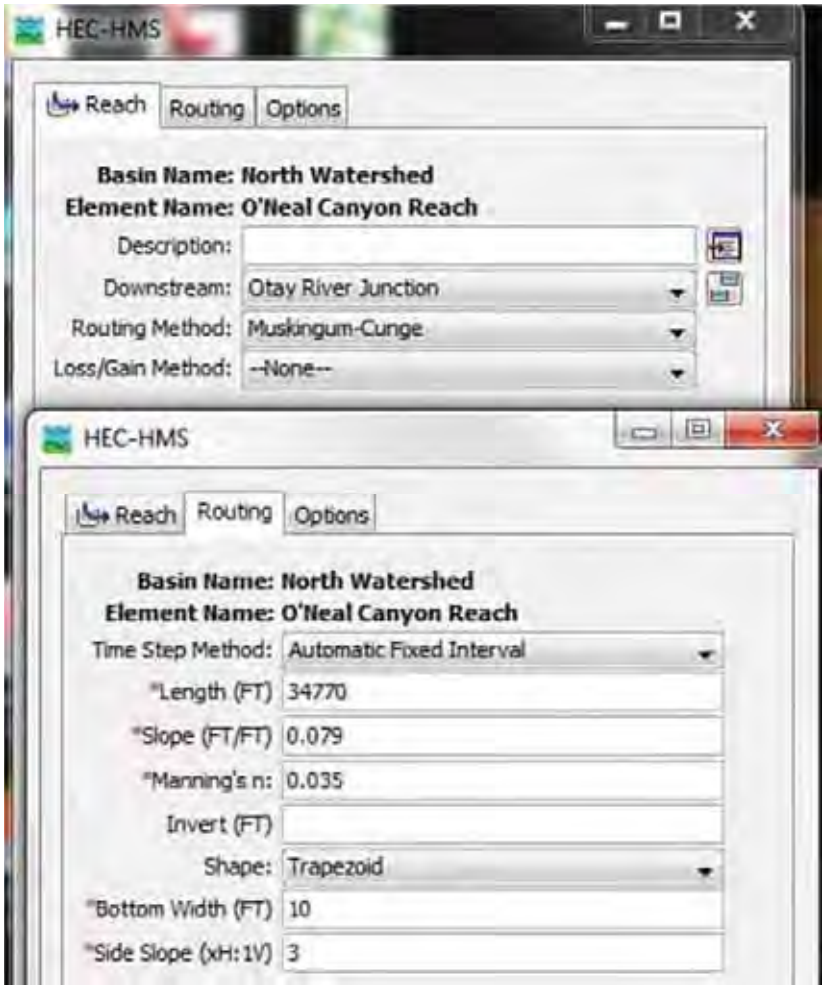
CURVE NUMBER =	85.6	AMC=2.0
Adjusted CN=	**89.8**	AMC=2.5

Average n	0.035	
m	0.38	
L	5.98	miles
Lc	2.99	miles
U/S Elev.	1600	feet
D/S Elev.	240	feet
S	227	ft/mile

LAG TIME =	**0.896**	**hours**
	53.8	**min**

SOIL GROUP D ASSUMED


HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Subbasin
Description:
Downstream: O'Neal Canyon Reach
*Area (MI2) 7.528
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Subbasin
Initial Abstraction (IN)
*Curve Number: 86.5
*Impervious (%) 0.0
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Subbasin
Graph Type: Standard
*Lag Time (MIN) 51.5


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Reach
Description:
Downstream: Otay River Junction
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 34770
*Slope (FT/FT) 0.079
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 10
*Side Slope (xH:1V) 3

OTAY RANCH VILLAGE 9 Otay River Analysis
O'Neal Canyon Subbasin & Reach

Existing Conditions

DRAINAGE AREA	4822.0 acres	
	7.534	mi^2

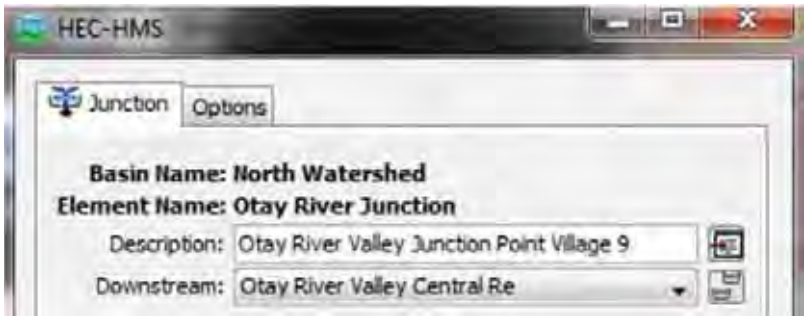
CN = 98	0	acres	(Major Arterials)
CN = 92	0	acres	(Commercial Development)
CN = 91	0	acres	(Mixed Use - Schools, Hospital)
CN = 90	0	acres	(High Density Residential Development)
CN = 87	0	acres	(Single-Family Residential Development)
CN = 81	4822	acres	(Open Space)

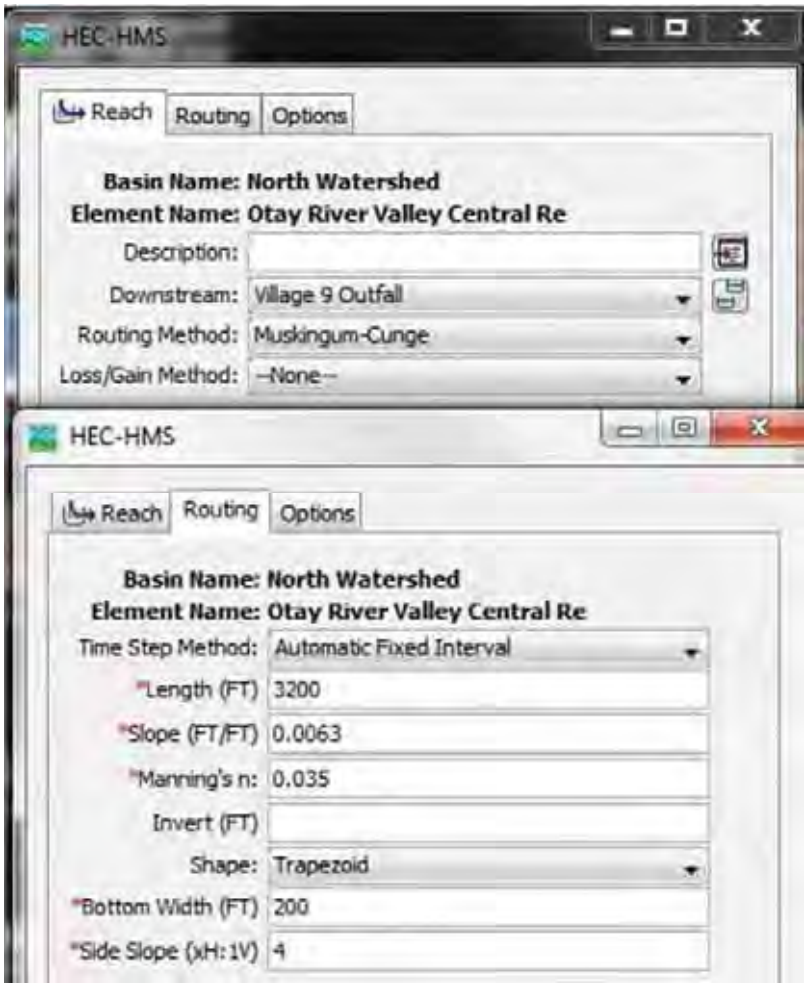
CURVE NUMBER =	81.0	AMC=2.0
	86.5	AMC=2.5

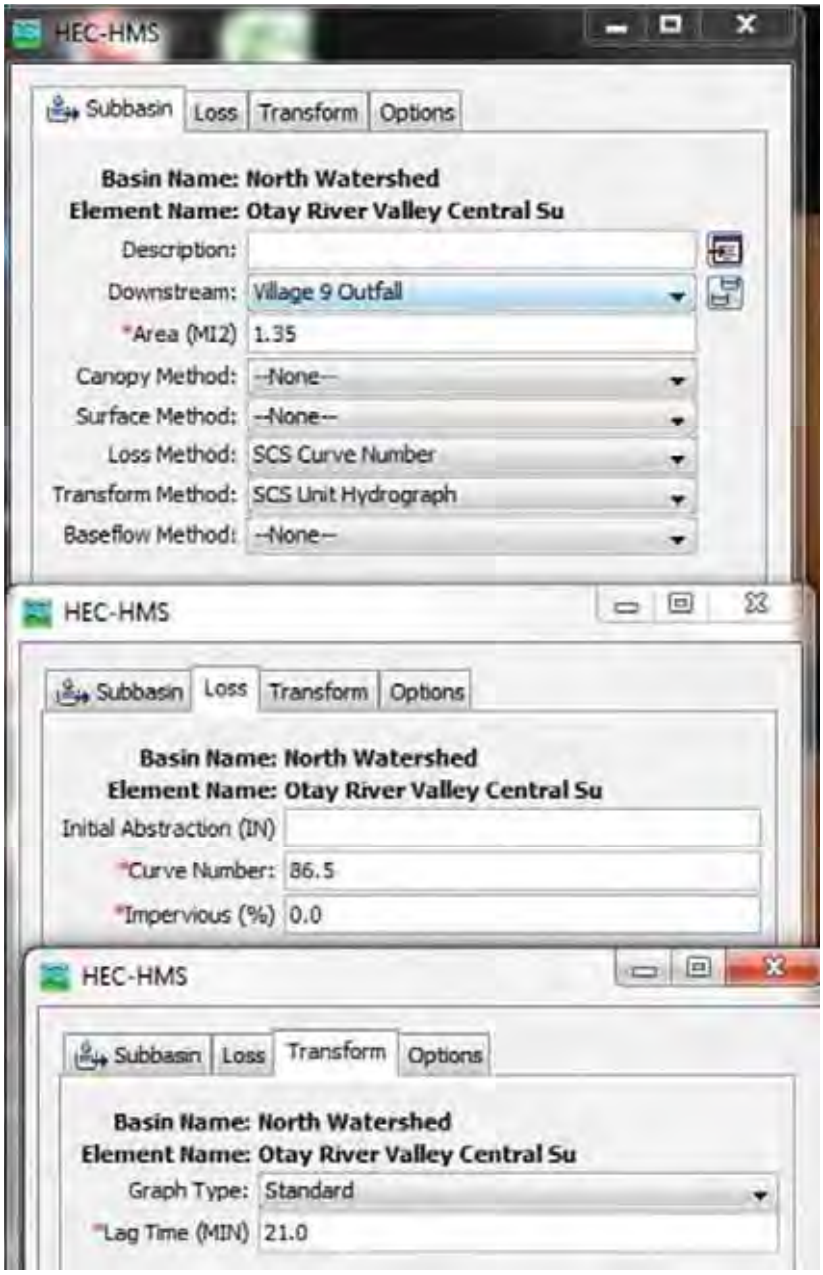
Average n	0.035	
m	0.38	
L	6.58	miles
Lc	3.29	miles
U/S Elev.	3000	feet
D/S Elev.	240	feet
S	419	ft/mile

LAG TIME =	0.858	hours
	51.5	min

SOIL GROUP D ASSUMED


HEC-HMS
Junction
Options
Basin Name: North Watershed
Element Name: Otay River Junction
Description: Otay River Valley Junction Point Village 9
Downstream: Otay River Valley Central Re


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Re
Description:
Downstream: Village 9 Outfall
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Re
Time Step Method: Automatic Fixed Interval
*Length (FT) 3200
*Slope (FT/FT) 0.0063
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 200
*Side Slope (xH:1V) 4


HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Su
Description:
Downstream: Village 9 Outfall
*Area (MI2) 1.35
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Su
Initial Abstraction (IN)
*Curve Number: 86.5
*Impervious (%) 0.0
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Su
Graph Type: Standard
*Lag Time (MIN) 21.0

OTAY RANCH VILLAGE 9 Otay River Analysis
Otay River Valley Central Subbasin

Existing Conditions

DRAINAGE	865.0 acres	
AREA	1.352	mi^2

CN = 98	0	acres	(Major Arterials)
CN = 92	0	acres	(Commercial Development)
CN = 91	0	acres	(Mixed Use - Schools, Hospital)
CN = 90	0	acres	(High Density Residential Development)
CN = 87	0	acres	(Single-Family Residential Development)
CN = 81	865	acres	(Open Space)

CURVE NUMBER =	81.0	AMC=2.0
	86.5	AMC=2.5

Average n	0.035	
m	0.38	
L	1.77	miles
Lc	0.885	miles
U/S Elev.	660	feet
D/S Elev.	220	feet
S	249	ft/mile

LAG TIME =	0.349	hours
	21.0	min

SOIL GROUP D ASSUMED

Global Summary Results for Run "100yr 6hr"

Project: 0917 HMS-EX Simulation Run: 100yr 6hr

Start of Run: 01Jan2011, 00:00 Basin Model: North Watershed
End of Run: 08Jan2011, 00:00 Meteorologic Model: 100yr 6hr
Compute Time: 21Mar2011, 10:01:16 Control Specifications: 100 Year

Show Elements: Initial Selection Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Village 9 Outfall	111.004	6577.7	01Jan2011, 09:05	1.12

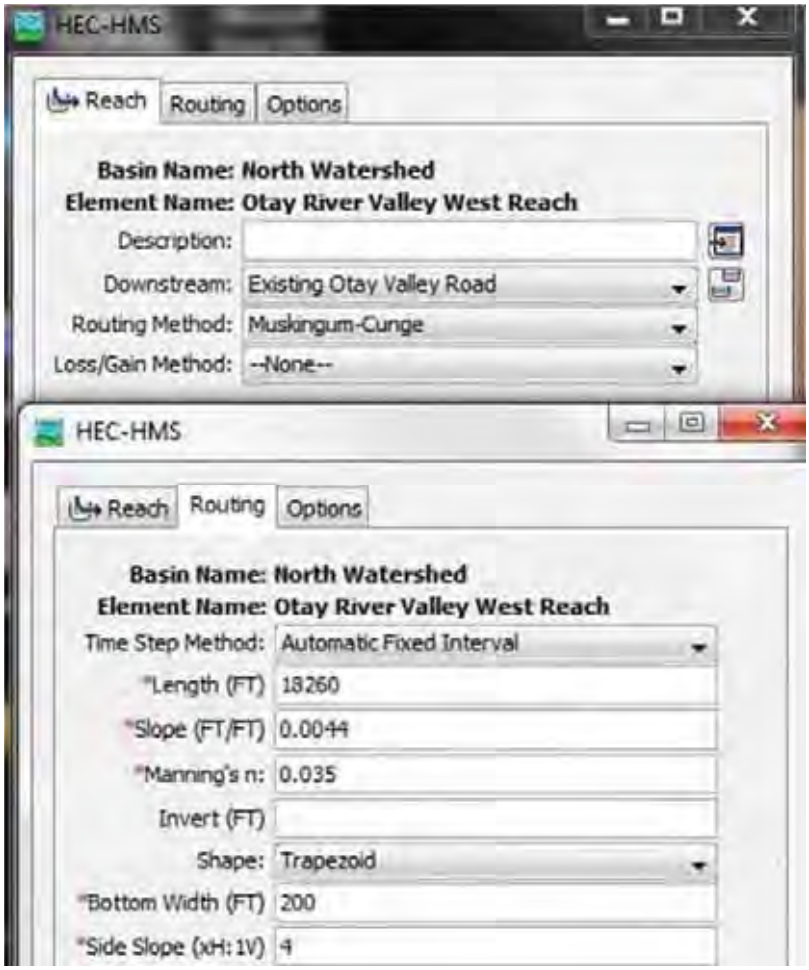
Global Summary Results for Run "100yr 24hr"

Project: 0917 HMS-EX Simulation Run: 100yr 24hr

Start of Run: 01Jan2011, 00:00 Basin Model: North Watershed
End of Run: 08Jan2011, 00:00 Meteorologic Model: 100yr 24hr
Compute Time: 21Mar2011, 10:02:38 Control Specifications: 100 Year

Show Elements: Initial Selection Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Village 9 Outfall	111.004	18735.2	01Jan2011, 20:50	3.67


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Reach
Description:
Downstream: Existing Otay Valley Road
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 18260
*Slope (FT/FT) 0.0044
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 200
*Side Slope (xH:1V) 4

HEC-HMS
Junction
Options
Basin Name: North Watershed
Element Name: Existing Otay Valley Road
Description:
Downstream: --None--

HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Subba
Description:
Downstream: Existing Otay Valley Road
*Area (MI2) 9.85
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Subba
Initial Abstraction (IN)
*Curve Number: 86.8
*Impervious (%) 4.04
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Subba
Graph Type: Standard
*Lag Time (MIN) 67.9

OTAY RANCH VILLAGE 9 Otay River Analysis
Otay River Valley West Subbasin

Existing Conditions

DRAINAGE	6305.0 acres	
AREA	9.852	mi^2

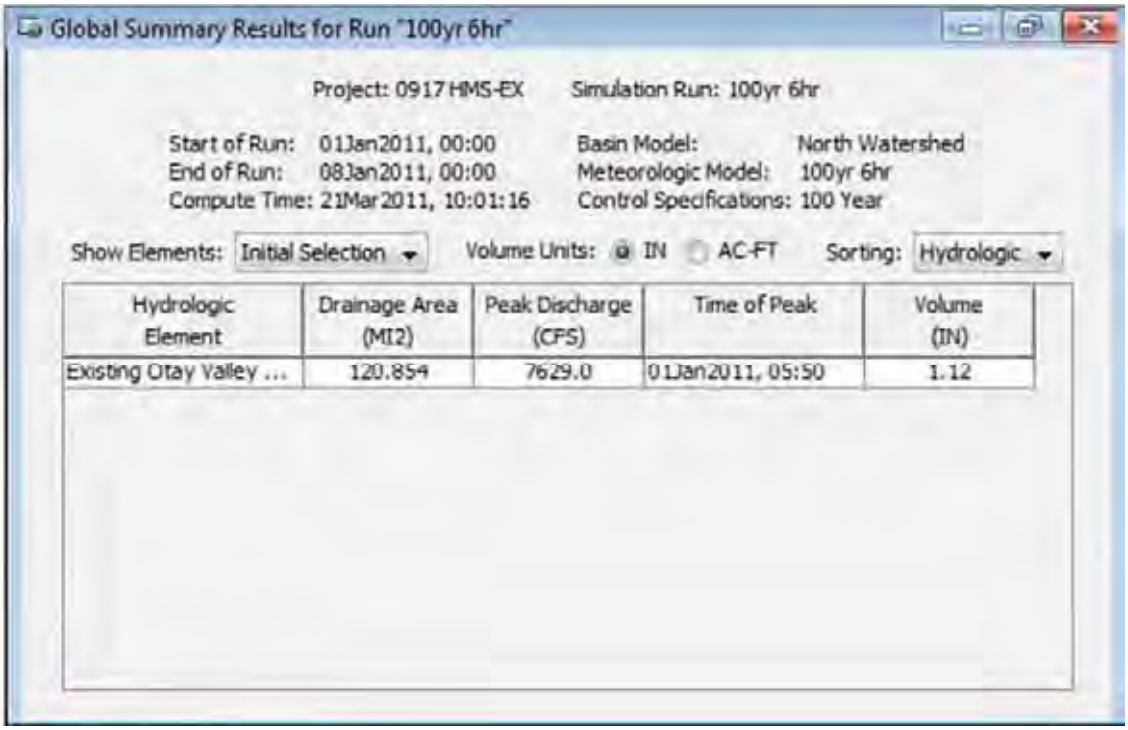
CN = 98	0	acres	(Major Arterials)
CN = 92	0	acres	(Commercial Development)
CN = 91	0	acres	(Mixed Use - Schools, Hospital)
CN = 90	0	acres	(High Density Residential Development)
CN = 87	510	acres	(Single-Family Residential Development)
CN = 81	5795	acres	(Open Space)

CURVE NUMBER =	81.5	AMC=2.0
	86.8	AMC=2.5

Average n	0.035	
m	0.38	
L	6.88	miles
Lc	3.44	miles
U/S Elev.	940	feet
D/S Elev.	140	feet
S	116	ft/mile

LAG TIME =	1.132	hours
	67.9	min

SOIL GROUP D ASSUMED



Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Otay Valley ...	120.854	7629.0	01Jan2011, 05:50	1.12

Global Summary Results for Run "100yr 24hr"

Project: 0917 HMS-EX Simulation Run: 100yr 24hr

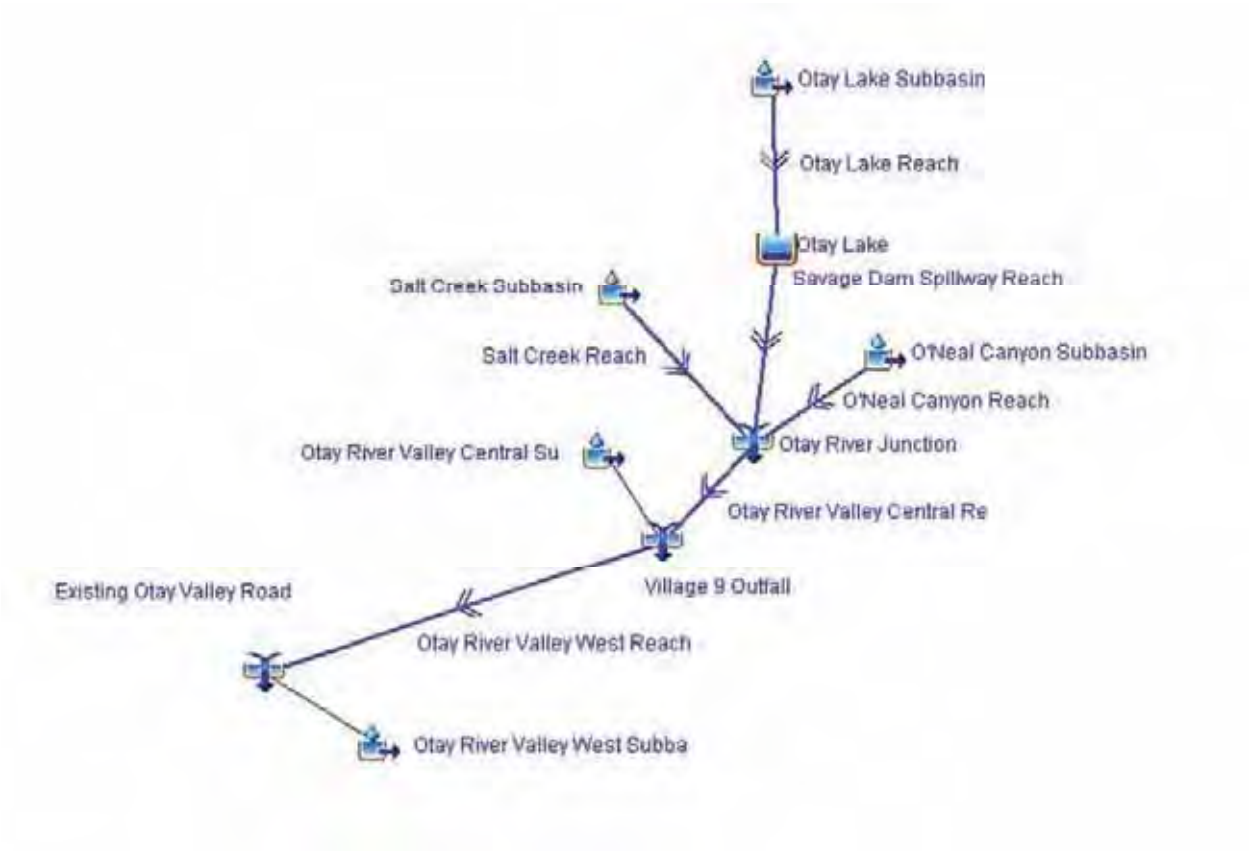
Start of Run: 01Jan2011, 00:00
End of Run: 08Jan2011, 00:00
Compute Time: 21Mar2011, 10:02:38

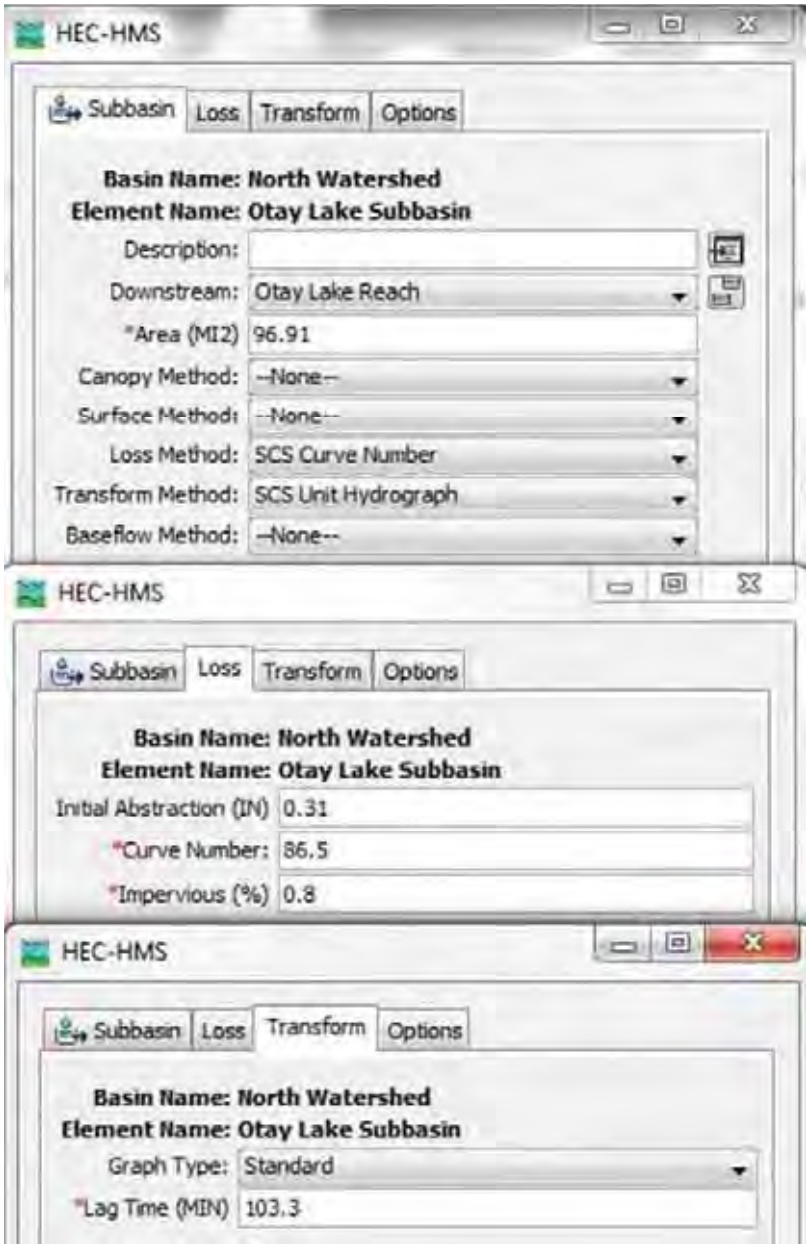
Basin Model: North Watershed
Meteorologic Model: 100yr 24hr
Control Specifications: 100 Year

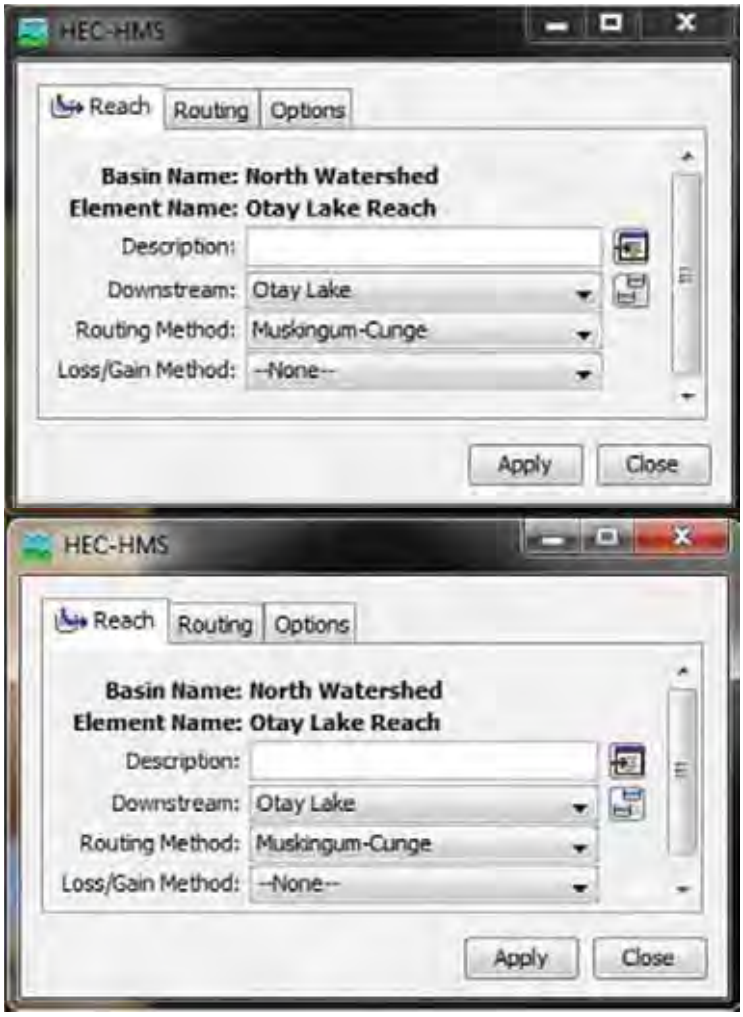
Show Elements: Initial Selection Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Otay Valley ...	120.854	20132.7	01Jan2011, 21:05	3.68

Otay River Valley Proposed Condition HEC HMS Analysis




HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay Lake Subbasin
Description:
Downstream: Otay Lake Reach
*Area (MI2) 96.91
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay Lake Subbasin
Initial Abstraction (IN) 0.31
*Curve Number: 86.5
*Impervious (%) 0.8
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay Lake Subbasin
Graph Type: Standard
*Lag Time (MIN) 103.3


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay Lake Reach
Description:
Downstream: Otay Lake
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
Apply
Close
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay Lake Reach
Description:
Downstream: Otay Lake
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
Apply
Close

OTAY RANCH VILLAGE 9 Otay River Analysis
Otay Lake Subbasin & Reach

Proposed Conditions

DRAINAGE AREA	62024.0 acres	
	96.913	mi^2

98	0	acres	(Major Arterials)
92	0	acres	(Commercial Development)
91	0	acres	(Mixed Use - Schools, Hospital)
90	0	acres	(High Density Residential Development)
87	1024	acres	(Single-Family Residential Development)
81	61000	acres	(Open Space)

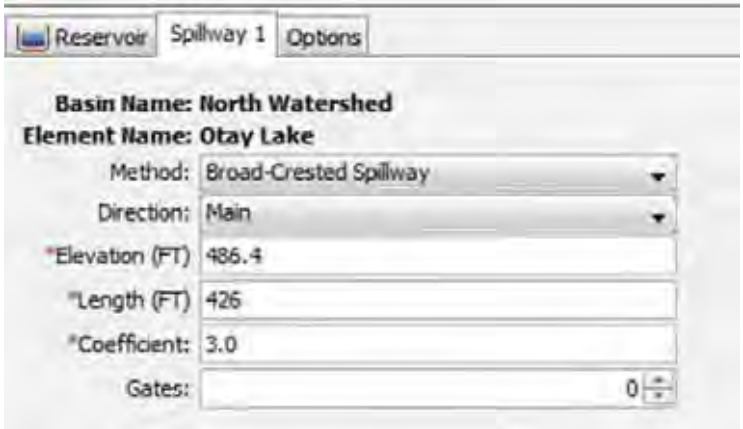
CURVE NUMBER =	81.1	AMC=2.0
	86.5	AMC=2.5

Average n	0.035	
m	0.38	
L	13.51	miles
Lc	6.755	miles
U/S Elev.	3060	feet
D/S Elev.	486.4	feet
S	190	ft/mile

LAG TIME =	1.722	hours
	103.3	min

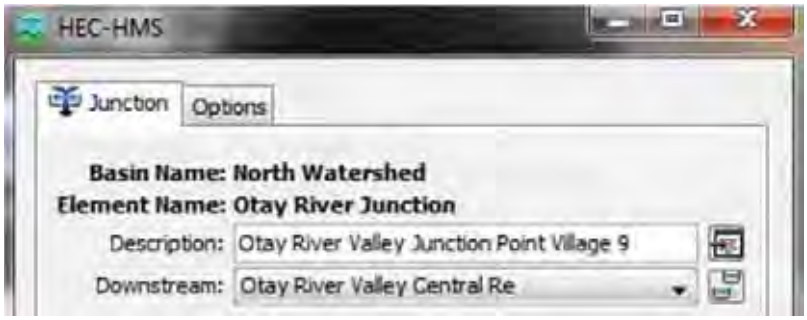
SOIL GROUP D ASSUMED

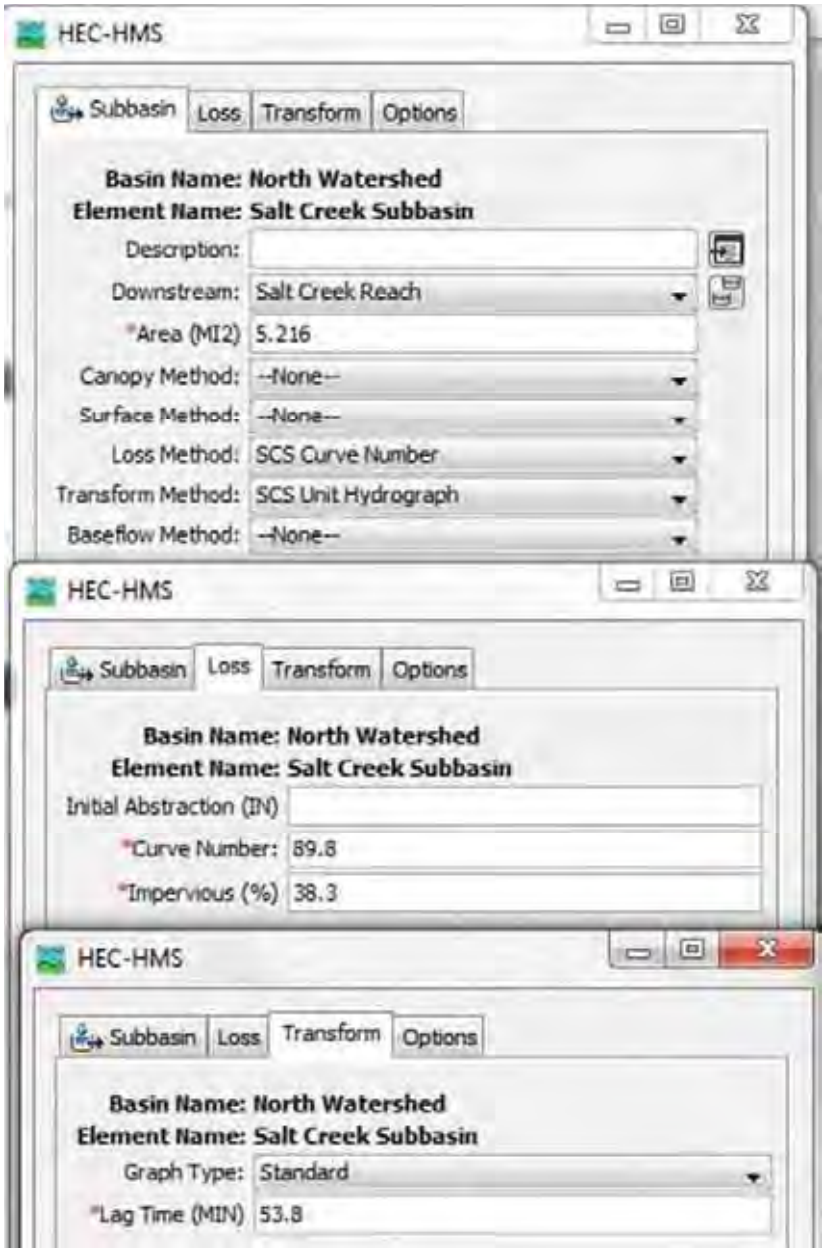
HEC-HMS
Reservoir
Options
Basin Name: North Watershed
Element Name: Otay Lake
Description: Lower Otay Reservoir
Downstream: Savage Dam Spillway Reach
Method: Outflow Structures
Storage Method: Elevation-Area
*Elev-Area Function: Reservoir Elev-Area
Initial Condition: Elevation
*Initial Elevation (FT) 486.4
Main Tailwater: Assume None
Auxiliary: --None--
Time Step Method: Automatic Adaption
Outlets: 0
Spillways: 1
Dam Tops: 0
Pumps: 0
Dam Break: No
Dam Seepage: No
Release: No
Evaporation: No
Apply
Close


Reservoir
Spillway 1
Options
Basin Name: North Watershed
Element Name: Otay Lake
Method: Broad-Crested Spillway
Direction: Main
*Elevation (FT) 486.4
*Length (FT) 426
*Coefficient: 3.0
Gates: 0

HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Savage Dam Spillway Reach
Description: Channel from Reservoir to Otay River Valle
Downstream: Otay River Junction
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
Apply
Close

HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Savage Dam Spillway Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 10920
*Slope (FT/FT) 0.023
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 10
*Side Slope (xH:1V) 3
Apply
Close


HEC-HMS
Junction
Options
Basin Name: North Watershed
Element Name: Otay River Junction
Description: Otay River Valley Junction Point Village 9
Downstream: Otay River Valley Central Re


HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Salt Creek Subbasin
Description:
Downstream: Salt Creek Reach
*Area (MI2) 5.216
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Salt Creek Subbasin
Initial Abstraction (IN)
*Curve Number: 89.8
*Impervious (%) 38.3
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Salt Creek Subbasin
Graph Type: Standard
*Lag Time (MIN) 53.8

OTAY RANCH VILLAGE 9 Otay River Analysis
Salt Creek Subbasin & Reach

Proposed Conditions

DRAINAGE	3338.0 acres	
AREA	5.216	mi^2

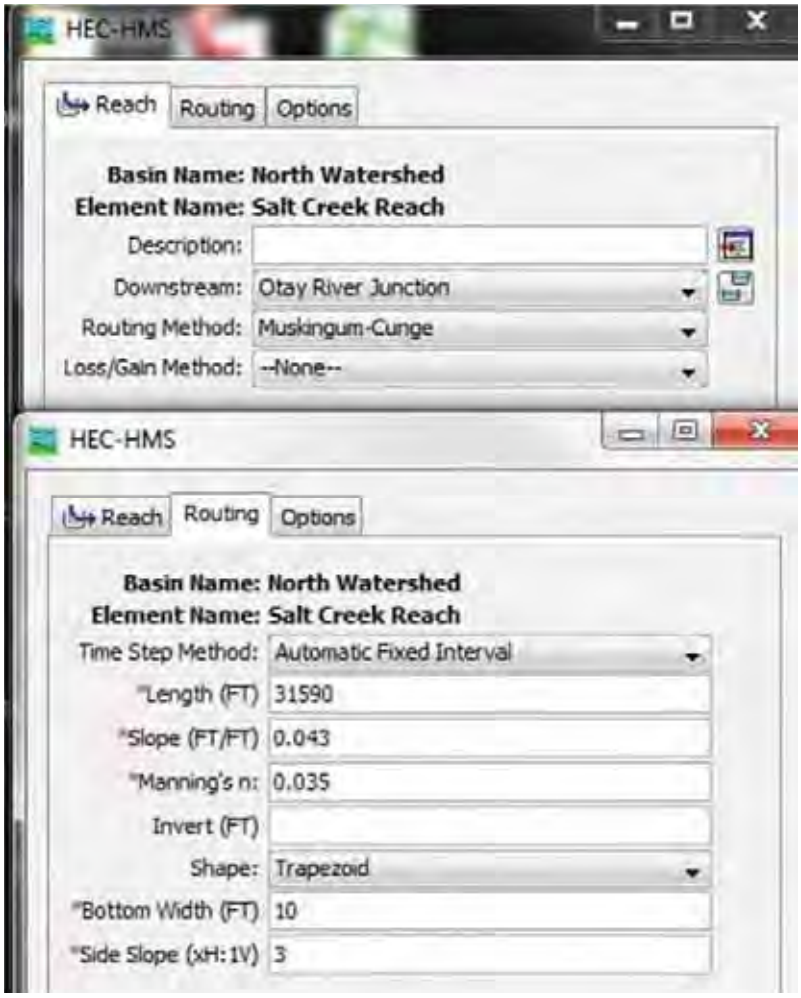
Curve Number			
98	0	acres	(Major Arterials)
92	0	acres	(Commercial Development)
91	0	acres	(Mixed Use - Schools, Hospital)
90	0	acres	(High Density Residential Development)
87	2556	acres	(Single-Family Residential Development)
81	782	acres	(Open Space)

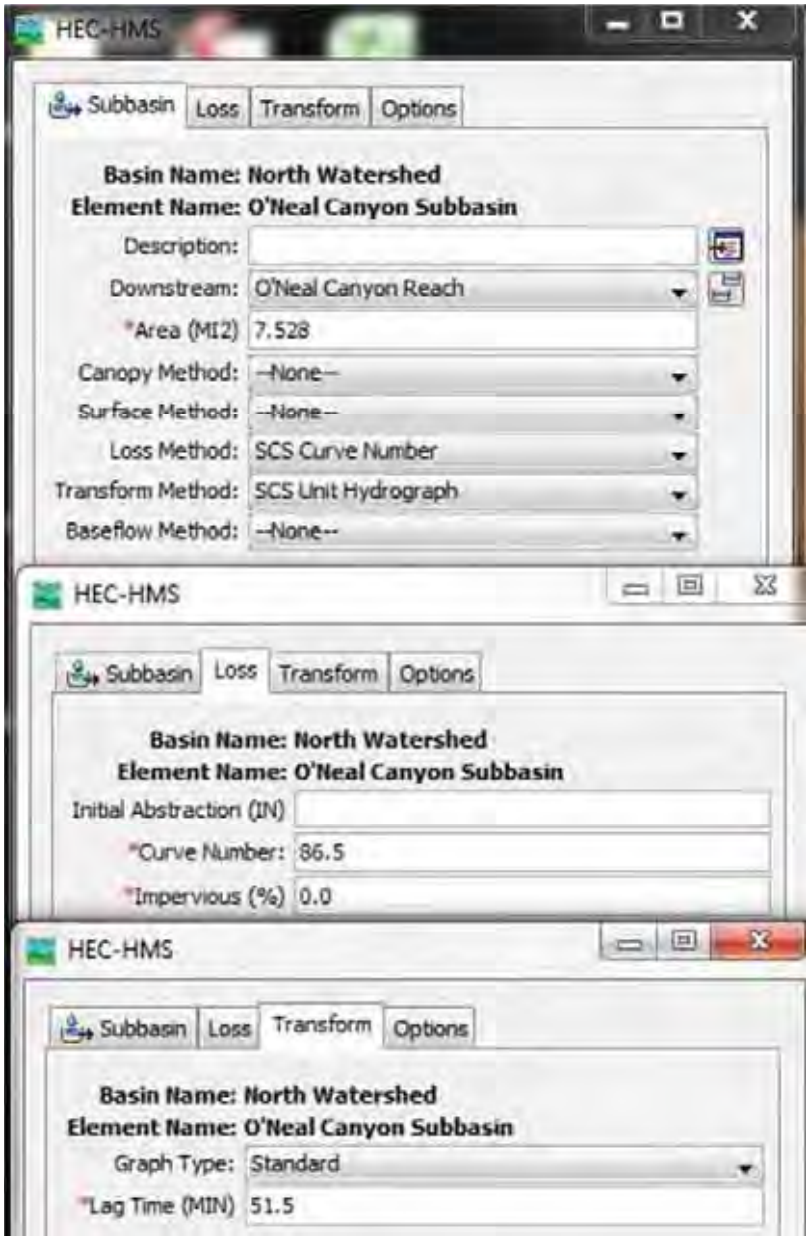
CURVE NUMBER =	85.6	AMC=2.0
Adjusted CN=	89.8	AMC=2.5

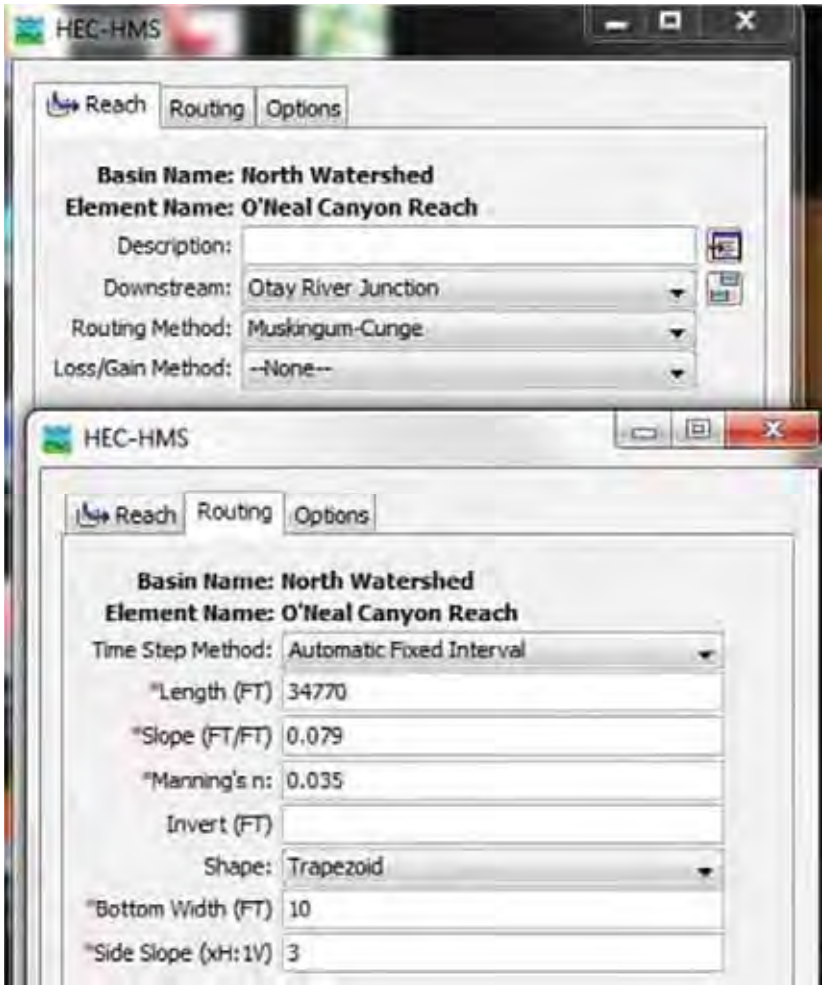
Average n	0.035	
m	0.38	
L	5.98	miles
Lc	2.99	miles
U/S Elev.	1600	feet
D/S Elev.	240	feet
S	227	ft/mile

LAG TIME =	0.896	hours
	53.8	min

SOIL GROUP D ASSUMED


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Salt Creek Reach
Description:
Downstream: Otay River Junction
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Salt Creek Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 31590
*Slope (FT/FT) 0.043
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 10
*Side Slope (xH:1V) 3


HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Subbasin
Description:
Downstream: O'Neal Canyon Reach
*Area (MI2) 7.528
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Subbasin
Initial Abstraction (IN)
*Curve Number: 86.5
*Impervious (%) 0.0
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Subbasin
Graph Type: Standard
*Lag Time (MIN) 51.5


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Reach
Description:
Downstream: Otay River Junction
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: O'Neal Canyon Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 34770
*Slope (FT/FT) 0.079
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 10
*Side Slope (xH:1V) 3

OTAY RANCH VILLAGE 9 Otay River Analysis
O'Neal Canyon Subbasin & Reach

Proposed Conditions

DRAINAGE AREA	4822.0 acres	
	7.534	mi^2

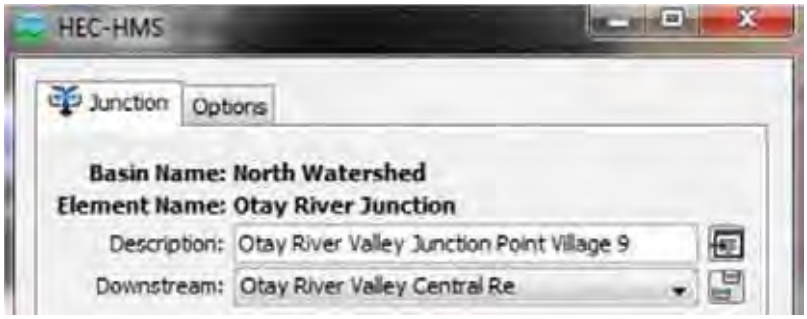
CN = 98	0	acres	(Major Arterials)
CN = 92	0	acres	(Commercial Development)
CN = 91	0	acres	(Mixed Use - Schools, Hospital)
CN = 90	0	acres	(High Density Residential Development)
CN = 87	0	acres	(Single-Family Residential Development)
CN = 81	4822	acres	(Open Space)

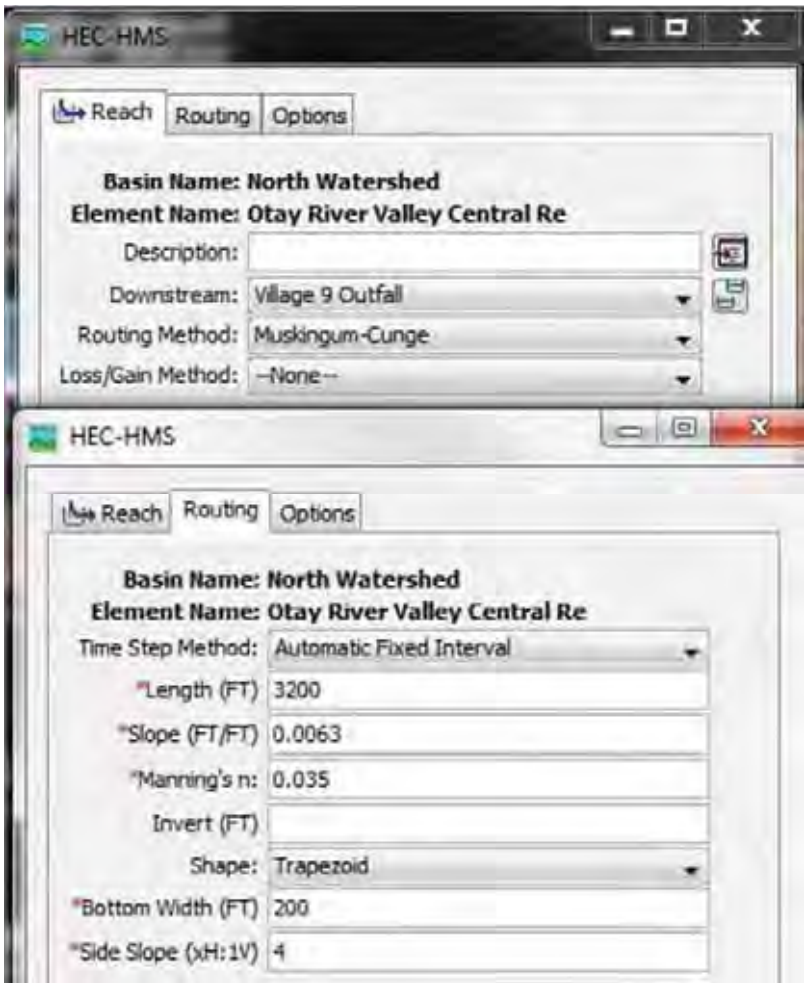
CURVE NUMBER =	81.0	AMC=2.0
	86.5	AMC=2.5

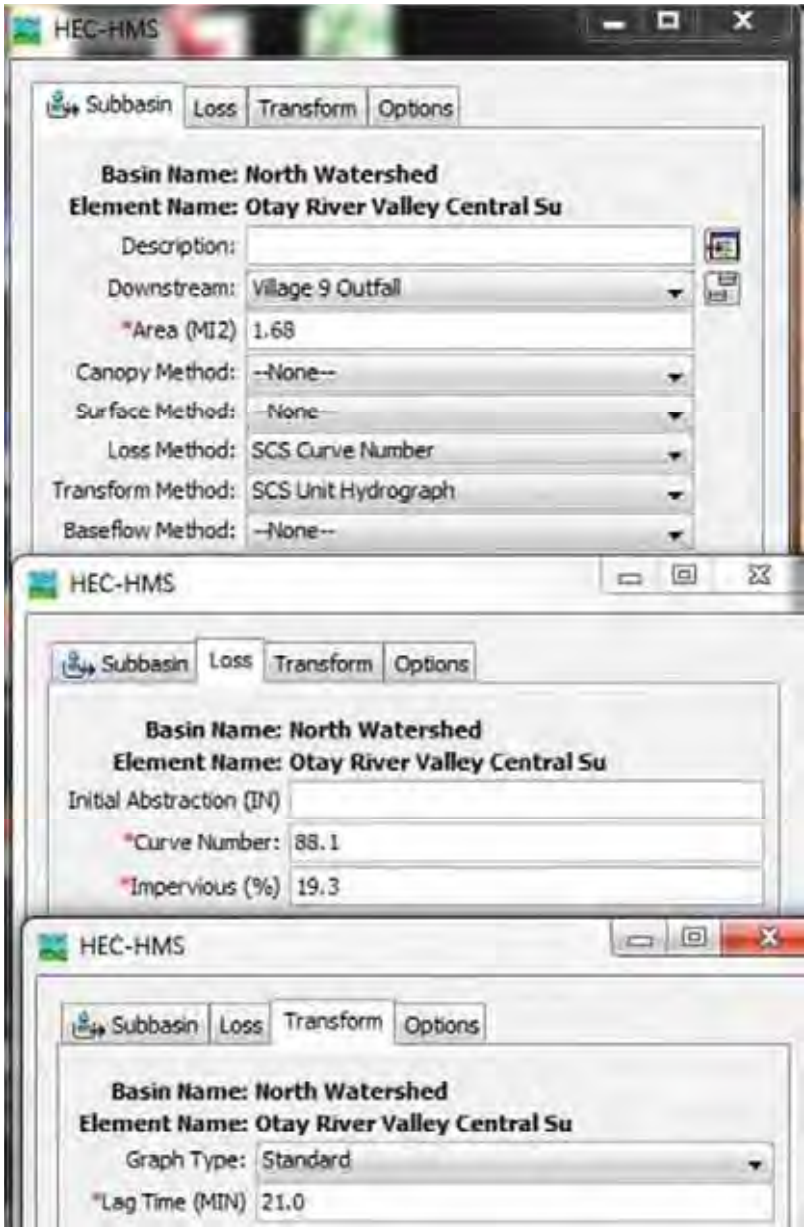
Average n	0.035	
m	0.38	
L	6.58	miles
Lc	3.29	miles
U/S Elev.	3000	feet
D/S Elev.	240	feet
S	419	ft/mile

LAG TIME =	0.858	hours
	51.5	min

SOIL GROUP D ASSUMED


HEC-HMS
Junction
Options
Basin Name: North Watershed
Element Name: Otay River Junction
Description: Otay River Valley Junction Point Village 9
Downstream: Otay River Valley Central Re


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Re
Description:
Downstream: Village 9 Outfall
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Re
Time Step Method: Automatic Fixed Interval
*Length (FT) 3200
*Slope (FT/FT) 0.0063
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 200
*Side Slope (xH:1V) 4


HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Su
Description:
Downstream: Village 9 Outfall
*Area (MI2) 1.68
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Su
Initial Abstraction (IN)
*Curve Number: 88.1
*Impervious (%) 19.3
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley Central Su
Graph Type: Standard
*Lag Time (MIN) 21.0

OTAY RANCH VILLAGE 9 Otay River Analysis
Otay River Valley Central Subbasin

Proposed Conditions

DRAINAGE	1075.0 acres	
AREA	1.680	mi^2

CN = 98	0	acres	(Major Arterials)
CN = 92	0	acres	(Commercial Development)
CN = 91	0	acres	(Mixed Use - Schools, Hospital)
CN = 90	259	acres	(High Density Residential Development)
CN = 87	0	acres	(Single-Family Residential Development)
CN = 81	816	acres	(Open Space)

CURVE NUMBER =	83.2	AMC=2.0
	88.1	AMC=2.5

Average n	0.035	
m	0.38	
L	1.77	miles
Lc	0.885	miles
U/S Elev.	660	feet
D/S Elev.	220	feet
S	249	ft/mile

LAG TIME =	0.349	hours
	21.0	min

SOIL GROUP D ASSUMED

Global Summary Results for Run "100yr 6hr"

Project: 0917_HMS_PR Simulation Run: 100yr 6hr

Start of Run: 01Jan2011, 00:00 Basin Model: North Watershed
End of Run: 08Jan2011, 00:00 Meteorologic Model: 100yr 6hr
Compute Time: 21Mar2011, 09:43:29 Control Specifications: 100 Year

Show Elements: Initial Selection Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Village 9 Outfall	111.334	6577.7	01Jan2011, 09:05	1.12

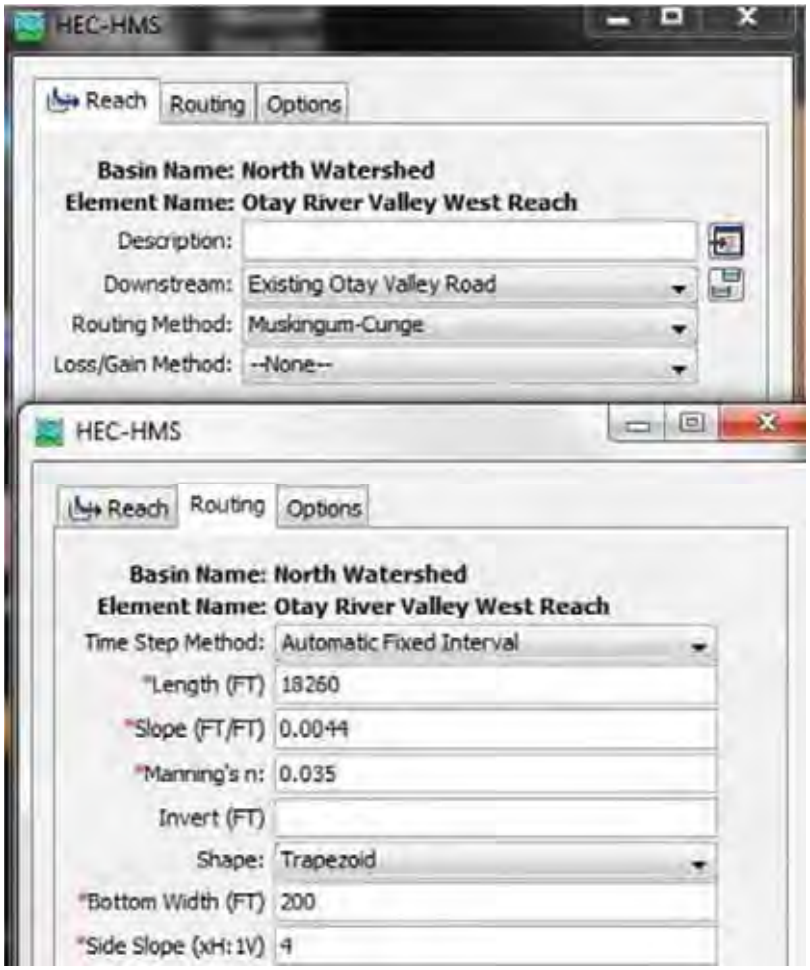
Global Summary Results for Run "100yr 24hr"

Project: 0917_HMS_PR Simulation Run: 100yr 24hr

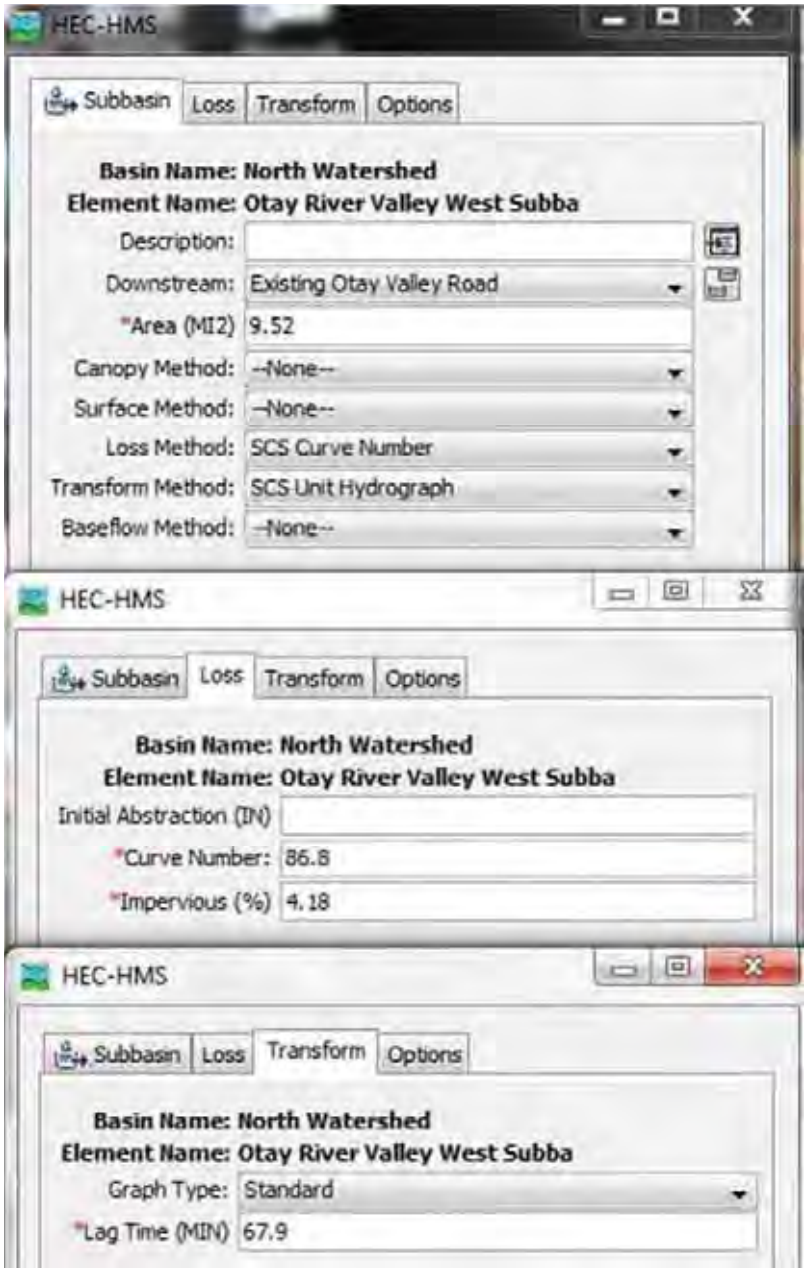
Start of Run: 01Jan2011, 00:00 Basin Model: North Watershed
End of Run: 08Jan2011, 00:00 Meteorologic Model: 100yr 24hr
Compute Time: 21Mar2011, 09:44:41 Control Specifications: 100 Year

Show Elements: Initial Selection Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Village 9 Outfall	111.334	18788.3	01Jan2011, 20:45	3.68


HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Reach
Description:
Downstream: Existing Otay Valley Road
Routing Method: Muskingum-Cunge
Loss/Gain Method: --None--
HEC-HMS
Reach
Routing
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Reach
Time Step Method: Automatic Fixed Interval
*Length (FT) 18260
*Slope (FT/FT) 0.0044
*Manning's n: 0.035
Invert (FT)
Shape: Trapezoid
*Bottom Width (FT) 200
*Side Slope (xH:1V) 4

HEC-HMS
Junction
Options
Basin Name: North Watershed
Element Name: Existing Otay Valley Road
Description:
Downstream: --None--


HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Subba
Description:
Downstream: Existing Otay Valley Road
*Area (MI2) 9.52
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Subba
Initial Abstraction (IN)
*Curve Number: 86.8
*Impervious (%) 4.18
HEC-HMS
Subbasin
Loss
Transform
Options
Basin Name: North Watershed
Element Name: Otay River Valley West Subba
Graph Type: Standard
*Lag Time (MIN) 67.9

OTAY RANCH VILLAGE 9 Otay River Analysis
Otay River Valley West Subbasin

Proposed Conditions

DRAINAGE	6095.0 acres	
AREA	9.523	mi^2

CN = 98	0	acres	(Major Arterials)
CN = 92	0	acres	(Commercial Development)
CN = 91	0	acres	(Mixed Use - Schools, Hospital)
CN = 90	0	acres	(High Density Residential Development)
CN = 87	510	acres	(Single-Family Residential Development)
CN = 81	5585	acres	(Open Space)

CURVE NUMBER =	81.5	AMC=2.0
	86.8	AMC=2.5

Average n	0.035	
m	0.38	
L	6.88	miles
Lc	3.44	miles
U/S Elev.	940	feet
D/S Elev.	140	feet
S	116	ft/mile

LAG TIME =	1.132	hours
	67.9	min

SOIL GROUP D ASSUMED

Global Summary Results for Run "100yr 6hr"

Project: 0917_HMS_PR Simulation Run: 100yr 6hr

Start of Run: 01Jan2011, 00:00 Basin Model: North Watershed
End of Run: 08Jan2011, 00:00 Meteorologic Model: 100yr 6hr
Compute Time: 21Mar2011, 09:43:29 Control Specifications: 100 Year

Show Elements: Initial Selection Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Otay Valley ...	120.854	7648.8	01Jan2011, 05:50	1.12

Global Summary Results for Run "100yr 24hr"

Project: 0917_HMS_PR Simulation Run: 100yr 24hr

Start of Run: 01Jan2011, 00:00 Basin Model: North Watershed
End of Run: 08Jan2011, 00:00 Meteorologic Model: 100yr 24hr
Compute Time: 21Mar2011, 09:44:41 Control Specifications: 100 Year

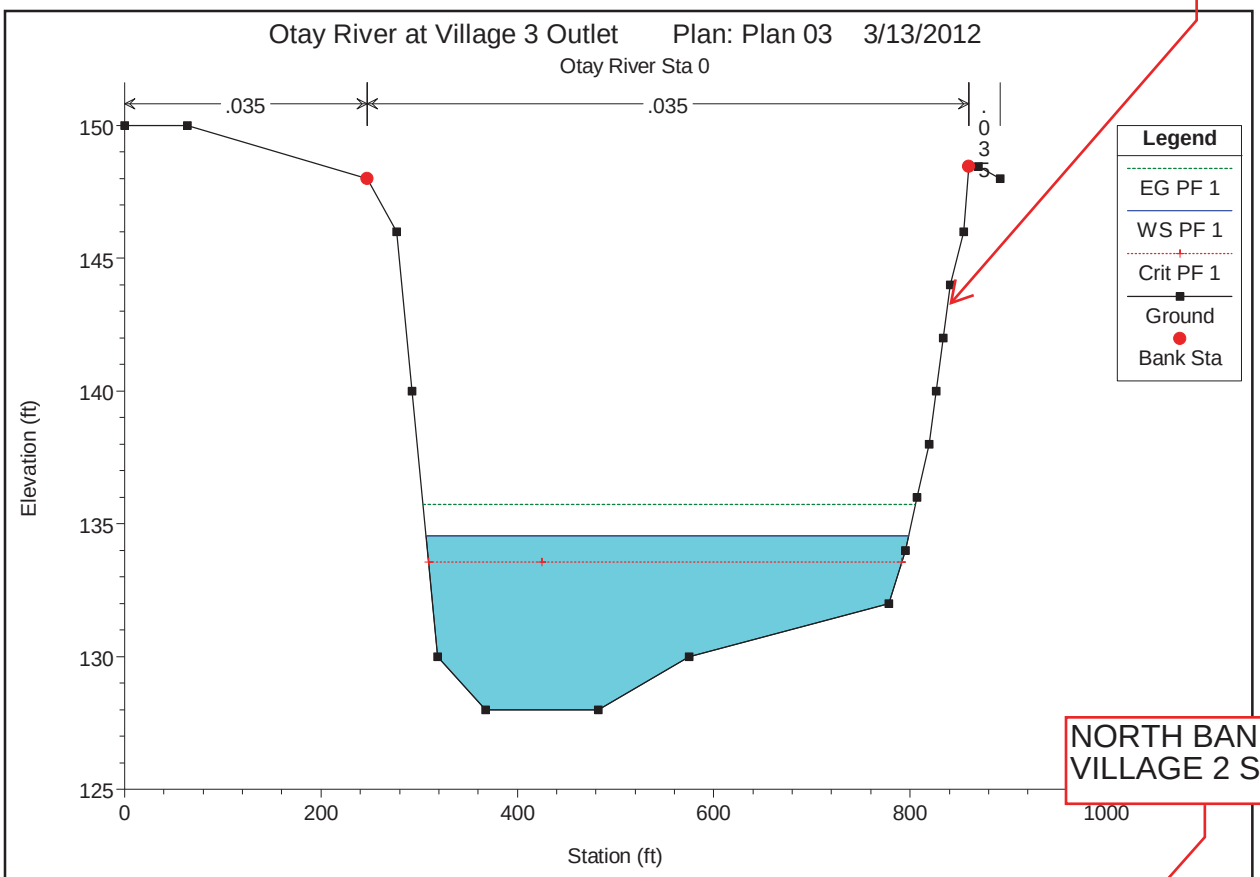
Show Elements: Initial Selection Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Existing Otay Valley ...	120.854	20138.8	01Jan2011, 21:05	3.68

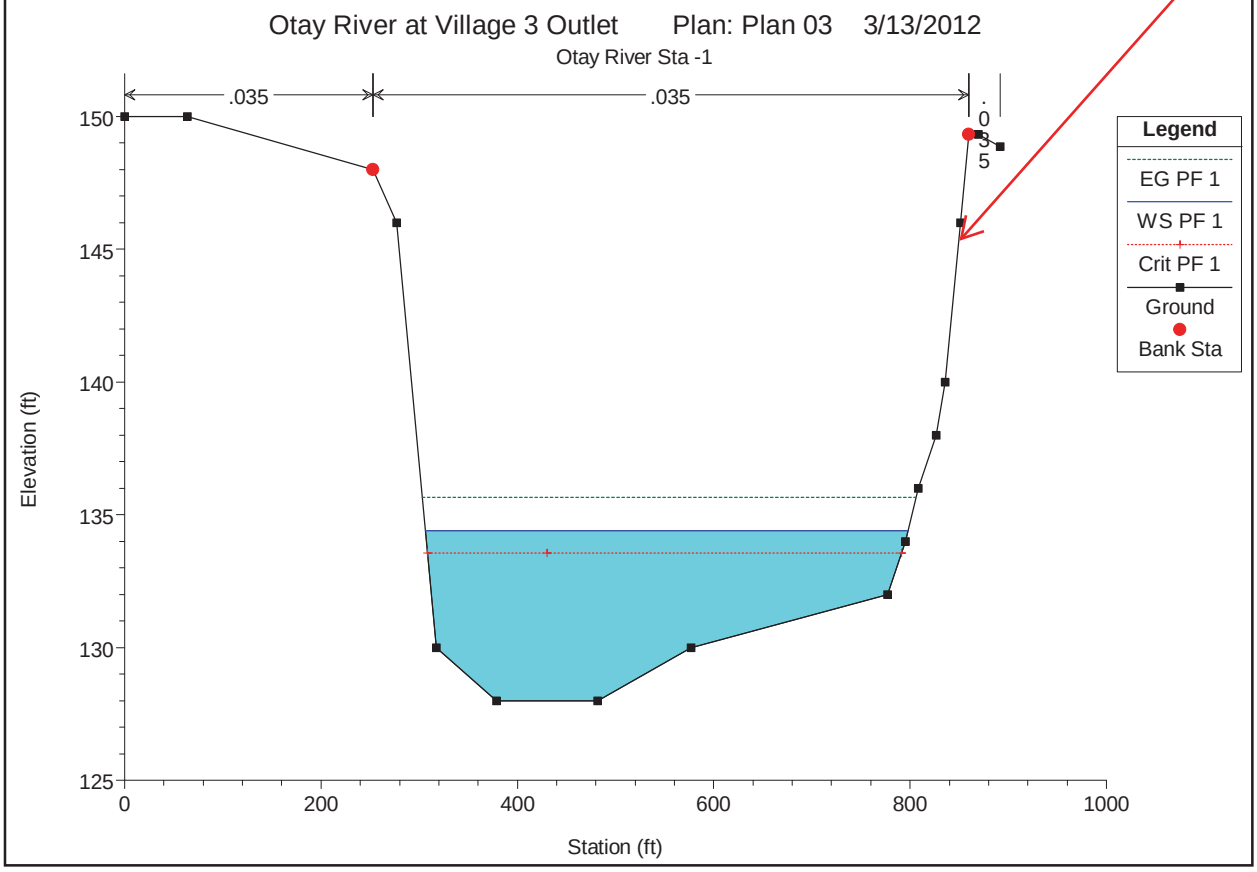
CHAPTER 6

HEC-RAS STUDY FOR 100-YEAR, 24-HOUR STORM EVENT WATER SURFACE ELEVATION AT THE VILLAGE 2 SOUTH OUTLET AND ANALYSIS OF VELOCITY AFTER FLOWS LEAVE CONCRETE ENERGY DISSIPATOR AND PRIOR TO RIP-RAP

NORTH BANK
VILLAGE 2 SIDE



NORTH BANK
VILLAGE 2 SIDE



Plan: Plan 02 Otay River 1 RS: 101 Profile: PF 1

E.G. Elev (ft)	135.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.18	Wt. n-Val.		0.035	
W.S. Elev (ft)	134.54	Reach Len. (ft)	10.00	10.00	10.00
Crit W.S. (ft)	133.55	Flow Area (sq ft)		2307.94	
E.G. Slope (ft/ft)	0.005389	Area (sq ft)		2307.94	
Q Total (cfs)	20139.00	Flow (cfs)		20139.00	
Top Width (ft)	491.54	Top Width (ft)		491.54	
Vel Total (ft/s)	8.73	Avg. Vel. (ft/s)		8.73	
Max Chl Dpth (ft)	6.54	Hydr. Depth (ft)		4.70	
Conv. Total (cfs)	274349.0	Conv. (cfs)		274349.0	
Length Wtd. (ft)	10.00	Wetted Per. (ft)		492.60	
Min Ch El (ft)	128.00	Shear (lb/sq ft)		1.58	
Alpha	1.00	Stream Power (lb/ft s)	891.79	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)		0.52	
C & E Loss (ft)	0.01	Cum SA (acres)		0.11	

Plan: Plan 02 Otay River 1 RS: 100 Profile: PF 1

E.G. Elev (ft)	135.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.26	Wt. n-Val.		0.035	
W.S. Elev (ft)	134.40	Reach Len. (ft)			
Crit W.S. (ft)	133.55	Flow Area (sq ft)		2234.80	
E.G. Slope (ft/ft)	0.006002	Area (sq ft)		2234.80	
Q Total (cfs)	20139.00	Flow (cfs)		20139.00	
Top Width (ft)	491.74	Top Width (ft)		491.74	
Vel Total (ft/s)	9.01	Avg. Vel. (ft/s)		9.01	
Max Chl Dpth (ft)	6.40	Hydr. Depth (ft)		4.54	
Conv. Total (cfs)	259949.0	Conv. (cfs)		259949.0	
Length Wtd. (ft)		Wetted Per. (ft)		492.78	
Min Ch El (ft)	128.00	Shear (lb/sq ft)		1.70	
Alpha	1.00	Stream Power (lb/ft s)	891.79	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

OTAY RANCH VILLAGE 2

IMPACT BASIN AT OTAY RIVER OUTLET (84" RCP)

ENERGY DISSIPATOR - IMPACT BASIN CALCULATIONS

(APWA Standard Plan 384-1)

Given :

$Q =$ 742 cfs
$d =$ 84 " RCP
$W_w =$ 62.4 pcf
$H_v = v^2/(2g)$

Then :

$A =$ 38.5 sq. ft.
$v =$ 19.3 fps
$H_v =$ 5.77 ft.

for full pipe flow

IMPACT = $H_v \times W_w$
= 360 psf < 825 psf for W= 20 feet; OK

Therefore:

Use basin width, W = 20 feet
length of riprap = 4 x d = 28 feet

Size riprap based on velocity over end sill:

weir eqn: $Q = CLH^{1.5}$; C = 3.3 per Table 5-3 of King's Handbook

$H = (Q/CL)^{2/3}$
$H =$ 5.02 feet

Then :

$A =$ 100 sq. ft.
$v =$ 7.39 fps

See riprap sizing spreadsheet for sizing based upon this velocity.

CHAPTER 7

EXHIBIT 1.1
NORTH PORTION
PRE-DEVELOPED CONDITION
HYDROLOGY MAP

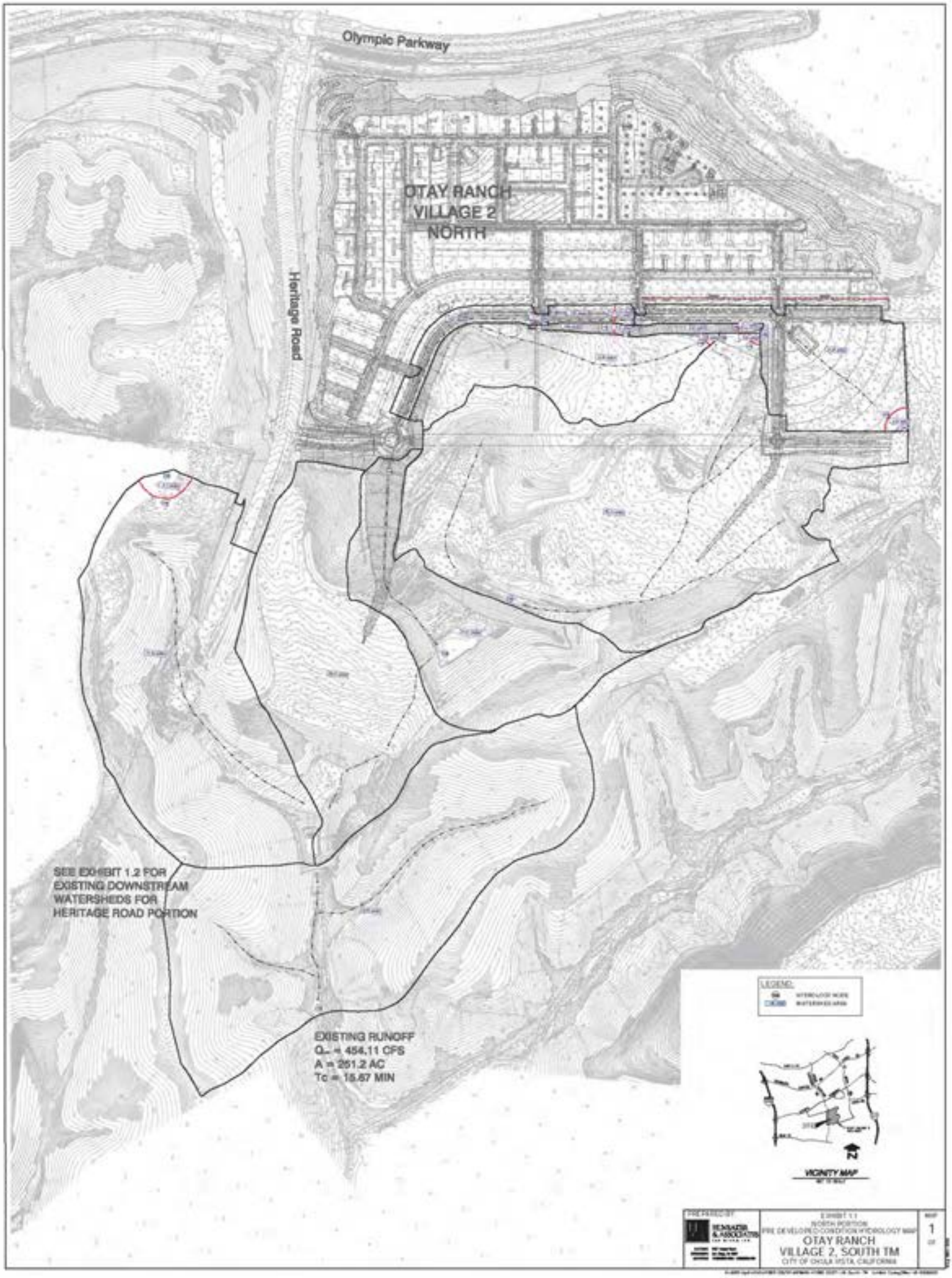
EXHIBIT 1.2
HERITAGE ROAD PORTION
PRE-DEVELOPED CONDITION
HYDROLOGY MAP

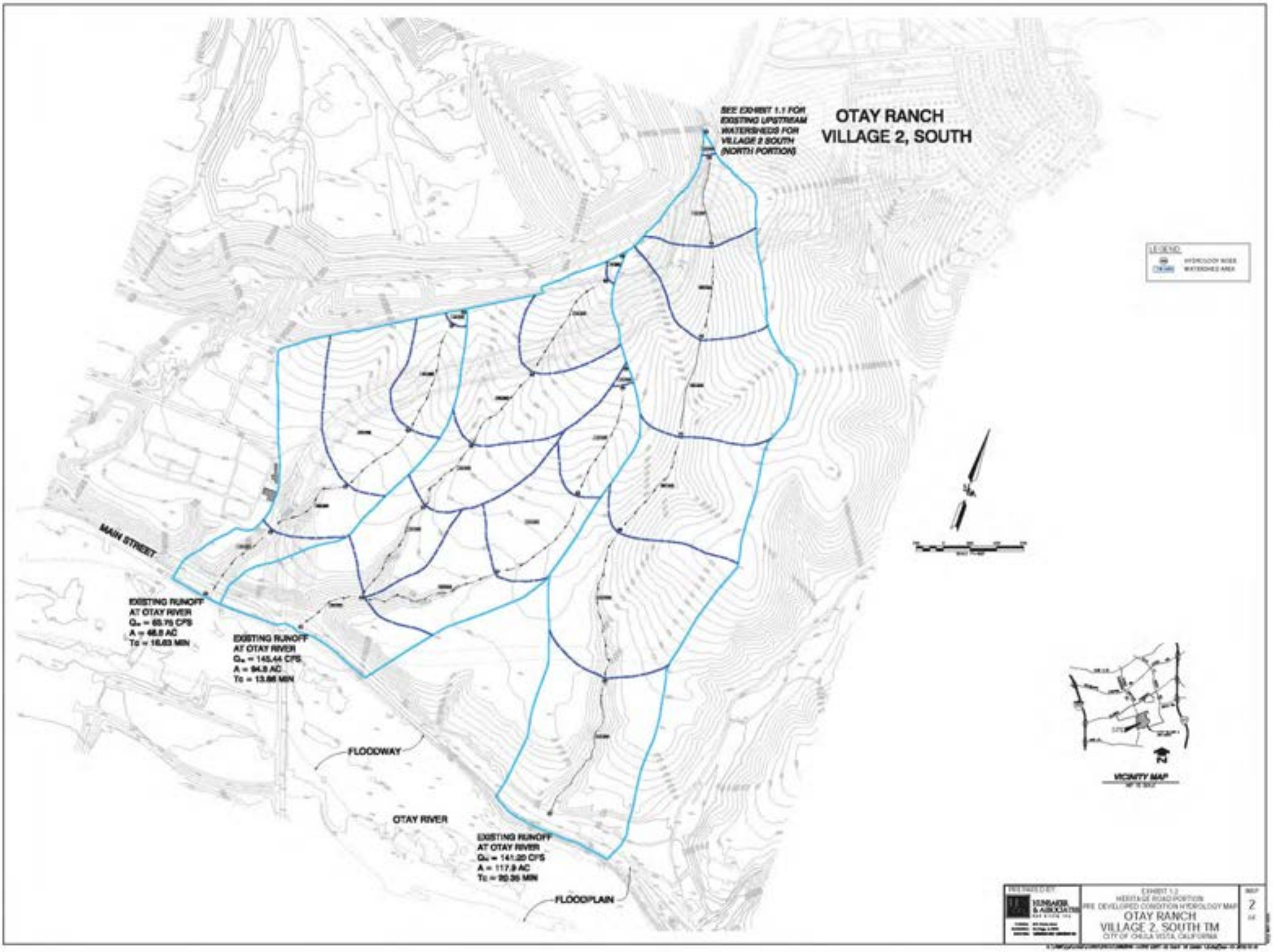
EXHIBIT 1.3
NORTH PORTION
DEVELOPED CONDITION
HYDROLOGY MAP

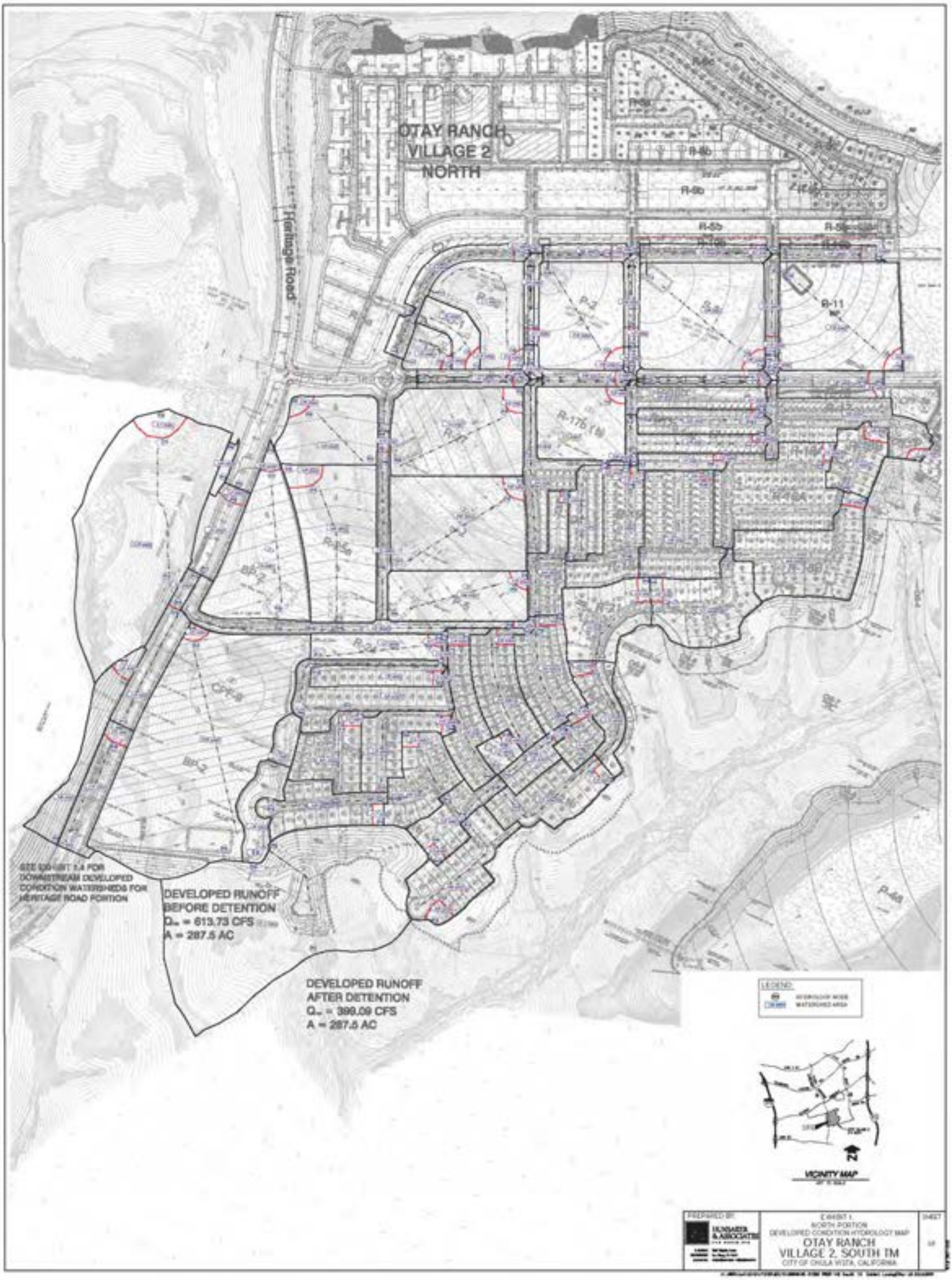
EXHIBIT 1.4
HERITAGE ROAD PORTION
DEVELOPED CONDITION
HYDROLOGY MAP

EXHIBIT 1.4
HEC-HMS Pre-Developed Condition Exhibit

EXHIBIT 1.6
HEC-HMS Developed Condition Exhibit


Olympic Parkway
OTAY RANCH
VILLAGE 2
NORTH
Heritage Road
SEE EXHIBIT 1.2 FOR
EXISTING DOWNSTREAM
WATERSHEDS FOR
HERITAGE ROAD PORTION
EXISTING RUNOFF
Q100 = 454.11 CFS
A = 251.2 AC
Tc = 15.57 MIN
LEGEND:
VICINITY MAP
N
EXHIBIT 1.1
NORTH PORTION
PRE DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA
1


OTAY RANCH
VILLAGE 2, SOUTH
SEE EXHIBIT 1.1 FOR EXISTING UPSTREAM WATERSHEDS FOR VILLAGE 2 SOUTH (NORTH PORTION)
LEGEND
HYDROLOGY NODE
WATERSHED AREA
MAIN STREET
EXISTING RUNOFF AT OTAY RIVER
Q_{100} = 65.75 CFS
A = 46.8 AC
Tc = 16.63 MIN
EXISTING RUNOFF AT OTAY RIVER
Q_{100} = 145.44 CFS
A = 94.8 AC
Tc = 13.86 MIN
FLOODWAY
OTAY RIVER
EXISTING RUNOFF AT OTAY RIVER
Q_{100} = 141.20 CFS
A = 117.9 AC
Tc = 20.35 MIN
FLOODPLAIN
VICINITY MAP
EXHIBIT 1.2
HERITAGE ROAD PORTION
PRE DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA
MAP
2

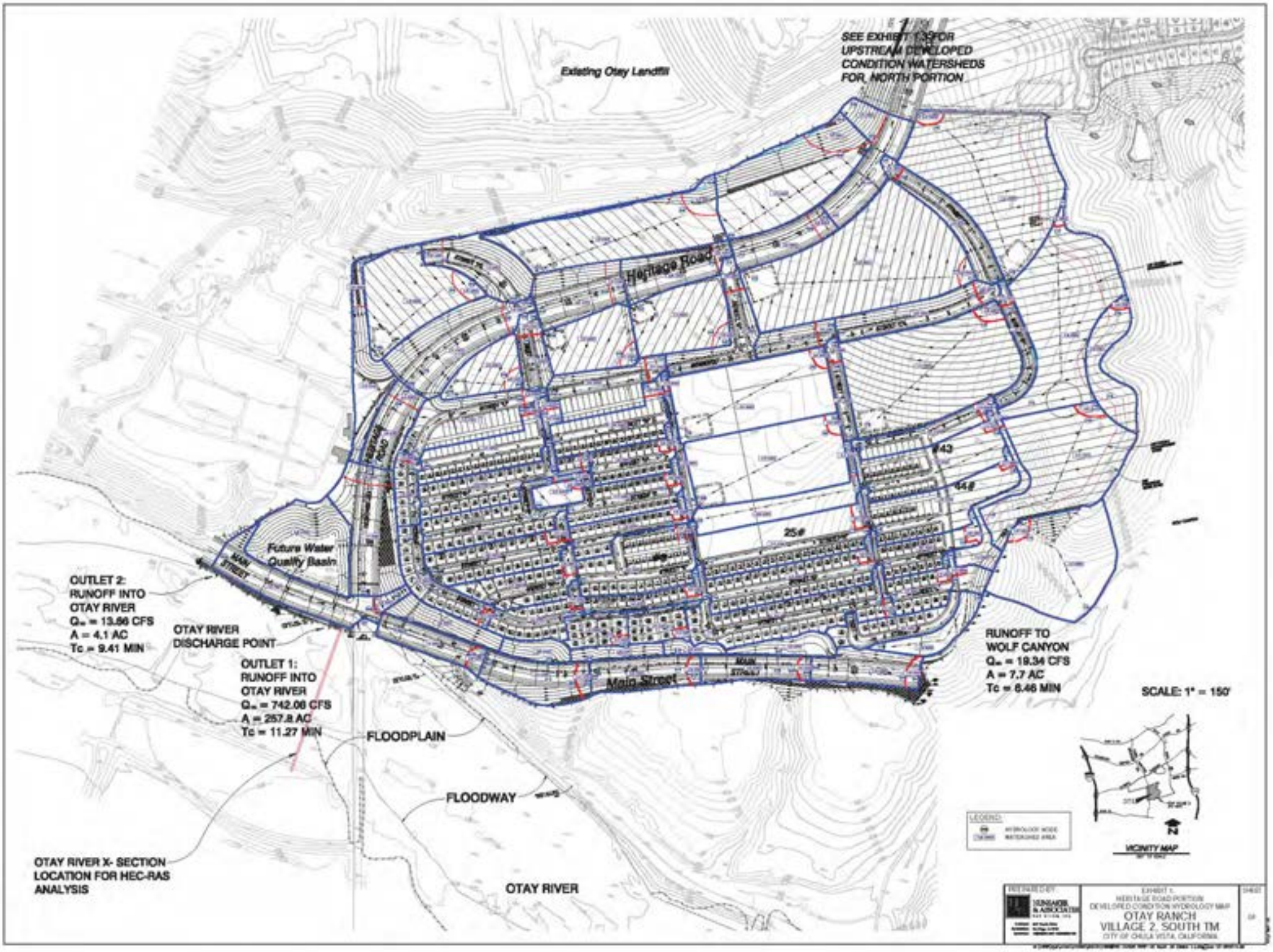


PREPARED BY

HUNSAKER & ASSOCIATES

EXHIBIT 1.
NORTH PORTION
DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA

SHEET


SEE EXHIBIT 1.3 FOR UPSTREAM DEVELOPED CONDITION WATERSHEDS FOR NORTH PORTION
Existing Otay Landfill
Heritage Road
Future Water Quality Basin
MAIN STREET
Main Street
OUTLET 2: RUNOFF INTO OTAY RIVER
Q100 = 13.86 CFS
A = 4.1 AC
Tc = 9.41 MIN
OTAY RIVER DISCHARGE POINT
OUTLET 1: RUNOFF INTO OTAY RIVER
Q100 = 742.06 CFS
A = 257.8 AC
Tc = 11.27 MIN
FLOODPLAIN
FLOODWAY
OTAY RIVER X- SECTION LOCATION FOR HEC-RAS ANALYSIS
OTAY RIVER
RUNOFF TO WOLF CANYON
Q100 = 19.34 CFS
A = 7.7 AC
Tc = 8.46 MIN
SCALE: 1" = 150'
LEGEND
HYDROLOGY NODE
WATERSHED AREA
N
VICINITY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA

PREPARED BY:

EXHIBIT 1-A
PRE DEVELOPED CONDITION HYDROLOGY EXHIBIT
OTAY RIVER VALLEY REC AREA STUDY FOR

OTAY RANCH VILLAGE 2

CITY OF CHULA VISTA, CALIFORNIA

SHEET 5 OF 6

PREPARED BY:

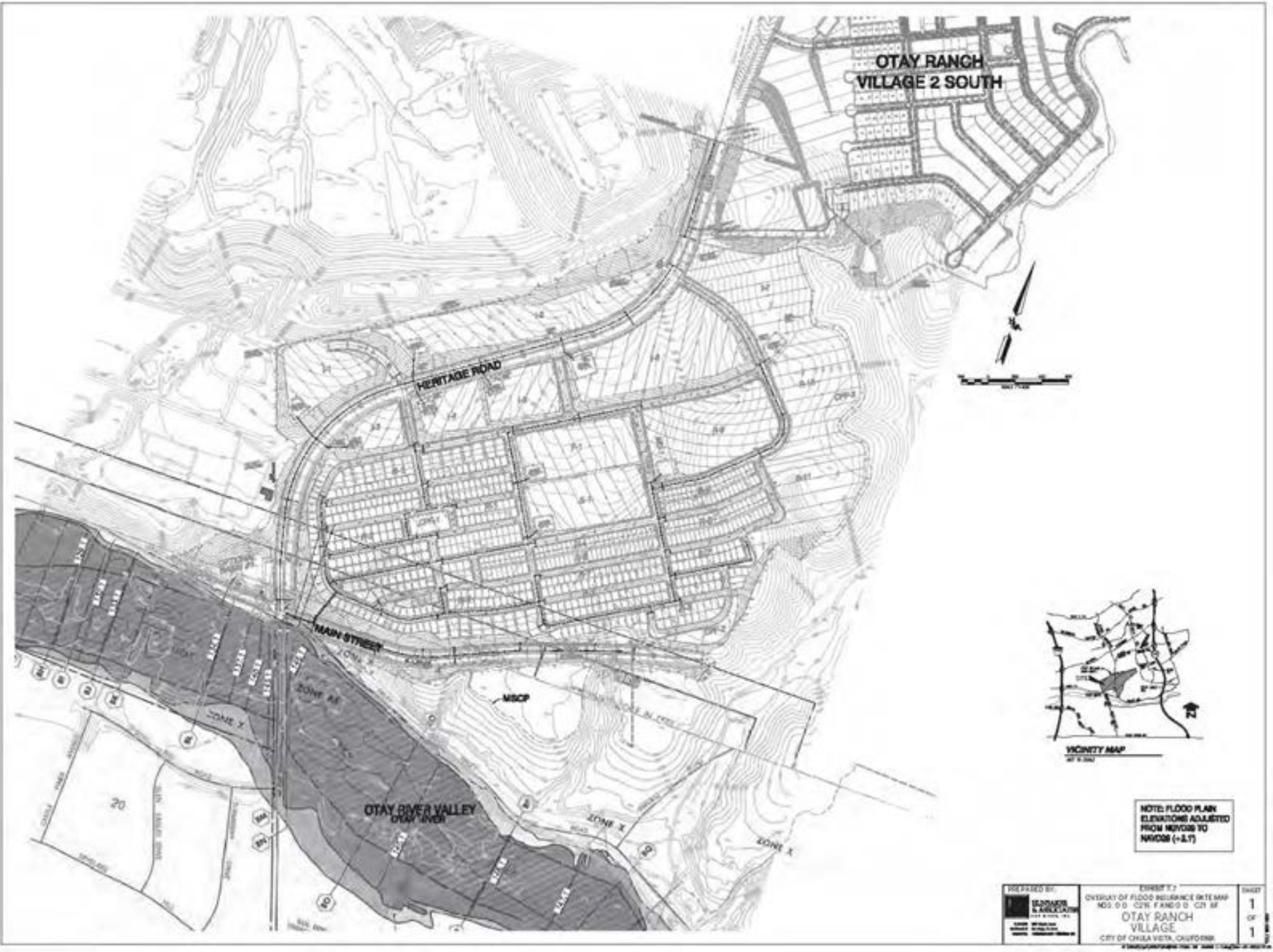
HUNSAKER & ASSOCIATES

EXHIBIT 1.6
DEVELOPED CONDITION HYDROLOGY EXHIBIT
OTAY RANCH VILLAGE 2 REC HMS STUDY FOR

OTAY RANCH VILLAGE 2

CITY OF CHULA VISTA, CALIFORNIA

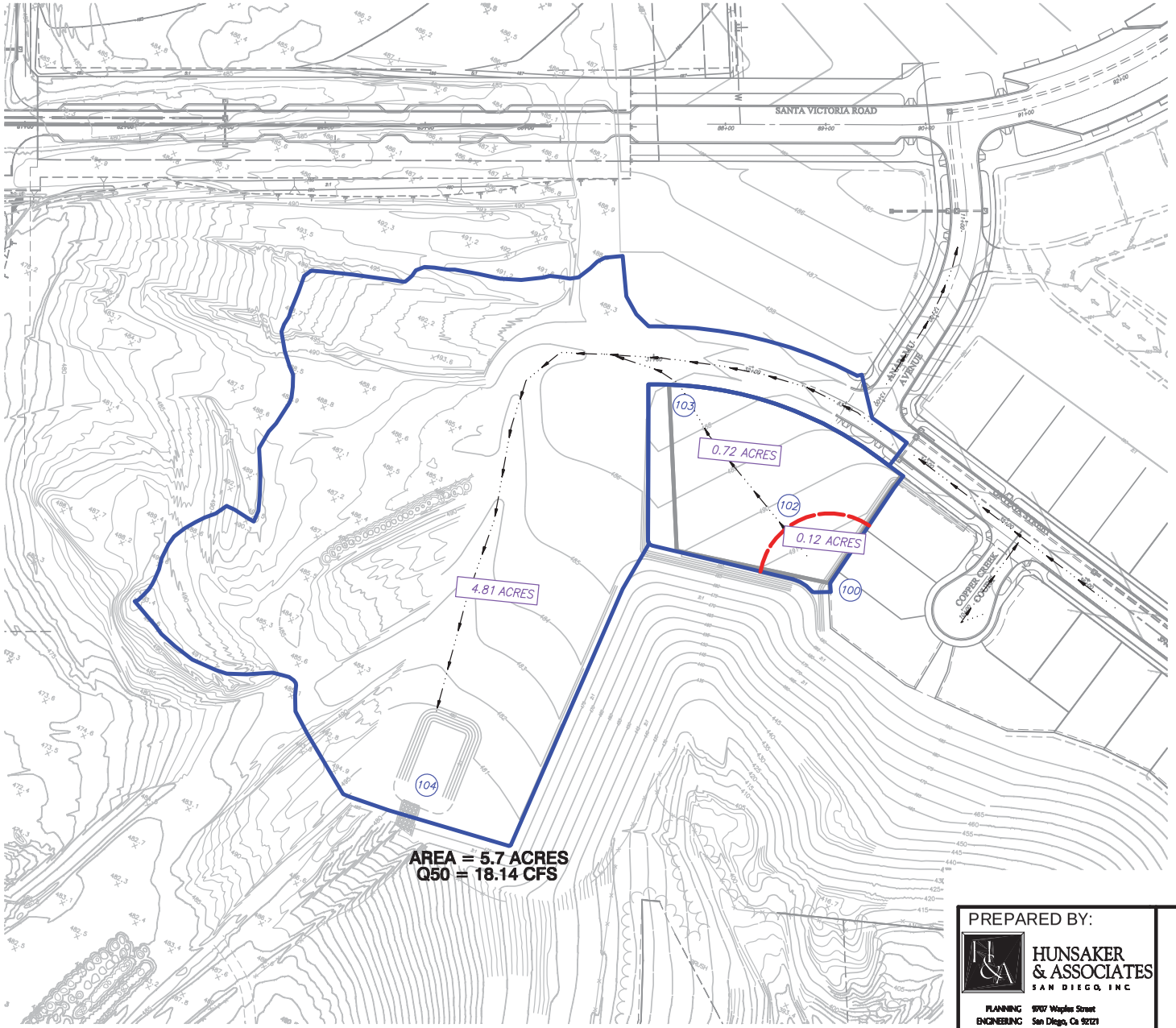
SHEET 6 OF 6

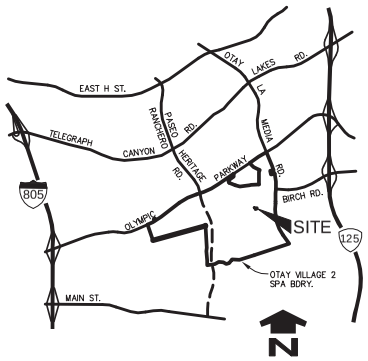

OTAY RANCH
VILLAGE 2 SOUTH
HERITAGE ROAD
MAIN STREET
MSCP
ZONE AE
ZONE X
OTAY RIVER VALLEY
OTAY RIVER
20
VICINITY MAP
NOTE: FLOOD PLAIN ELEVATIONS ADJUSTED FROM NGVD29 TO NAVD88 (+2.7)
PREPARED BY:
EXHIBIT 7.7
OVERLAY OF FLOOD INSURANCE RATE MAP
OTAY RANCH
VILLAGE
CITY OF CHULA VISTA, CALIFORNIA
SHEET
1
OF
1

CHAPTER 8

Interim Condition - Village 2 R-15c Stand-Alone

The following analysis pertains to the development of Village 2 R-15c and assumes that Village 2 South and its associated storm drain infrastructure has not been constructed. The residential areas within R-15c will drain towards Ortega Street. This site has been graded per the approved grading plans and associated hydrology study for Otay Ranch Village 2 Phase 1 (Dwg No. 05101-20). The site was intended to be developed as a CPF site. Per the Village 2 R-15c TM and this study, the site will be residential development. The following calculations determine the new flows associated with the revised land use.





VICINITY MAP

NOT TO SCALE

LEGEND:

100	HYDROLOGY NODE
XX.X ACRES	WATERSHED AREA

PREPARED BY:

HUNSAKER & ASSOCIATES
SAN DIEGO, INC.

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9707 Waples Street
San Diego, Ca 92121
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EXHIBIT 8.1
PRE DEVELOPED HYDROLOGY MAP

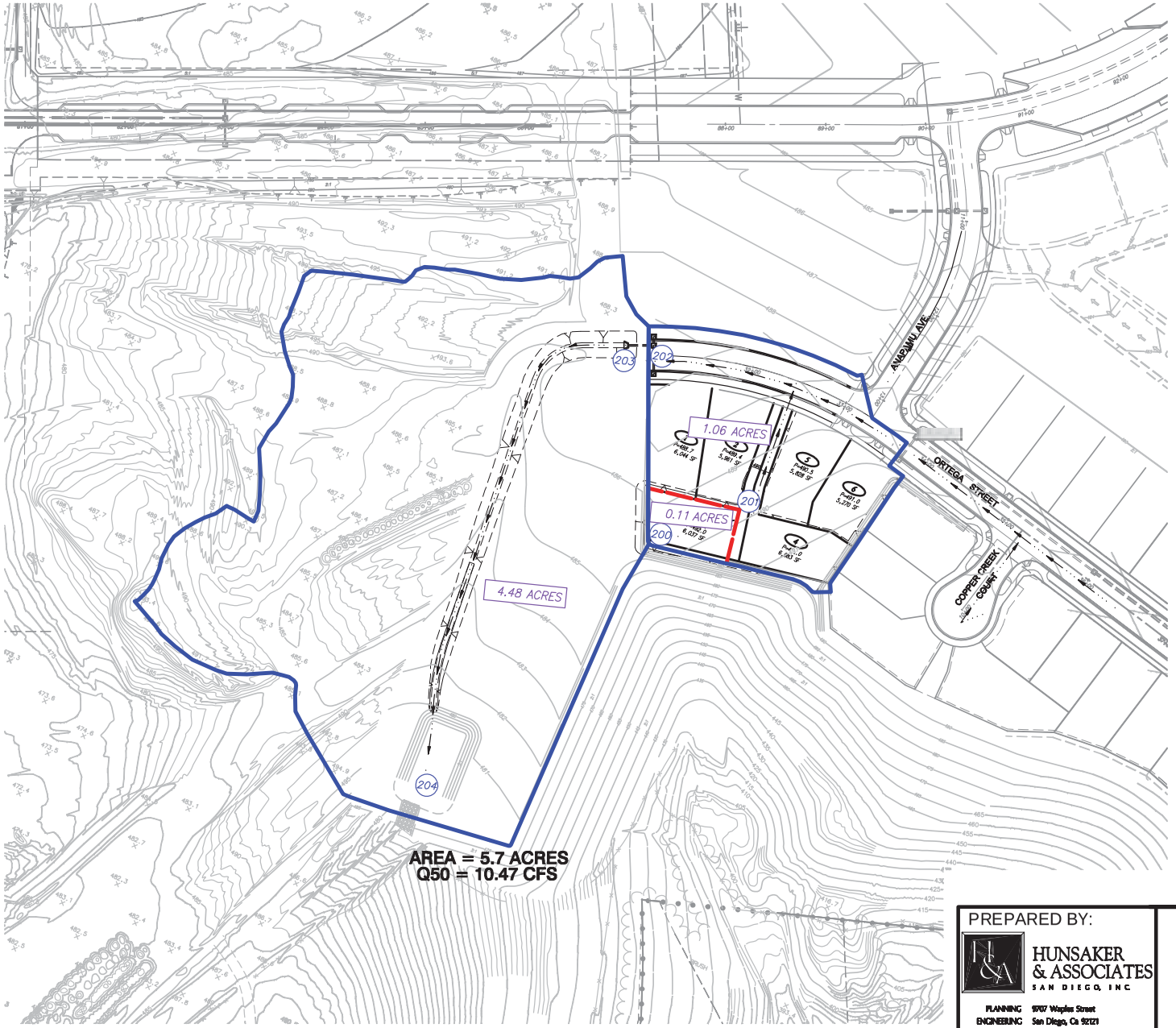
OTAY RANCH VILLAGE 2, R 15

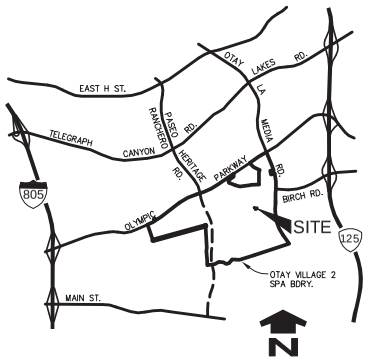
CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 2

W.O.# 2807-0035

R:\1089\Hyd\ACAD\HYDRO\R-15\1089$H01-HYDRO EXIST-V2 R-15 TM Exhibit 1.1.dwg[]Mar-12-2013:10:19





VICINITY MAP

NOT TO SCALE

LEGEND:

(100)	HYDROLOGY NODE
XX.X ACRES	WATERSHED AREA

PREPARED BY:

HUNSAKER & ASSOCIATES SAN DIEGO, INC

PLANNING 9707 Waples Street
ENGINEERING San Diego, Ca 92121
SURVEYING PH 858.558.4500 · FX 858.558.1414

EXHIBIT 8.2
POST DEVELOPED HYDROLOGY MAP

OTAY RANCH VILLAGE 2, R 15

CITY OF CHULA VISTA, CALIFORNIA

MAP 2 OF 2

W.O.# 2807-0035

R:\1089\Hyd\ACAD\HYDRO\R-15\1089$H01-HYDRO PROP-V2 R-15 TM Exhibit 1.2.dwg[]Mar-12-2013 10:19

```
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                    Hunsaker & Associates San Diego, Inc.
                              9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch Village 2 R-15b TM hydrology model.                           *
* 50-year return interval... Existing and Post developed condition         *
* W.O. 2807-35,  DLN 1089                                                  *
 ****************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\R15\EX50.DAT
  TIME/DATE OF STUDY: 12:56 03/01/2013
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  50.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.250
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   17.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  3   20.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  4   16.0     10.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  5   26.0     18.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  6   44.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+---------------------------------------------------------------------------+
| Begin Pre-Developed Hydrology Model.                                      |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    491.90
  DOWNSTREAM ELEVATION(FEET) =    490.50
  ELEVATION DIFFERENCE(FEET) =      1.40
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.184
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.53
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   490.50  DOWNSTREAM(FEET) =   487.00
  FLOW LENGTH(FEET) =   178.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.81
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.53
  PIPE TRAVEL TIME(MIN.) =   0.78    Tc(MIN.) =    4.96
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     248.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.928
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .7500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    0.72   SUBAREA RUNOFF(CFS) =    3.20
  TOTAL AREA(ACRES) =        0.8   TOTAL RUNOFF(CFS) =       3.73
  TC(MIN.) =    4.96

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   487.00  DOWNSTREAM(FEET) =   479.00
  FLOW LENGTH(FEET) =   472.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.34
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.73
  PIPE TRAVEL TIME(MIN.) =   1.24    Tc(MIN.) =    6.20
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.159
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (ROLLING) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6223
  SUBAREA AREA(ACRES) =    4.81   SUBAREA RUNOFF(CFS) =   14.89
  TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =      18.14
  TC(MIN.) =    6.20

+--------------------------------------------------------------------------+
| End Existing model for Onsite R-15b.                                     |
|                                                                          |
| Begin hydrology model for revised flow to existing inlet on Anapamu Ave. |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  DENSE RESIDENTIAL (R2,R3) RUNOFF COEFFICIENT = .6500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    492.35
  DOWNSTREAM ELEVATION(FEET) =    491.65
```

```
  ELEVATION DIFFERENCE(FEET) =      0.70
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.530
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.990
  SUBAREA RUNOFF(CFS) =      0.36
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.36

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  491.65  DOWNSTREAM ELEVATION(FEET) =  490.00
  STREET LENGTH(FEET) =   288.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.68
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.91
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.41
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.37
  STREET FLOW TRAVEL TIME(MIN.) =   3.40   Tc(MIN.) =    9.93
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.809
  *USER SPECIFIED(SUBAREA):
  NORMAL RESIDENTIAL (R1) RUNOFF COEFFICIENT = .6500
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.650
  SUBAREA AREA(ACRES) =    1.06      SUBAREA RUNOFF(CFS) =    2.62
  TOTAL AREA(ACRES) =        1.2        PEAK FLOW RATE(CFS) =       2.90

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.91
  FLOW VELOCITY(FEET/SEC.) =  1.59   DEPTH*VELOCITY(FT*FT/SEC.) =   0.48
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   286.00  DOWNSTREAM(FEET) =   282.00
  FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.31
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.90
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =    9.97
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =     388.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    482.00  DOWNSTREAM(FEET) =    479.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   535.00   CHANNEL SLOPE =  0.0056
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    50 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.036
  *USER SPECIFIED(SUBAREA):
```

```
  VEGETATED SLOPES (ROLLING) RUNOFF COEFFICIENT = .6000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.02
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.15
  AVERAGE FLOW DEPTH(FEET) =   0.54   TRAVEL TIME(MIN.) =   4.14
  Tc(MIN.) =   14.11
  SUBAREA AREA(ACRES) =     4.48       SUBAREA RUNOFF(CFS) =    8.16
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.610
  TOTAL AREA(ACRES) =        5.7         PEAK FLOW RATE(CFS) =      10.47

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.67   FLOW VELOCITY(FEET/SEC.) =   2.45
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =     923.00 FEET.

+----------------------------------------------------------------------------+
| End hydrology model for onsite-R-15b.                                      |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        5.7  TC(MIN.) =     14.11
  PEAK FLOW RATE(CFS)   =      10.47
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

TM DRAINAGE STUDY
For
OTAY RANCH VILLAGE 2 WEST

City of Chula Vista, California

Prepared for:
Baldwin & Sons, Inc.
610 W. Ash Street
Suite 1500
San Diego, CA 92121

W.O. 2807-35

November 13, 2013

Hunsaker & Associates
San Diego, Inc.

Alisa S. Vialpando, R.C.E. 47945
Principal

REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
No. 47945
Exp. 12/31/13
CIVIL
STATE OF CALIFORNIA

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2.2 Design Rainfall Determination
2.3 Runoff Coefficient Determination
2.4 Rainfall Intensity Determination
- Maximum Overland Flow Length & Initial Time of Concentration Table
- Urban Watershed Overland Time of Flow Nomograph
- Gutter & Roadway Discharge-Velocity Chart
- Manning's Equation Nomograph
- Intensity-Duration Design Chart

Chapter 3 - Hydrologic Analysis

3.1 100-Year Existing Condition AES Model Output
3.2 100-Year Developed Condition AES Model Output

Chapter 4 – Hydrology Exhibits/Maps

Existing Condition Hydrology Map (Exhibit 1.1) Map Pocket 1
Developed Condition Hydrology Map (Exhibit 1.2) Map Pocket 2

Appendix A – Excerpt from Master Drainage Study for Otay Ranch Villages 2, 3, & 4

CHAPTER 1 - EXECUTIVE SUMMARY

1.1 Introduction

This Preliminary Drainage Study has been prepared to assess the pre-developed and developed condition peak runoff rates from the proposed Otay Ranch Village 2 West site for Baldwin & Sons, Inc.

The Otay Ranch Village 2 West project site is located south of Olympic Parkway and west of the future extension of Heritage Road and north of the future extension of Santa Victoria Road in the City of Chula Vista. See Vicinity Map below. The gross subdivision area is 48.18 acres although approximately 28.28 acres will be graded and developed with single family, multi-family, and park area per this Tentative Map study. The remainder of boundary area will essentially consist of undisturbed areas, slopes, and brow ditches for erosion control.

Refer to Chapter 4 Exhibits 1.1 and 1.2 for an overview of the existing and proposed drainage patterns of the site. The Otay Ranch Village 2 West Tentative Map will consist of a total of 115 lots including 106 single family, 1 multi-family, 2 parks, 4 open spaces, and 2 neighborhood open spaces.

The entire Village 2 West site flows towards the northwest towards the existing Poggi Canyon Detention Basin located at the southwest quadrant of the Olympic Parkway- Santa Victoria Road intersection in both the pre and post developed conditions.

Per County of San Diego drainage criteria, the Modified Rational Method should be used to determine peak design flow rates when the contributing drainage area is less than 1.0-square mile. Since the total watershed area discharging from the Otay Ranch Village 2 West site is less than 1.0-square mile, the AES-2003 computer software was used to model the runoff response per the Modified Rational Method.

Methodology used for the computation of design rainfall events, runoff coefficients, and rainfall intensity values are consistent with criteria set forth in the most current "San Diego County Hydrology Manual" and the "City of Chula Vista Subdivision Manual". A more detailed explanation of methodology and model development used for this analysis is listed in Chapter 2 of this report.

1.2 Summary of Pre-Developed Conditions

The topography for existing Village 2 West project area is characterized by rolling hills, vegetation consisting mainly of brush and incised canyons that partition the site into the watersheds shown on Exhibit 1.1 in Chapter 4. The southern watershed boundary was defined by the grading which has occurred for the Otay Landfill. Please note that the project site per this study will only include the area immediately west of the Heritage Road and the future Santa Victoria Road as shown on Exhibit 1.1. The additional watersheds shown on the exhibits were included for informational and comparison purposes between the existing and ultimate development of Village 2 West. The natural drainage channels located throughout Village 2 West drain to the northwest and the existing Poggi Canyon Detention Basin. This detention basin was sized to accommodate runoff from this project as well as the other portions of the Village 2 Master Development which drain towards Poggi Canyon. Please refer to Appendix A for an excerpt from the *Master Drainage Study for Otay Ranch Village 2, 3, & 4* (2005) which shows the anticipated drainage areas towards the detention basin and attenuated flows. Runoff from the detention basin confluences with the Otay River downstream. The Otay River ultimately empties into San Diego Bay.

Table 1 below summarizes the 100-year pre-development peak flows to each of the delineated watersheds. Runoff coefficients for this site in its existing condition varied between 0.35- 0.60 depending on the terrains average slope and type per the City of

Chula Vista Subdivision Manual. These coefficients correspond to vegetated slopes (steep to flat).

TABLE 1 - Summary of Pre-Developed Flows to the Otay River

Watershed Name	Drainage Area (ac)	100-Year Peak Flow (cfs)
West	31.46	66.07
West-Central	2.63	7.69
East-Central	1.04	3.22
East	109.19	187.67
TOTAL	**144.32**	**264.65**

Supporting calculations for the data presented in Table 1 are located in Chapter 3 of this report. The corresponding hydrology map is Exhibit 1.1 in Chapter 4.

1.3 Summary of Developed Conditions

The Otay Ranch Village 2 West Tentative Map will consist of residential dwelling units, park sites, open space areas and paved roads. The hydrologic boundary per this study encompasses 48.18 acres with approximately 28.28 acres being graded for the residential units, parks, and roads. The boundary per this Tentative Map is delineated in the 'Developed Condition Hydrology Map' located in the Chapter 4. The TM project area is located in the eastern portion of the overall Village 2 West development immediately west of Heritage Road and south of Olympic Parkway.

Two streets (Barranca Avenue, Natoma Court) will intersect with the proposed extension of Santa Victoria Road which will be extended between Heritage Road and Olympic Parkway. The developed residential areas will slope towards the south with average slopes between 1 - 2%. Santa Victoria Road will drain towards the northwest with varying slopes between 1 - 8%. Onsite inlets will collect runoff from the study area and convey it south then west along Santa Victoria Road. Approximately 930 feet south of the intersection with Olympic Parkway, the storm drain will be directed towards the proposed water quality (WQ) basin to be located immediately south of the existing Poggi Canyon Detention Basin. Please refer to the *Water Quality Technical Report for Otay Ranch Village 2 West* (November 2013) for additional water quality information related to the WQ basin. After WQ treatment, runoff will be directed to the Poggi Canyon Detention Basin for peak flow attenuation. The Poggi Canyon Detention Basin was sized to attenuate flows related to the development of the overall Otay Ranch Village 2 which includes the

area in this study. Appendix A includes an excerpt from the master drainage study for Otay Ranch Village 2.

Per this TM, storm drain will need to be constructed from the developed residential areas to the detention basin via Santa Victoria Road. Future developments along the storm drain route will need to tie into it in the future. For instance, the industrial and offsite areas north of Santa Victoria Road will drain towards Santa Victoria Road when developed. For this reason, the 'Developed Condition Hydrology Map' (Exhibit 1.2) located in Chapter 4 includes the ultimate build-out scenario to account for expected runoff and to correctly design the proposed storm drain infrastructure along Santa Victoria Road.

Table 2 summarizes the 100-year developed condition peak flows to each of the discharge locations towards the Otay River. Runoff coefficients assumed for the proposed roads, commercial/industrial development, multi-family development, single family development, and the park areas are per the City of Chula Vista Subdivision Manual.

TABLE 2 - Summary of Developed Flows to Otay River

Watershed Name	Drainage Area (ac)	100-Year Peak Flow (cfs)
West Watershed	3.73	12.92
Village 2 Watershed	143.55	594.82
Ephemeral Stream	9.80*	8.28
East	3.12	14.52
TOTAL	**160.2**	**630.54**

*-This is a low flow channel. It includes area already accounted for in the Village 2 Watershed.

Supporting calculations for the data presented in Table 2 is located in Chapter 3 of this report. The corresponding hydrology map is Exhibit 1.2 in Chapter 4.

The storm drain outlet from the site will connect to an existing outlet structure into the Poggi Detention Basin. This structure was built per C.V. Dwg. No. 99-427.

1.4 Results & Recommendations

Table 3 summarizes the effects of site development at the receiving Otay River.

TABLE 3 - Summary of Pre vs. Post-Developed Condition Flows to Otay River

Condition	Drainage Area (acres)	100-Year Peak Flow (cfs)
Pre-Developed	144.32	264.65
Post-Developed	160.2	630.54
DIFFERENCE	**+ 15.88***	**+ 365.89**

* =Area diverted along northern project boundary and area double-counted for ephemeral stream.

Development of Otay Ranch Village 2 West results in a net increase of runoff discharge of about 366 cfs. However, the entire Village 2 West was included in the Poggi Canyon Channel and Detention Basin analysis included in the *Master Drainage Study for Otay Ranch Village 2, 3, & 4* (2005). The predeveloped Q100 inflow to the detention basin was determined to be 1,320 cfs. Peak flow attenuation performed by the detention basin will decrease basin (Q100) inflows from 2,295 cfs to 1,115 cfs which is less than the pre-developed condition. Therefore, Poggi Canyon Channel will be able to handle the expected developed flows.

The main storm drain outlet proposed for Otay Ranch Village 2 West outlets into the Poggi Canyon Detention. A water quality basin treats runoff tributary to the main storm drain. Formal discussion, calculations, and analysis regarding water quality for Village 2 West are included in the *Water Quality Technical Report for Otay Ranch Village 2 West Tentative Map* dated November 2013.

A comparison of the existing and proposed condition maps illustrate that the slope areas along the northern boundary of the Village 2 West development will be reduced in the post developed state. Therefore, direct runoff towards Poggi Canyon will be reduced along this stretch.

The main storm drain outfall from proposed Village 2 West discharges its water quality flows into the WQ Basin and subsequently into the Poggi Canyon Detention Basin. Concrete energy dissipators will be specified at each outfall into each basin. Devices per San Diego Regional Standard Drawings D-41 (or APWA Impact Basin 384-0) and rip-rap aprons will be designed to reduce velocities as dictated by the standard drawings during the final engineering stage.

Prior to discharge from the site, all developed site runoff will receive full water quality treatment in accordance with the most current City of Chula Vista Storm Water Manual standards applicable at the time of final engineering. The project will be designed to avoid violation of any water quality standards or waste discharge requirements. Storm water treatment design is further discussed in the *Water Quality Technical Report for Otay Ranch Village 2 West Tentative Map*.

Summary:

- Drainage facilities within Village 2 West will be designed in accordance with the requirements of the Chula Vista Subdivision Manual, the San Diego County Hydrology Manual and the requirements of the San Diego Regional Water Quality Control Board.

- Peak discharge flows produced by the development of the site will be attenuated via the existing Poggi Canyon Detention Basin as previously determined by the *Master Drainage Study for Otay Ranch Village 2, 3, & 4* (2005).

- Development of the project site will not further degrade potential beneficial uses of downstream water bodies as designated by the Regional Water Quality Control Board, including water bodies listed on the Clean Water Section 303d list.

- Onsite and offsite drainage easements shall be provided to the satisfaction of the Director of Public Works.

References

City of Chula Vista Subdivision Manual; Engineering Department and Land Development; Section 3, July 1, 2002 (*Rev 2011)*.

San Diego County Hydrology Manual; County of San Diego Department of Public Works Flood Control Division, June 2003

Master Drainage Study for Otay Ranch Village 2, 3, & 4 prepared by Hunsaker & Associated, July 14, 2005.

Hydromodification Management Plan prepared for County of San Diego, California, March 2011

"Order No. R9-2007-0001, NPDES No. CAS0108758 – Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, San Diego Unified Port District and the San Diego County Regional Airport Authority", California Regional Water Quality Control Board – San Diego Region; January 24, 2007.

Water Quality Technical Report for Otay Ranch Village 2 West Tentative Map prepared by Hunsaker & Associated, November 2013.

CHAPTER 2 - METHODOLOGY

2.1 - Rational Method Model Development Summary

Computer Software Package – AES-2010

Design Storm – 100-Year Return Interval

Land Use – Park, Multi Family, Single Family, and Open Space

Soil Type - Hydrologic soil group D was assumed for all areas. Group D soils have very slow infiltration rates when thoroughly wetted. Consisting chiefly of clay soils with a high swelling potential, soils with a high permanent water table, soils with clay pan or clay layer at or near the surface, and shallow soils over nearly impervious materials, Group D soils have a very slow rate of water transmission.

Runoff Coefficient – In accordance with the City of Chula Vista Subdivision Manual, a runoff coefficient of 0.90 was used for fully paved areas, 0.85 for the Industrial/Commercial Sites, 0.75 for the Multi-Family Sites and dense residential, 0.65 for the Single-Family pads, 0.35 for proposed open space, and 0.30 for parks.

Method of Analysis – The Rational Method is the most widely used hydrologic model for estimating peak runoff rates. Applied to small urban and semi-urban areas with drainage areas less than 1.0 square mile, the Rational Method relates storm rainfall intensity, a runoff coefficient, and drainage area to peak runoff rate. This relationship is expressed by the equation:

Q = CIA, where:

Q = The peak runoff rate in cubic feet per second at the point of analysis.

C = A runoff coefficient representing the area - averaged ratio of runoff to rainfall intensity.

I = The time-averaged rainfall intensity in inches per hour corresponding to the time of concentration.

A = The drainage basin area in acres.

To perform a node-link study, the total watershed area is divided into subareas which discharge at designated nodes.

The procedure for the subarea summation model is as follows:

(1) Subdivide the watershed into an initial subarea (generally 1 lot) and subsequent subareas, which are generally less than 10 acres in size. Assign upstream and downstream node numbers to each subarea.

(2) Estimate an initial T_c by using the appropriate nomograph or overland flow velocity estimation.

(3) Using the initial T_c, determine the corresponding values of I. Then Q = C I A.

(4) Using Q, estimate the travel time between this node and the next by Manning's equation as applied to the particular channel or conduit linking the two nodes. Then, repeat the calculation for Q based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES-2010 computer subarea menu is as follows:

SUBAREA HYDROLOGIC PROCESS

1. Confluence analysis at node.
2. Initial subarea analysis (including time of concentration calculation).
3. Pipeflow travel time (computer estimated).
4. Pipeflow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through subarea.
7. User - specified information at node.
8. Addition of subarea runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

$$Q_p = Q_a + Q_b;\ T_p = T_a = T_b$$

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by the ratio of rainfall intensities.

$Q_p = Q_a + Q_b \ (I_a/I_b)$; $T_p = T_a$

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

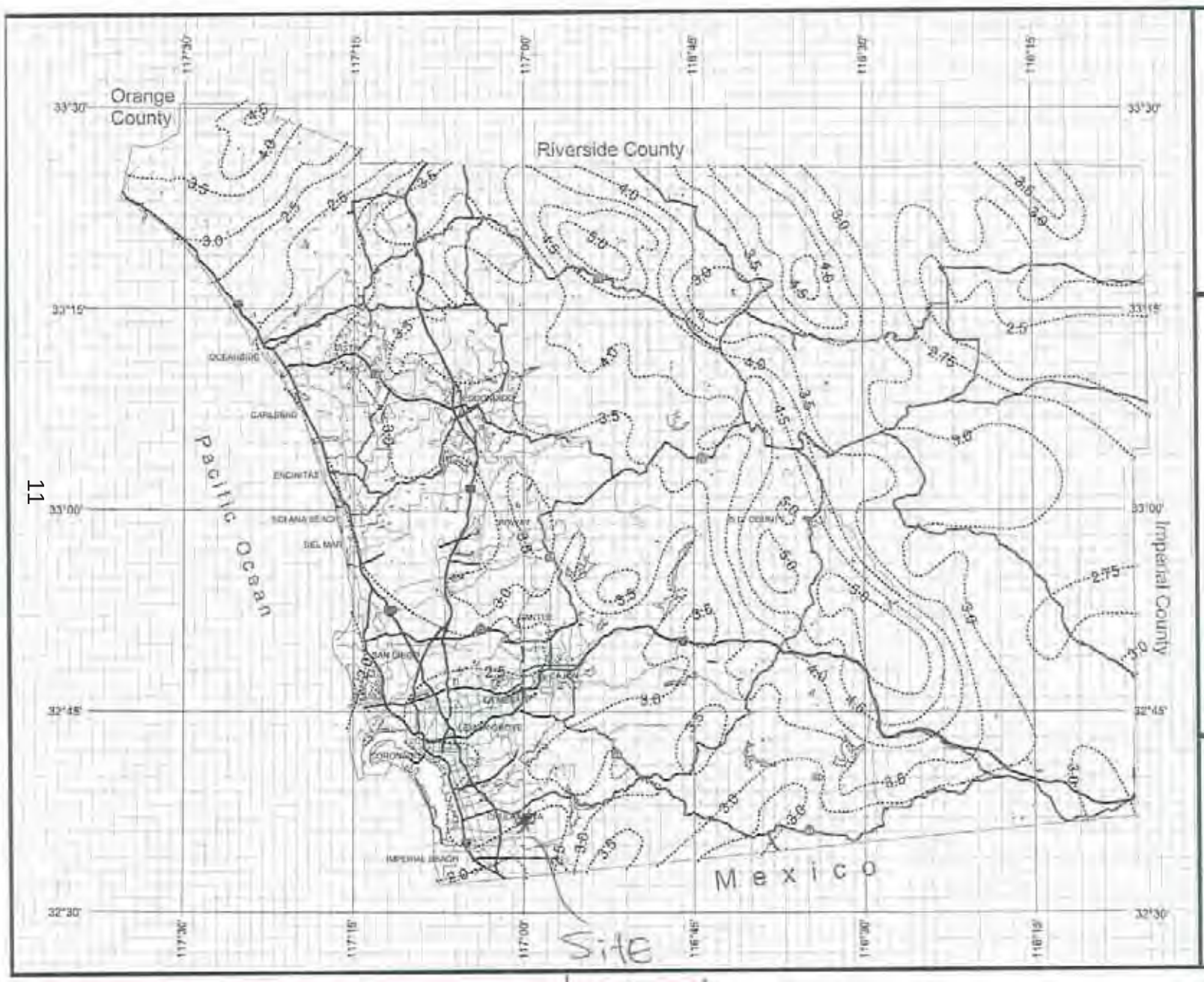
$Q_p = Q_b + Q_a \ (T_b/T_a)$; $T_p = T_b$

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.2 – Design Rainfall Determination

100-Year, 6-Hour and 50-Year, 6-Hour Rainfall Isopluvial Maps from San Diego County Hydrology Manual June 2003



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

VILLAGE 2-WEST

$P_6 = 2.5$

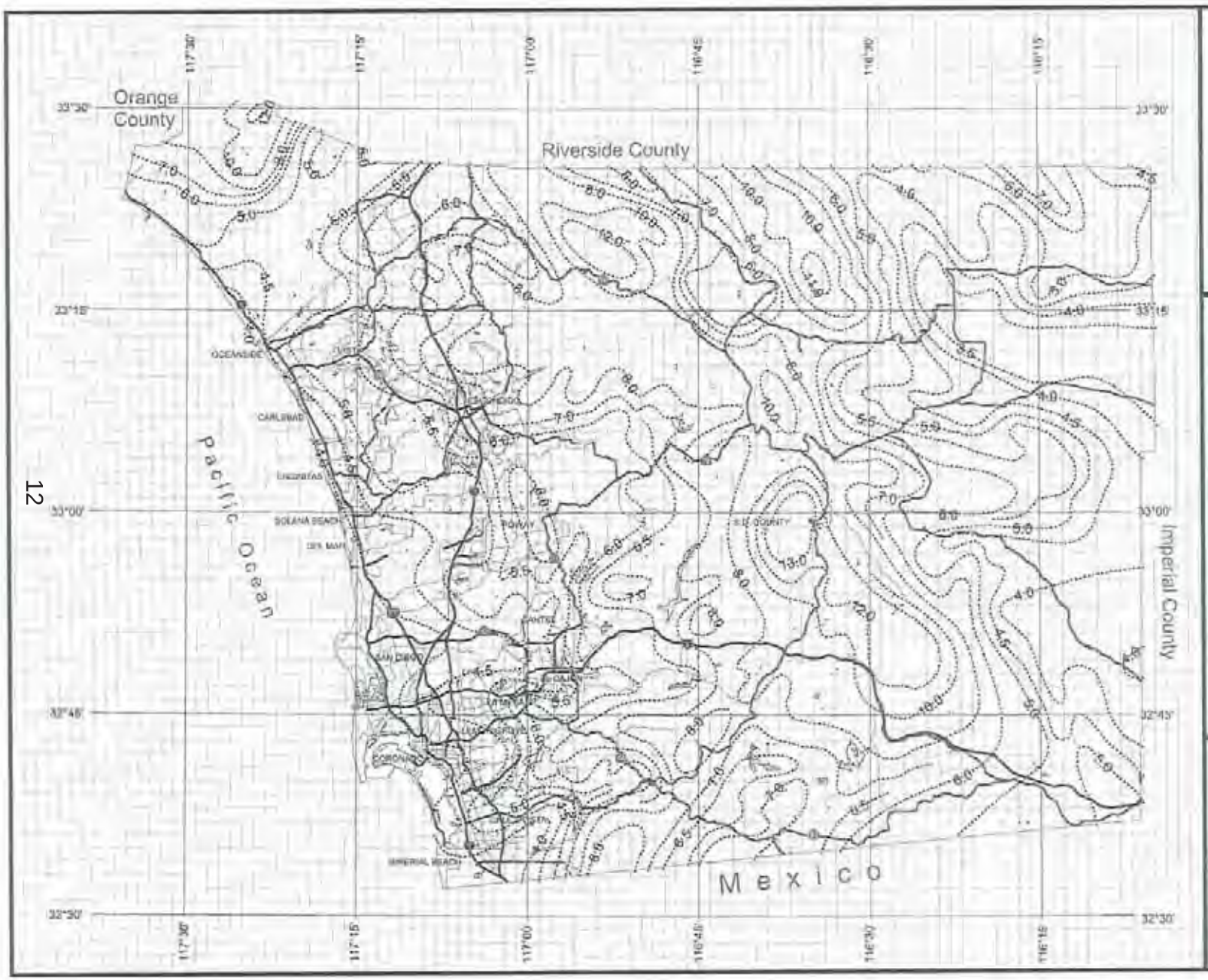
32° 36'48"
117° 00' 13"

DPW GIS

SanGIS

N
W
E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

VILLAGE 2-WEST

$P_{100} = 4.1$

DPW GIS

SanGIS

N W E S

3 0 3 Miles

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.3 – Runoff Coefficient Determination

3-203.1 **Previously Approved Reports** - Runoff quantities, as set forth or derived from the report prepared by Lawrence, Fogg, Florer and Smith titled "A Special Study of Storm Drain Facilities" on file in the office of the City Engineer may be used in the design of drainage facilities in Chula Vista. A hydrologic study prepared and approved at General Development Plan (GDP) or Specific Planning Area (SPA) plan may be used as determined by the City Engineer.

3-203.2 For local drainage basins, storm discharge flow may be estimated based on the Rational Method or the Modified Rational Method. For all lateral and major drainage basins the SCS method, U.S. Army Corps of Engineers HEC-1 computer method or other tabular or computer method may be used upon City Engineer approval.

3-203.3 **Rational and Modified Rational Methods**

(1) The rational method equation relates storm rainfall intensity (I), a selected runoff coefficient (C) and drainage area (A) to the peak runoff rate (Q):

$$Q = CIA \text{ (Empirical Units)}$$

where:

Q = Peak runoff in cubic feet per second
C = Runoff coefficient
I = Intensity, inches per hours
A = Drainage basin area in acres

Or

$$Q = 0.278CIA \text{ (Metric Units)}$$

where:

Q = Peak runoff in cubic meters per second
C = Runoff coefficient
I = Intensity in millimeters per second
A = Drainage area in square kilometers

(2) Coefficient of Runoff: Consider probable development. Use highest number of the following values:

a)	Paved Surface	0.90
b)	Commercial Area	0.85
c)	Dense Residential (R2, R3)	0.75
d)	Normal Residential (R1)	0.65
e)	Suburban Property (RE)	0.55
f)	Barren Slopes Steep	0.80
g)	Barren Slopes Hilly	0.75
h)	" " Rolling	0.70
i)	" " Flat	0.65
j)	Vegetated Slopes Steep	0.60
k)	" " Hilly	0.55
l)	" " Rolling	0.50
m)	" " Flat	0.45

n)	Farm Land	0.35
o)	Parks, Golf Courses	0.30

CHAPTER 2

METHODOLOGY & MODEL DEVELOPMENT

2.4 – Rainfall Intensity Determination

-Maximum Overland Flow Length & Initial Time of Concentration

-Urban Watershed Overland Time of Flow Nomograph

-Gutter & Roadway Discharge-Velocity Chart

- Manning's Equation Nomograph

-Intensity-Duration Design Chart

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.

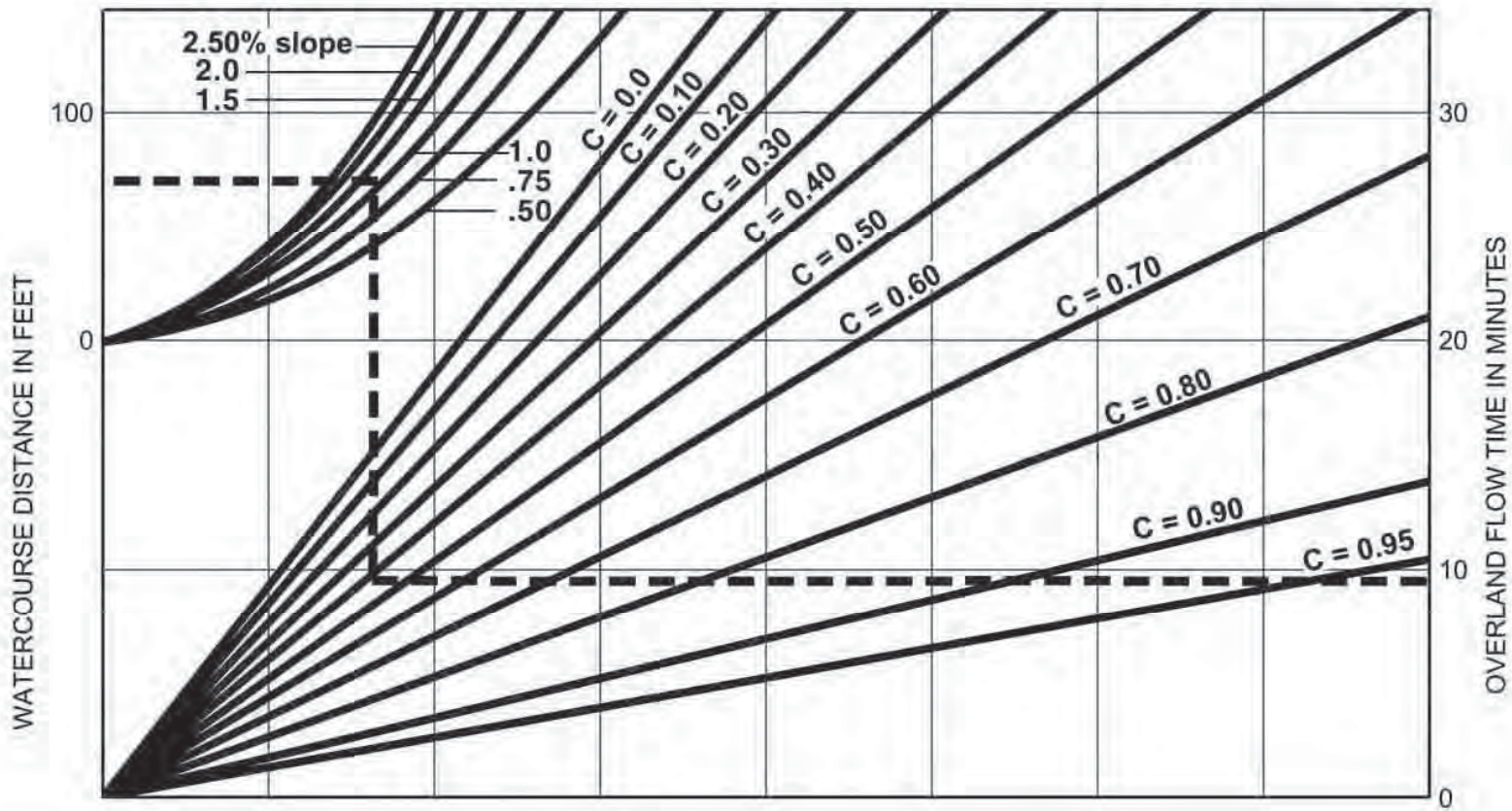
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved 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/	.5%		1%		2%		3%		5%		10%	
	Acre	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



EXAMPLE:

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

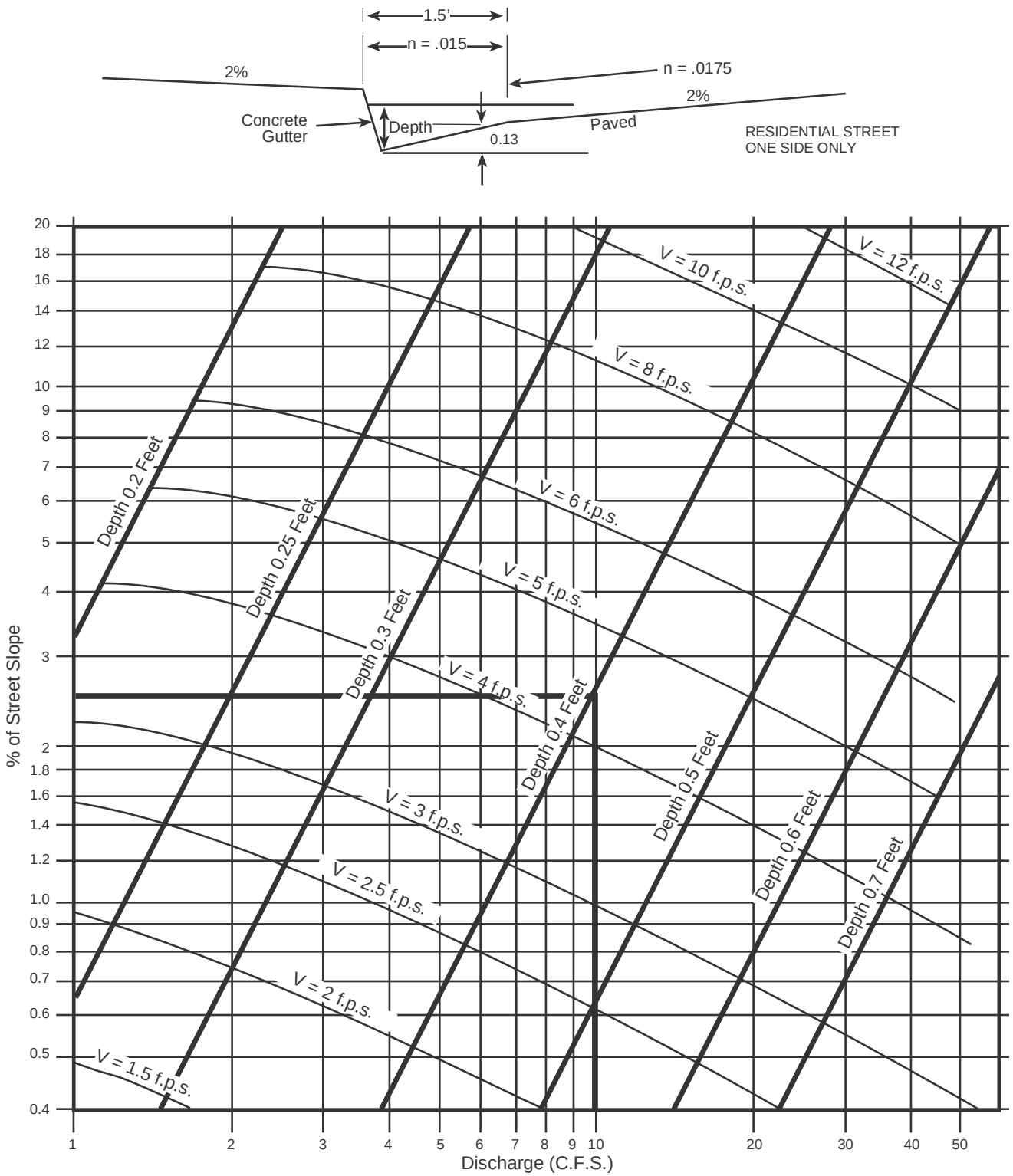
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

Rational Formula - Overland Time of Flow Nomograph

3-3



EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

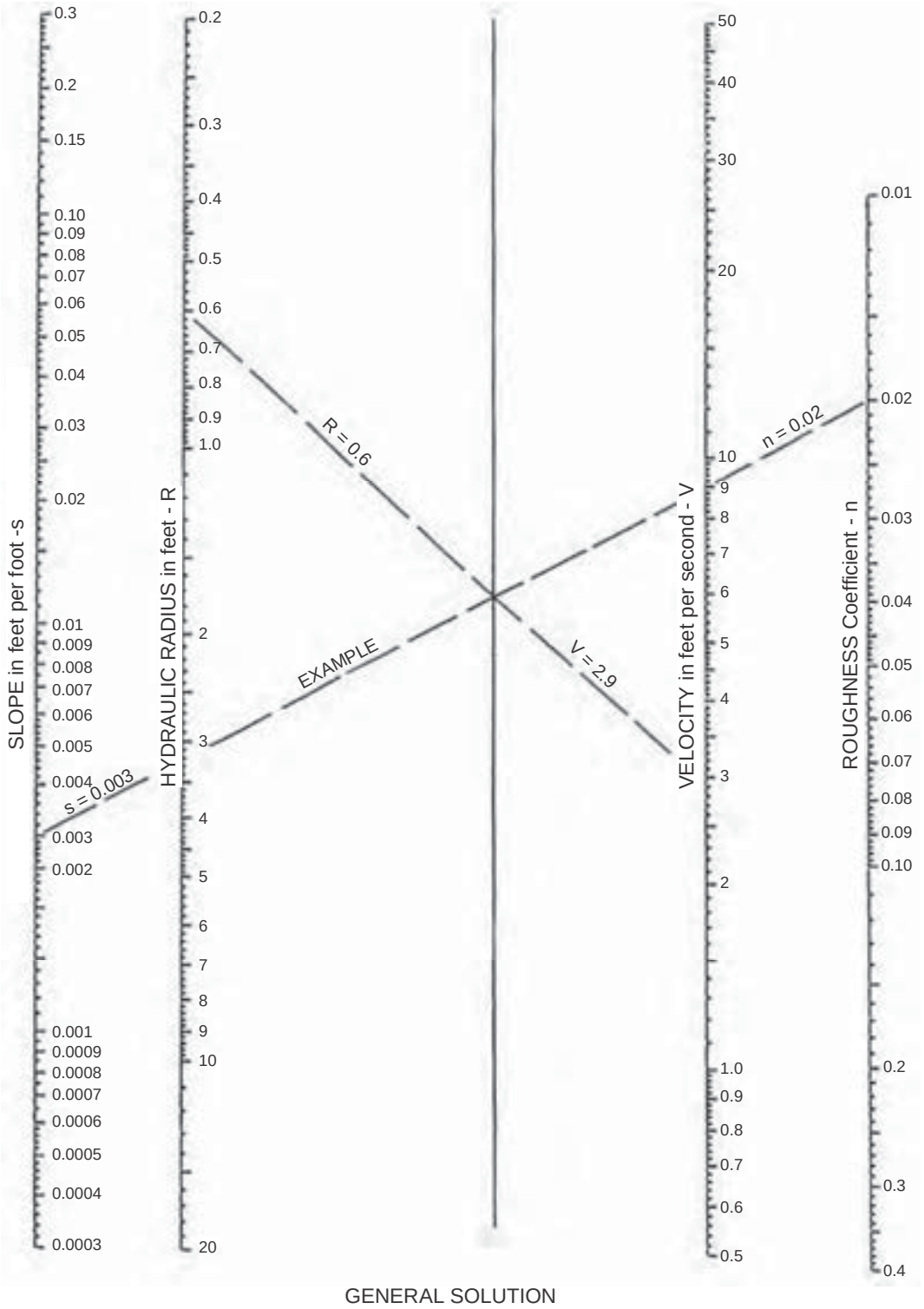
SOURCE: San Diego County Department of Special District Services Design Manual

FIGURE

Gutter and Roadway Discharge - Velocity Chart

3-6

EQUATION: $V = \frac{1.49}{n} R^{2/3} s^{1/2}$



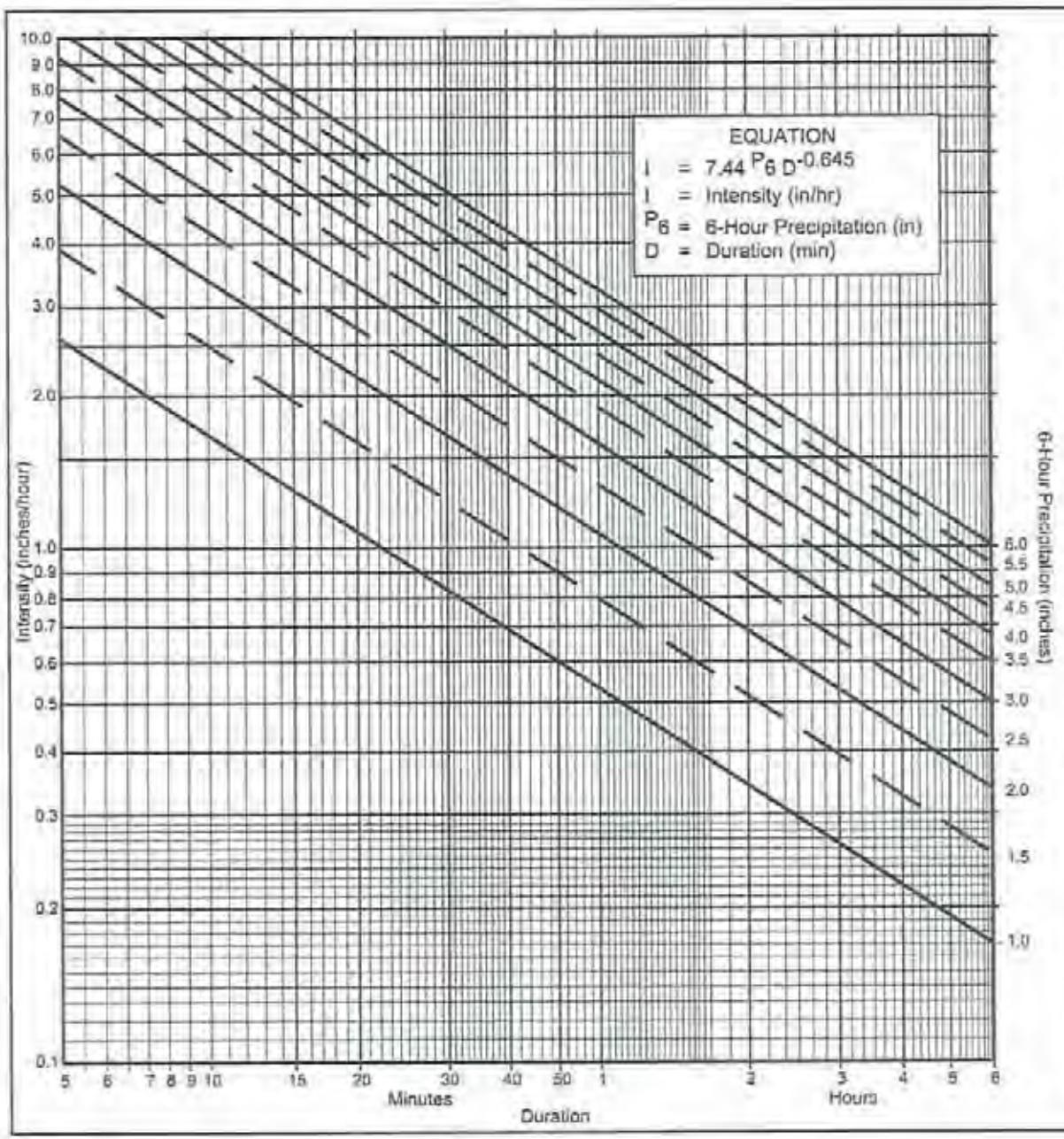
SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

Manning's Equation Nomograph

3-7

VILLAGE 2-WEST



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = 2.5 in., P_{24} = 4.1, $\frac{P_6}{P_{24}}$ = 61 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.5 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

CHAPTER 3

HYDROLOGIC ANALYSIS

3.1 – 100-Year Pre-Developed Condition AES Model Output

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____________________________________________________________________________
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                          2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                  Hunsaker & Associates San Diego, Inc.
                            9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch Village 2, West TM                                            *
* EXISTING CONDITION, 100-YEAR RETURN INTERVAL                             *
* W.O. 2807-35, DLN 1089                                                   *
 ***************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\W\EX100.DAT
  TIME/DATE OF STUDY: 15:10 06/01/2012
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    450.00
  DOWNSTREAM ELEVATION(FEET) =    440.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      3.48
  TOTAL AREA(ACRES) =      0.88   TOTAL RUNOFF(CFS) =      3.48

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    440.00  DOWNSTREAM(FEET) =    426.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   831.00   CHANNEL SLOPE =  0.0168
  CHANNEL FLOW THRU SUBAREA(CFS) =       3.48
  FLOW VELOCITY(FEET/SEC) =   2.52 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.50   Tc(MIN.) =    9.68
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     931.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.303
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    7.08   SUBAREA RUNOFF(CFS) =   18.28
  TOTAL AREA(ACRES) =        8.0   TOTAL RUNOFF(CFS) =      20.55
  TC(MIN.) =    9.68

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    425.00  DOWNSTREAM(FEET) =    345.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   730.00   CHANNEL SLOPE =  0.1096
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      20.55
  FLOW VELOCITY(FEET/SEC) =   9.55 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.27   Tc(MIN.) =   10.95
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1661.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.973
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5685
  SUBAREA AREA(ACRES) =   13.59   SUBAREA RUNOFF(CFS) =   29.69
  TOTAL AREA(ACRES) =       21.5   TOTAL RUNOFF(CFS) =      48.67
  TC(MIN.) =   10.95

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    345.00  DOWNSTREAM(FEET) =    300.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   665.00   CHANNEL SLOPE =  0.0677
  CHANNEL FLOW THRU SUBAREA(CFS) =      48.67
  FLOW VELOCITY(FEET/SEC) =   9.99 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.11   Tc(MIN.) =   12.06
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    2326.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.733
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5627
  SUBAREA AREA(ACRES) =    9.91   SUBAREA RUNOFF(CFS) =   20.35
  TOTAL AREA(ACRES) =       31.5   TOTAL RUNOFF(CFS) =      66.07
  TC(MIN.) =   12.06

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    460.50
  DOWNSTREAM ELEVATION(FEET) =    450.50
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.63
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.63

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    450.00  DOWNSTREAM(FEET) =    330.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   581.00   CHANNEL SLOPE =  0.2065
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.63
  FLOW VELOCITY(FEET/SEC) =   2.55 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.80   Tc(MIN.) =    7.98
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     681.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.871
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    2.47   SUBAREA RUNOFF(CFS) =    7.22
  TOTAL AREA(ACRES) =        2.6   TOTAL RUNOFF(CFS) =       7.69
  TC(MIN.) =    7.98

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    251.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    445.00
  DOWNSTREAM ELEVATION(FEET) =    435.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =      0.04   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
  FLOW PROCESS FROM NODE    251.00 TO NODE    252.00 IS CODE =  53
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    435.00  DOWNSTREAM(FEET) =    325.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   494.00   CHANNEL SLOPE =  0.2227
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.16
  FLOW VELOCITY(FEET/SEC) =   2.64 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.12   Tc(MIN.) =    7.29
  LONGEST FLOWPATH FROM NODE    250.00 TO NODE    252.00 =     594.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    251.00 TO NODE    252.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.163
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (STEEP) RUNOFF COEFFICIENT = .6000
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    1.00   SUBAREA RUNOFF(CFS) =    3.10
  TOTAL AREA(ACRES) =        1.0   TOTAL RUNOFF(CFS) =       3.22
  TC(MIN.) =    7.29

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (FLAT) RUNOFF COEFFICIENT = .4500
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    495.00
  DOWNSTREAM ELEVATION(FEET) =    488.00
  ELEVATION DIFFERENCE(FEET) =      7.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.117
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.784
  SUBAREA RUNOFF(CFS) =      1.28
  TOTAL AREA(ACRES) =      0.49   TOTAL RUNOFF(CFS) =      1.28

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  53
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL MOUNTAIN CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    488.00  DOWNSTREAM(FEET) =    384.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   800.00   CHANNEL SLOPE =  0.1300
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.28
  FLOW VELOCITY(FEET/SEC) =   2.19 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.09   Tc(MIN.) =   12.21
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     900.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.704
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5481
  SUBAREA AREA(ACRES) =   25.86   SUBAREA RUNOFF(CFS) =   52.68
  TOTAL AREA(ACRES) =       26.4   TOTAL RUNOFF(CFS) =      53.50
  TC(MIN.) =   12.21

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    384.00  DOWNSTREAM(FEET) =    354.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   527.00   CHANNEL SLOPE =  0.0569
  CHANNEL FLOW THRU SUBAREA(CFS) =      53.50
  FLOW VELOCITY(FEET/SEC) =   9.42 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.93   Tc(MIN.) =   13.14
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    1427.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.532
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5492
  SUBAREA AREA(ACRES) =   35.94   SUBAREA RUNOFF(CFS) =   69.82
  TOTAL AREA(ACRES) =       62.3   TOTAL RUNOFF(CFS) =     120.84
  TC(MIN.) =   13.14

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    354.00  DOWNSTREAM(FEET) =    313.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1405.00   CHANNEL SLOPE =  0.0292
  CHANNEL FLOW THRU SUBAREA(CFS) =     120.84
  FLOW VELOCITY(FEET/SEC) =   8.58 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.73   Tc(MIN.) =   15.87
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =    2832.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.127
  *USER SPECIFIED(SUBAREA):
  VEGETATED SLOPES (HILLY) RUNOFF COEFFICIENT = .5500
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5496
  SUBAREA AREA(ACRES) =   46.90   SUBAREA RUNOFF(CFS) =   80.67
  TOTAL AREA(ACRES) =      109.2   TOTAL RUNOFF(CFS) =     187.67
  TC(MIN.) =   15.87
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      109.2  TC(MIN.) =     15.87
  PEAK FLOW RATE(CFS)   =     187.67
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 3

HYDROLOGIC ANALYSIS

3.2 – 100-Year Developed Condition AES Model Output

```
____________________________________________________________________________
****************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                          2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2010 Advanced Engineering Software (aes)
             Ver. 17.0 Release Date: 07/01/2010  License ID 1239

                           Analysis prepared by:

                  Hunsaker & Associates San Diego, Inc.
                            9707 Waples Street
                           San Diego,  CA  92121


 ************************** DESCRIPTION OF STUDY **************************
* Otay Ranch Village 2, West TM                                            *
* 100-year return interval                                                 *
* W.O. 2807-35,  DLN 1089                                                  *
 ****************************************************************************

  FILE NAME: R:\1089\HYD\CALCS\AES\W\PR100.DAT
  TIME/DATE OF STUDY: 13:35 11/12/2013
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.500
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   17.0      8.5    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0160
  2   29.0     14.5    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  LAWNS, GOLF COURSES, ETC. FAIR COVER RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    433.70
  DOWNSTREAM ELEVATION(FEET) =    432.00
  ELEVATION DIFFERENCE(FEET) =      1.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.537
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.072
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.23

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   432.00  DOWNSTREAM(FEET) =   426.00
  FLOW LENGTH(FEET) =   287.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.06
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.23
  PIPE TRAVEL TIME(MIN.) =   1.56    Tc(MIN.) =   12.10
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     372.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.725
  *USER SPECIFIED(SUBAREA):
  LAWNS, GOLF COURSES, ETC. FAIR COVER RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =    2.51   SUBAREA RUNOFF(CFS) =    2.80
  TOTAL AREA(ACRES) =        2.7   TOTAL RUNOFF(CFS) =       3.02
  TC(MIN.) =   12.10

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   421.00  DOWNSTREAM(FEET) =   420.00
  FLOW LENGTH(FEET) =    96.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.11
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.02
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =   12.41
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     13.00 =     468.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

+--------------------------------------------------------------------------+
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    157.10 TO NODE    157.20 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    482.00
  DOWNSTREAM ELEVATION(FEET) =    472.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.089
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      2.91
```

```
  TOTAL AREA(ACRES) =      0.52   TOTAL RUNOFF(CFS) =      2.91

****************************************************************************
  FLOW PROCESS FROM NODE    157.20 TO NODE    157.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   472.00  DOWNSTREAM(FEET) =   429.00
  FLOW LENGTH(FEET) =   271.38   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.35
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.91
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =    2.43
  LONGEST FLOWPATH FROM NODE    157.10 TO NODE    157.00 =     371.38 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    157.20 TO NODE    157.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    3.00   SUBAREA RUNOFF(CFS) =   16.80
  TOTAL AREA(ACRES) =        3.5   TOTAL RUNOFF(CFS) =      19.71
  TC(MIN.) =    2.43

****************************************************************************
  FLOW PROCESS FROM NODE    157.00 TO NODE    158.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   424.50  DOWNSTREAM(FEET) =   419.50
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.86
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.71
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =    2.50
  LONGEST FLOWPATH FROM NODE    157.10 TO NODE    158.00 =     441.38 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    2.50
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     3.52
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.71

****************************************************************************
  FLOW PROCESS FROM NODE    159.00 TO NODE    160.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   125.00
  UPSTREAM ELEVATION(FEET) =    442.00
  DOWNSTREAM ELEVATION(FEET) =    429.50
```

```
  ELEVATION DIFFERENCE(FEET) =     12.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.671
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.77
  TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.77

****************************************************************************
  FLOW PROCESS FROM NODE    160.00 TO NODE    158.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  429.50  DOWNSTREAM ELEVATION(FEET) =  429.20
  STREET LENGTH(FEET) =   534.67   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 33.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.35
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.49
    HALFSTREET FLOOD WIDTH(FEET) =   17.95
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    0.70
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.34
  STREET FLOW TRAVEL TIME(MIN.) =  12.68   Tc(MIN.) =   14.36
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.336
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.99      SUBAREA RUNOFF(CFS) =    2.97
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       3.36

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.54   HALFSTREET FLOOD WIDTH(FEET) =  22.50
  FLOW VELOCITY(FEET/SEC.) =  0.77   DEPTH*VELOCITY(FT*FT/SEC.) =   0.41
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  534.7 FT WITH ELEVATION-DROP =   0.3 FT, IS    5.9 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    158.00
  LONGEST FLOWPATH FROM NODE    159.00 TO NODE    158.00 =     659.67 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.36
  RAINFALL INTENSITY(INCH/HR) =   3.34
  TOTAL STREAM AREA(ACRES) =     1.12
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.36

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       19.71     2.50        6.587          3.52
      2        3.36    14.36        3.336          1.12
```

```
  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       20.29     2.50       6.587
      2       13.34    14.36       3.336

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.29   Tc(MIN.) =    2.50
  TOTAL AREA(ACRES) =        4.6
  LONGEST FLOWPATH FROM NODE    159.00 TO NODE    158.00 =     659.67 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    158.00 TO NODE    156.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   424.20  DOWNSTREAM(FEET) =   418.50
  FLOW LENGTH(FEET) =    38.51   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  22.46
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      20.29
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    2.53
  LONGEST FLOWPATH FROM NODE    159.00 TO NODE    156.00 =     698.18 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    2.53
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     4.64
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     20.29

****************************************************************************
  FLOW PROCESS FROM NODE    162.00 TO NODE    163.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   146.33
  UPSTREAM ELEVATION(FEET) =    432.90
  DOWNSTREAM ELEVATION(FEET) =    430.20
  ELEVATION DIFFERENCE(FEET) =      2.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.669
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    82.68
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.95
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.95

****************************************************************************
  FLOW PROCESS FROM NODE    163.00 TO NODE    164.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
```

```
  UPSTREAM ELEVATION(FEET) =  430.10  DOWNSTREAM ELEVATION(FEET) =  427.10
  STREET LENGTH(FEET) =   226.20   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 33.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.28
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.26
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.34
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
  STREET FLOW TRAVEL TIME(MIN.) =   1.61   Tc(MIN.) =    4.28
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.45      SUBAREA RUNOFF(CFS) =    2.67
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       3.62

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.31
  FLOW VELOCITY(FEET/SEC.) =  2.59   DEPTH*VELOCITY(FT*FT/SEC.) =   0.91
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    164.00 =     372.53 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    164.00 TO NODE    156.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   422.00  DOWNSTREAM(FEET) =   418.50
  FLOW LENGTH(FEET) =    24.25   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.79
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.62
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    4.31
  LONGEST FLOWPATH FROM NODE    162.00 TO NODE    156.00 =     396.78 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE    156.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.31
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.61
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.62

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       20.29     2.53        6.587          4.64
      2        3.62     4.31        6.587          0.61

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       22.41     2.53       6.587
      2       23.91     4.31       6.587

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      23.91   Tc(MIN.) =    4.31
  TOTAL AREA(ACRES) =        5.2
  LONGEST FLOWPATH FROM NODE    159.00 TO NODE    156.00 =     698.18 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    156.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   421.00  DOWNSTREAM(FEET) =   420.00
  FLOW LENGTH(FEET) =   138.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.34
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.91
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    4.62
  LONGEST FLOWPATH FROM NODE    159.00 TO NODE     13.00 =     836.18 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       23.91     4.62       6.587        5.25
  LONGEST FLOWPATH FROM NODE    159.00 TO NODE     13.00 =     836.18 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        3.02    12.41       3.664        2.70
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     13.00 =     468.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      25.03       4.62        6.587
      2      16.32      12.41        3.664

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      25.03   Tc(MIN.) =    4.62
  TOTAL AREA(ACRES) =        7.9

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
|                                                                          |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    180.00 TO NODE    181.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    460.10
  DOWNSTREAM ELEVATION(FEET) =    459.40
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.271
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.366
  SUBAREA RUNOFF(CFS) =      1.05
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      1.05

******************************************************************************
  FLOW PROCESS FROM NODE    181.00 TO NODE    182.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  456.50  DOWNSTREAM ELEVATION(FEET) =  428.50
  STREET LENGTH(FEET) =   440.77   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.26
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.62
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.66
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.30
  STREET FLOW TRAVEL TIME(MIN.) =   1.58   Tc(MIN.) =    6.85
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.378
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.09      SUBAREA RUNOFF(CFS) =    4.40
  TOTAL AREA(ACRES) =        1.3        PEAK FLOW RATE(CFS) =       5.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   9.53
  FLOW VELOCITY(FEET/SEC.) =  5.15   DEPTH*VELOCITY(FT*FT/SEC.) =   1.63
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    182.00 =     510.77 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    182.00 TO NODE    175.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   423.50  DOWNSTREAM(FEET) =   423.00
  FLOW LENGTH(FEET) =    16.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.78
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.28
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    6.88
  LONGEST FLOWPATH FROM NODE    180.00 TO NODE    175.00 =     527.27 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =   1
------------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.88
  RAINFALL INTENSITY(INCH/HR) =   5.36
  TOTAL STREAM AREA(ACRES) =     1.31
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.28

******************************************************************************
  FLOW PROCESS FROM NODE    185.00 TO NODE    186.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.65
  DOWNSTREAM ELEVATION(FEET) =    464.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.520
  SUBAREA RUNOFF(CFS) =      1.81
  TOTAL AREA(ACRES) =      0.37   TOTAL RUNOFF(CFS) =      1.81

******************************************************************************
  FLOW PROCESS FROM NODE    186.00 TO NODE    187.00 IS CODE =  61
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  464.00  DOWNSTREAM ELEVATION(FEET) =  428.50
  STREET LENGTH(FEET) =   588.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.61
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.84
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.16
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.67
  STREET FLOW TRAVEL TIME(MIN.) =   1.90   Tc(MIN.) =    6.98
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.313
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    7.57
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       9.05

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.09
  FLOW VELOCITY(FEET/SEC.) =  5.72   DEPTH*VELOCITY(FT*FT/SEC.) =   2.11
  LONGEST FLOWPATH FROM NODE    185.00 TO NODE    187.00 =     653.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    187.00 TO NODE    175.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   423.50  DOWNSTREAM(FEET) =   423.00
  FLOW LENGTH(FEET) =    16.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.12
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.05
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.00
  LONGEST FLOWPATH FROM NODE    185.00 TO NODE    175.00 =     669.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    175.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.00
  RAINFALL INTENSITY(INCH/HR) =   5.30
  TOTAL STREAM AREA(ACRES) =     2.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.05

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.28     6.88        5.362          1.31
      2        9.05     7.00        5.300          2.27

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       14.17     6.88       5.362
      2       14.27     7.00       5.300

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      14.27   Tc(MIN.) =    7.00
  TOTAL AREA(ACRES) =        3.6
  LONGEST FLOWPATH FROM NODE    185.00 TO NODE    175.00 =     669.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    175.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   423.00  DOWNSTREAM(FEET) =   418.00
  FLOW LENGTH(FEET) =    38.92   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.46
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      14.27
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.04
  LONGEST FLOWPATH FROM NODE    185.00 TO NODE    250.00 =     708.42 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    448.65
  DOWNSTREAM ELEVATION(FEET) =    448.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.520
  SUBAREA RUNOFF(CFS) =      1.03
  TOTAL AREA(ACRES) =      0.21   TOTAL RUNOFF(CFS) =      1.03

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   443.00  DOWNSTREAM(FEET) =   435.00
  FLOW LENGTH(FEET) =   788.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.73
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.03
  PIPE TRAVEL TIME(MIN.) =   3.52    Tc(MIN.) =    8.60
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     853.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.642
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    6.12   SUBAREA RUNOFF(CFS) =   21.31
  TOTAL AREA(ACRES) =        6.3   TOTAL RUNOFF(CFS) =      22.04
  TC(MIN.) =    8.60

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   435.00  DOWNSTREAM(FEET) =   429.00
  FLOW LENGTH(FEET) =   619.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.18
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      22.04
  PIPE TRAVEL TIME(MIN.) =   1.26    Tc(MIN.) =    9.86
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1472.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.250
  *USER SPECIFIED(SUBAREA):
```

```
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7500
  SUBAREA AREA(ACRES) =    5.20   SUBAREA RUNOFF(CFS) =   16.57
  TOTAL AREA(ACRES) =       11.5   TOTAL RUNOFF(CFS) =      36.75
  TC(MIN.) =    9.86

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    112.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   429.00  DOWNSTREAM(FEET) =   425.00
  FLOW LENGTH(FEET) =   262.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.69
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      36.75
  PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   10.27
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =    1734.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.140
  *USER SPECIFIED(SUBAREA):
  LAWNS, GOLF COURSES, ETC. FAIR COVER RUNOFF COEFFICIENT = .3000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7267
  SUBAREA AREA(ACRES) =    0.63   SUBAREA RUNOFF(CFS) =    0.78
  TOTAL AREA(ACRES) =       12.2   TOTAL RUNOFF(CFS) =      36.75
  TC(MIN.) =   10.27
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.27
  RAINFALL INTENSITY(INCH/HR) =   4.14
  TOTAL STREAM AREA(ACRES) =    12.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     36.75

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    436.50
  DOWNSTREAM ELEVATION(FEET) =    436.00
  ELEVATION DIFFERENCE(FEET) =      0.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.829
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    60.77
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.06
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      1.06
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  436.00  DOWNSTREAM ELEVATION(FEET) =  430.00
  STREET LENGTH(FEET) =   393.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 33.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  16.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.08
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =   10.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.64
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.87
  STREET FLOW TRAVEL TIME(MIN.) =   2.48   Tc(MIN.) =    6.31
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.667
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.767
  SUBAREA AREA(ACRES) =    0.94      SUBAREA RUNOFF(CFS) =    4.00
  TOTAL AREA(ACRES) =        1.1        PEAK FLOW RATE(CFS) =       4.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.43
  FLOW VELOCITY(FEET/SEC.) =  2.95   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =     458.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.31
  RAINFALL INTENSITY(INCH/HR) =   5.67
  TOTAL STREAM AREA(ACRES) =     1.13
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.91

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       36.75    10.27        4.140         12.16
      2        4.91     6.31        5.667          1.13

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       27.50     6.31       5.667
      2       40.34    10.27       4.140

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      40.34   Tc(MIN.) =   10.27
  TOTAL AREA(ACRES) =       13.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =    1734.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   425.00  DOWNSTREAM(FEET) =   424.00
  FLOW LENGTH(FEET) =   203.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.29
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      40.34
  PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =   10.74
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =    1937.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.74
  RAINFALL INTENSITY(INCH/HR) =   4.02
  TOTAL STREAM AREA(ACRES) =    13.29
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     40.34

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    116.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OPEN BRUSH FAIR COVER RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    483.00
  DOWNSTREAM ELEVATION(FEET) =    476.50
  ELEVATION DIFFERENCE(FEET) =      6.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.358
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.54
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.54

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   451.00  DOWNSTREAM(FEET) =   435.00
  FLOW LENGTH(FEET) =   213.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.21
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.54
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =    2.93
  LONGEST FLOWPATH FROM NODE    115.00 TO NODE    117.00 =     278.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    116.00 TO NODE    117.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
```

```
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8314
  SUBAREA AREA(ACRES) =    0.48   SUBAREA RUNOFF(CFS) =    2.69
  TOTAL AREA(ACRES) =        0.6   TOTAL RUNOFF(CFS) =       3.23
  TC(MIN.) =    2.93

****************************************************************************
  FLOW PROCESS FROM NODE    117.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   430.00  DOWNSTREAM(FEET) =   424.00
  FLOW LENGTH(FEET) =    85.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.35
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.23
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    3.07
  LONGEST FLOWPATH FROM NODE    115.00 TO NODE    113.00 =     363.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.07
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.59
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.23

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       40.34    10.74        4.024         13.29
      2        3.23     3.07        6.587          0.59

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       27.87     3.07       6.587
      2       42.31    10.74       4.024

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      42.31   Tc(MIN.) =   10.74
  TOTAL AREA(ACRES) =       13.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =    1937.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    118.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   424.00  DOWNSTREAM(FEET) =   421.00
  FLOW LENGTH(FEET) =   282.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.93
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      42.31
  PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =   11.21
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    118.00 =    2219.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    118.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    464.85
  DOWNSTREAM ELEVATION(FEET) =    464.20
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.520
  SUBAREA RUNOFF(CFS) =      1.52
  TOTAL AREA(ACRES) =      0.31   TOTAL RUNOFF(CFS) =      1.52

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  464.20  DOWNSTREAM ELEVATION(FEET) =  460.50
  STREET LENGTH(FEET) =   168.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.82
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    7.62
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.74
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.76
  STREET FLOW TRAVEL TIME(MIN.) =   1.02   Tc(MIN.) =    6.10
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.792
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.06      SUBAREA RUNOFF(CFS) =    4.60
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       5.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.34
  FLOW VELOCITY(FEET/SEC.) =  3.00   DEPTH*VELOCITY(FT*FT/SEC.) =   0.94
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =     233.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   455.50  DOWNSTREAM(FEET) =   449.00
  FLOW LENGTH(FEET) =   386.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.31
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.95
  PIPE TRAVEL TIME(MIN.) =   0.88    Tc(MIN.) =    6.98
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    127.00 =     619.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.98
  RAINFALL INTENSITY(INCH/HR) =   5.31
  TOTAL STREAM AREA(ACRES) =     1.37
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.95

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    126.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    463.75
  DOWNSTREAM ELEVATION(FEET) =    463.10
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.520
  SUBAREA RUNOFF(CFS) =      1.81
  TOTAL AREA(ACRES) =      0.37   TOTAL RUNOFF(CFS) =      1.81

****************************************************************************
  FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  463.10  DOWNSTREAM ELEVATION(FEET) =  454.00
  STREET LENGTH(FEET) =   501.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.19
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.35
    HALFSTREET FLOOD WIDTH(FEET) =   11.16
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.01
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.05
  STREET FLOW TRAVEL TIME(MIN.) =   2.78   Tc(MIN.) =    7.86
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.921
```

```
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    3.42      SUBAREA RUNOFF(CFS) =   12.62
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =      13.99

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.91
  FLOW VELOCITY(FEET/SEC.) =  3.41   DEPTH*VELOCITY(FT*FT/SEC.) =   1.38
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    127.00 =     566.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.86
  RAINFALL INTENSITY(INCH/HR) =   4.92
  TOTAL STREAM AREA(ACRES) =     3.79
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.99

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.95     6.98        5.310          1.37
      2       13.99     7.86        4.921          3.79

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       18.38     6.98       5.310
      2       19.50     7.86       4.921

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      19.50   Tc(MIN.) =    7.86
  TOTAL AREA(ACRES) =        5.2
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    127.00 =     619.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    127.00 TO NODE    132.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   449.00  DOWNSTREAM(FEET) =   435.00
  FLOW LENGTH(FEET) =   682.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.38
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.50
  PIPE TRAVEL TIME(MIN.) =   1.09    Tc(MIN.) =    8.95
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    132.00 =    1301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    132.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.95
  RAINFALL INTENSITY(INCH/HR) =   4.52
  TOTAL STREAM AREA(ACRES) =     5.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.50
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    131.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    454.25
  DOWNSTREAM ELEVATION(FEET) =    453.60
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.520
  SUBAREA RUNOFF(CFS) =      1.47
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.47

****************************************************************************
  FLOW PROCESS FROM NODE    131.00 TO NODE    132.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  453.60  DOWNSTREAM ELEVATION(FEET) =  440.00
  STREET LENGTH(FEET) =   695.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.74
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   12.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.30
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.23
  STREET FLOW TRAVEL TIME(MIN.) =   3.51   Tc(MIN.) =    8.59
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.647
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    5.23      SUBAREA RUNOFF(CFS) =   18.23
  TOTAL AREA(ACRES) =        5.5        PEAK FLOW RATE(CFS) =      19.27

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  15.53
  FLOW VELOCITY(FEET/SEC.) =  3.81   DEPTH*VELOCITY(FT*FT/SEC.) =   1.66
  LONGEST FLOWPATH FROM NODE    130.00 TO NODE    132.00 =     760.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    132.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.59
  RAINFALL INTENSITY(INCH/HR) =   4.65
```

```
  TOTAL STREAM AREA(ACRES) =     5.53
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.27

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       19.50     8.95        4.524          5.16
      2       19.27     8.59        4.647          5.53

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       38.26     8.59       4.647
      2       38.27     8.95       4.524

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      38.27   Tc(MIN.) =    8.95
  TOTAL AREA(ACRES) =       10.7
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    132.00 =    1301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    132.00 TO NODE    118.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   435.00  DOWNSTREAM(FEET) =   421.00
  FLOW LENGTH(FEET) =    35.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  38.16
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.27
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    8.97
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    118.00 =    1336.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    118.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       38.27     8.97       4.519       10.69
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    118.00 =    1336.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       42.31    11.21       3.913       13.88
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    118.00 =    2219.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      72.12       8.97        4.519
      2      75.45      11.21        3.913

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      75.45   Tc(MIN.) =   11.21
  TOTAL AREA(ACRES) =       24.6

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    118.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
```

```
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    118.00 TO NODE    274.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   421.00  DOWNSTREAM(FEET) =   419.00
  FLOW LENGTH(FEET) =   527.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.74
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      75.45
  PIPE TRAVEL TIME(MIN.) =   1.14    Tc(MIN.) =   12.34
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    274.00 =    2746.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    274.00 TO NODE    274.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.34
  RAINFALL INTENSITY(INCH/HR) =   3.68
  TOTAL STREAM AREA(ACRES) =    24.57
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     75.45

****************************************************************************
  FLOW PROCESS FROM NODE    271.00 TO NODE    272.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    440.00
  DOWNSTREAM ELEVATION(FEET) =    438.70
  ELEVATION DIFFERENCE(FEET) =      1.30
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.304
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    272.00 TO NODE    273.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  438.00  DOWNSTREAM ELEVATION(FEET) =  430.50
  STREET LENGTH(FEET) =   394.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.66
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.39
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.50
```

```
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.68
  STREET FLOW TRAVEL TIME(MIN.) =   2.63   Tc(MIN.) =    4.93
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.38      SUBAREA RUNOFF(CFS) =    2.25
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       2.79

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.39
  FLOW VELOCITY(FEET/SEC.) =  2.79   DEPTH*VELOCITY(FT*FT/SEC.) =   0.88
  LONGEST FLOWPATH FROM NODE    271.00 TO NODE    273.00 =     459.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    273.00 TO NODE    274.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.93
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.79

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       75.45    12.34        3.677         24.57
      2        2.79     4.93        6.587          0.47

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       32.92     4.93       6.587
      2       77.00    12.34       3.677

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      77.00   Tc(MIN.) =   12.34
  TOTAL AREA(ACRES) =       25.0
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    274.00 =    2746.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    274.00 TO NODE    274.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    281.00 TO NODE    282.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    89.92
  UPSTREAM ELEVATION(FEET) =    450.00
  DOWNSTREAM ELEVATION(FEET) =    445.00
  ELEVATION DIFFERENCE(FEET) =      5.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.299
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.344
  SUBAREA RUNOFF(CFS) =      0.66
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.66
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    282.00 TO NODE    283.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   445.00  DOWNSTREAM(FEET) =   435.00
  FLOW LENGTH(FEET) =   367.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.66
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.66
  PIPE TRAVEL TIME(MIN.) =   1.31    Tc(MIN.) =    6.61
  LONGEST FLOWPATH FROM NODE    281.00 TO NODE    283.00 =     456.92 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    282.00 TO NODE    283.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.500
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    0.63   SUBAREA RUNOFF(CFS) =    1.91
  TOTAL AREA(ACRES) =        0.8   TOTAL RUNOFF(CFS) =       2.48
  TC(MIN.) =    6.61

****************************************************************************
  FLOW PROCESS FROM NODE    283.00 TO NODE    293.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   435.00  DOWNSTREAM(FEET) =   430.00
  FLOW LENGTH(FEET) =    40.44   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.69
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.48
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    6.67
  LONGEST FLOWPATH FROM NODE    281.00 TO NODE    293.00 =     497.36 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    293.00 TO NODE    293.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.67
  RAINFALL INTENSITY(INCH/HR) =   5.47
  TOTAL STREAM AREA(ACRES) =     0.82
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.48

****************************************************************************
  FLOW PROCESS FROM NODE    291.00 TO NODE    292.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    440.00
  DOWNSTREAM ELEVATION(FEET) =    438.70
  ELEVATION DIFFERENCE(FEET) =      1.30
```

```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.304
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.53
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.53

****************************************************************************
  FLOW PROCESS FROM NODE    292.00 TO NODE    293.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  438.00  DOWNSTREAM ELEVATION(FEET) =  430.00
  STREET LENGTH(FEET) =   391.51   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.69
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.33
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
  STREET FLOW TRAVEL TIME(MIN.) =   2.53   Tc(MIN.) =    4.84
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.39      SUBAREA RUNOFF(CFS) =    2.31
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       2.85

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.32
  FLOW VELOCITY(FEET/SEC.) =  2.89   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
  LONGEST FLOWPATH FROM NODE    291.00 TO NODE    293.00 =     456.51 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    293.00 TO NODE    293.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.84
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.85

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.48     6.67        5.470          0.82
      2        2.85     4.84        6.587          0.48

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
```

```
     1        4.64     4.84       6.587
     2        4.84     6.67       5.470

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.84   Tc(MIN.) =    6.67
  TOTAL AREA(ACRES) =        1.3
  LONGEST FLOWPATH FROM NODE    281.00 TO NODE    293.00 =     497.36 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    293.00 TO NODE    274.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        4.84     6.67       5.470        1.30
  LONGEST FLOWPATH FROM NODE    281.00 TO NODE    274.00 =     497.36 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       77.00    12.34       3.677       25.04
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    274.00 =    2746.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      46.45       6.67        5.470
     2      80.26      12.34        3.677

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      80.26   Tc(MIN.) =   12.34
  TOTAL AREA(ACRES) =       26.3

****************************************************************************
  FLOW PROCESS FROM NODE    274.00 TO NODE    274.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    274.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   419.00  DOWNSTREAM(FEET) =   418.00
  FLOW LENGTH(FEET) =   111.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.88
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      80.26
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =   12.51
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    250.00 =    2857.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       80.26    12.51       3.645       26.34
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    250.00 =    2857.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       14.27     7.04       5.284        3.58
  LONGEST FLOWPATH FROM NODE    185.00 TO NODE    250.00 =     708.42 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      59.40       7.04        5.284
      2      90.10      12.51        3.645

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      90.10   Tc(MIN.) =   12.51
  TOTAL AREA(ACRES) =       29.9

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    487.00
  DOWNSTREAM ELEVATION(FEET) =    477.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.596
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.74
  TOTAL AREA(ACRES) =      0.48   TOTAL RUNOFF(CFS) =      1.74

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   476.00  DOWNSTREAM(FEET) =   403.00
  FLOW LENGTH(FEET) =   875.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.13
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.74
  PIPE TRAVEL TIME(MIN.) =   1.60    Tc(MIN.) =    6.19
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    303.00 =     975.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.738
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
```

```
  SUBAREA AREA(ACRES) =    6.36   SUBAREA RUNOFF(CFS) =   20.07
  TOTAL AREA(ACRES) =        6.8   TOTAL RUNOFF(CFS) =      21.59
  TC(MIN.) =    6.19

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.19
  RAINFALL INTENSITY(INCH/HR) =   5.74
  TOTAL STREAM AREA(ACRES) =     6.84
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     21.59

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   185.48
  UPSTREAM ELEVATION(FEET) =    495.20
  DOWNSTREAM ELEVATION(FEET) =    485.00
  ELEVATION DIFFERENCE(FEET) =     10.20
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.609
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.116
  SUBAREA RUNOFF(CFS) =      2.39
  TOTAL AREA(ACRES) =      0.71   TOTAL RUNOFF(CFS) =      2.39

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   485.00  DOWNSTREAM(FEET) =   402.00
  FLOW LENGTH(FEET) =   698.17   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.39
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.39
  PIPE TRAVEL TIME(MIN.) =   1.02    Tc(MIN.) =    6.63
  LONGEST FLOWPATH FROM NODE    305.00 TO NODE    303.00 =     883.65 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.490
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    8.50   SUBAREA RUNOFF(CFS) =   25.67
  TOTAL AREA(ACRES) =        9.2   TOTAL RUNOFF(CFS) =      27.81
  TC(MIN.) =    6.63

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.63
  RAINFALL INTENSITY(INCH/HR) =   5.49
  TOTAL STREAM AREA(ACRES) =     9.21
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.81

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       21.59     6.19        5.738          6.84
      2       27.81     6.63        5.490          9.21

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       47.56     6.19       5.738
      2       48.47     6.63       5.490

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      48.47   Tc(MIN.) =    6.63
  TOTAL AREA(ACRES) =       16.0
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    303.00 =     975.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   402.00  DOWNSTREAM(FEET) =   390.00
  FLOW LENGTH(FEET) =   543.23   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.49
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      48.47
  PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =    7.30
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    304.00 =    1518.23 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.30
  RAINFALL INTENSITY(INCH/HR) =   5.16
  TOTAL STREAM AREA(ACRES) =    16.05
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     48.47

****************************************************************************
  FLOW PROCESS FROM NODE    311.00 TO NODE    312.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   214.27
  UPSTREAM ELEVATION(FEET) =    439.00
  DOWNSTREAM ELEVATION(FEET) =    436.50
  ELEVATION DIFFERENCE(FEET) =      2.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.640
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.50
```

```
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      4.14
  TOTAL AREA(ACRES) =      0.74   TOTAL RUNOFF(CFS) =      4.14

****************************************************************************
  FLOW PROCESS FROM NODE    312.00 TO NODE    313.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   436.50  DOWNSTREAM(FEET) =   425.20
  FLOW LENGTH(FEET) =   526.72   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.25
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.14
  PIPE TRAVEL TIME(MIN.) =   1.21    Tc(MIN.) =    4.85
  LONGEST FLOWPATH FROM NODE    311.00 TO NODE    313.00 =     740.99 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    312.00 TO NODE    313.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    4.99   SUBAREA RUNOFF(CFS) =   27.94
  TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =      32.08
  TC(MIN.) =    4.85

****************************************************************************
  FLOW PROCESS FROM NODE    313.00 TO NODE    304.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   420.00  DOWNSTREAM(FEET) =   390.00
  FLOW LENGTH(FEET) =    10.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  76.15
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.08
  PIPE TRAVEL TIME(MIN.) =   0.00    Tc(MIN.) =    4.85
  LONGEST FLOWPATH FROM NODE    311.00 TO NODE    304.00 =     750.99 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.85
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     5.73
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     32.08

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       48.47     7.30        5.159         16.05
```

```
      2       32.08     4.85        6.587          5.73

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       70.04     4.85       6.587
      2       73.60     7.30       5.159

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      73.60   Tc(MIN.) =    7.30
  TOTAL AREA(ACRES) =       21.8
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    304.00 =    1518.23 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    250.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   390.00  DOWNSTREAM(FEET) =   389.00
  FLOW LENGTH(FEET) =   177.85   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  31.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.95
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      73.60
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =    7.63
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    250.00 =    1696.08 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       73.60     7.63       5.014       21.78
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    250.00 =    1696.08 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       90.10    12.51       3.645       29.92
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    250.00 =    2857.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     128.55       7.63        5.014
      2     143.61      12.51        3.645

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     143.61   Tc(MIN.) =   12.51
  TOTAL AREA(ACRES) =       51.7

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    250.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    315.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   395.75  DOWNSTREAM(FEET) =   387.00
  FLOW LENGTH(FEET) =   509.89   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  34.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.88
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     143.61
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =   13.05
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    315.00 =    3366.89 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.05
  RAINFALL INTENSITY(INCH/HR) =   3.55
  TOTAL STREAM AREA(ACRES) =    51.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    143.61

****************************************************************************
  FLOW PROCESS FROM NODE    321.00 TO NODE    322.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    430.00
  DOWNSTREAM ELEVATION(FEET) =    428.70
  ELEVATION DIFFERENCE(FEET) =      1.30
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.304
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.65
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.65

****************************************************************************
  FLOW PROCESS FROM NODE    322.00 TO NODE    323.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  427.50  DOWNSTREAM ELEVATION(FEET) =  401.00
  STREET LENGTH(FEET) =   495.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.02
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.94
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.99
  STREET FLOW TRAVEL TIME(MIN.) =   2.10   Tc(MIN.) =    4.40
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
```

```
  SUBAREA AREA(ACRES) =    0.46      SUBAREA RUNOFF(CFS) =    2.73
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       3.38

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.09
  FLOW VELOCITY(FEET/SEC.) =  4.37   DEPTH*VELOCITY(FT*FT/SEC.) =   1.26
  LONGEST FLOWPATH FROM NODE    321.00 TO NODE    323.00 =     560.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    323.00 TO NODE    315.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   398.00  DOWNSTREAM(FEET) =   387.00
  FLOW LENGTH(FEET) =    28.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  19.20
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.38
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    4.42
  LONGEST FLOWPATH FROM NODE    321.00 TO NODE    315.00 =     588.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    4.42
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.57
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.38

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      143.61    13.05        3.548         51.70
      2        3.38     4.42        6.587          0.57

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       52.06     4.42       6.587
      2      145.43    13.05       3.548

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     145.43   Tc(MIN.) =   13.05
  TOTAL AREA(ACRES) =       52.3
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    315.00 =    3366.89 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    341.00 TO NODE    342.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    444.00
  DOWNSTREAM ELEVATION(FEET) =    430.00
  ELEVATION DIFFERENCE(FEET) =     14.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.596
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    342.00 TO NODE    343.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   430.00  DOWNSTREAM(FEET) =   403.00
  FLOW LENGTH(FEET) =   405.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.43
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.69
  PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =    5.64
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    343.00 =     505.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    342.00 TO NODE    343.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.091
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    1.08   SUBAREA RUNOFF(CFS) =    3.62
  TOTAL AREA(ACRES) =        1.3   TOTAL RUNOFF(CFS) =       4.25
  TC(MIN.) =    5.64

****************************************************************************
  FLOW PROCESS FROM NODE    343.00 TO NODE    353.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   400.00  DOWNSTREAM(FEET) =   395.00
  FLOW LENGTH(FEET) =    22.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.97
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.25
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    5.67
  LONGEST FLOWPATH FROM NODE    341.00 TO NODE    353.00 =     527.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    353.00 TO NODE    353.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.67
  RAINFALL INTENSITY(INCH/HR) =   6.08
  TOTAL STREAM AREA(ACRES) =     1.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.25

****************************************************************************
  FLOW PROCESS FROM NODE    351.00 TO NODE    352.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .6500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    460.00
  DOWNSTREAM ELEVATION(FEET) =    450.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.760
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.41
  TOTAL AREA(ACRES) =      0.33   TOTAL RUNOFF(CFS) =      1.41

****************************************************************************
  FLOW PROCESS FROM NODE    352.00 TO NODE    353.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  427.90  DOWNSTREAM ELEVATION(FEET) =  401.40
  STREET LENGTH(FEET) =   532.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.54
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.27
    HALFSTREET FLOOD WIDTH(FEET) =    7.21
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.98
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.08
  STREET FLOW TRAVEL TIME(MIN.) =   2.23   Tc(MIN.) =    5.99
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.865
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.791
  SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    2.27
  TOTAL AREA(ACRES) =        0.8        PEAK FLOW RATE(CFS) =       3.53

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.38
  FLOW VELOCITY(FEET/SEC.) =  4.30   DEPTH*VELOCITY(FT*FT/SEC.) =   1.26
  LONGEST FLOWPATH FROM NODE    351.00 TO NODE    353.00 =     632.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    353.00 TO NODE    353.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.99
  RAINFALL INTENSITY(INCH/HR) =   5.86
  TOTAL STREAM AREA(ACRES) =     0.76
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.53

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
```

```
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        4.25     5.67        6.076          1.27
      2        3.53     5.99        5.865          0.76

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        7.59     5.67       6.076
      2        7.63     5.99       5.865

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.63   Tc(MIN.) =    5.99
  TOTAL AREA(ACRES) =        2.0
  LONGEST FLOWPATH FROM NODE    351.00 TO NODE    353.00 =     632.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    353.00 TO NODE    315.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   370.00  DOWNSTREAM(FEET) =   350.00
  FLOW LENGTH(FEET) =    11.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  41.97
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.63
  PIPE TRAVEL TIME(MIN.) =   0.00    Tc(MIN.) =    5.99
  LONGEST FLOWPATH FROM NODE    351.00 TO NODE    315.00 =     643.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        7.63     5.99       5.862        2.03
  LONGEST FLOWPATH FROM NODE    351.00 TO NODE    315.00 =     643.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      145.43    13.05       3.548       52.27
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    315.00 =    3366.89 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      74.40       5.99        5.862
      2     150.05      13.05        3.548

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     150.05   Tc(MIN.) =   13.05
  TOTAL AREA(ACRES) =       54.3

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    315.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    315.00 TO NODE    355.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   387.00  DOWNSTREAM(FEET) =   350.00
  FLOW LENGTH(FEET) =   598.87   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  25.96
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     150.05
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =   13.43
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    355.00 =    3965.76 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    355.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.43
  RAINFALL INTENSITY(INCH/HR) =   3.48
  TOTAL STREAM AREA(ACRES) =    54.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    150.05

****************************************************************************
  FLOW PROCESS FROM NODE    361.00 TO NODE    362.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    401.00
  DOWNSTREAM ELEVATION(FEET) =    391.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.671
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.83
  TOTAL AREA(ACRES) =      0.14   TOTAL RUNOFF(CFS) =      0.83

****************************************************************************
  FLOW PROCESS FROM NODE    362.00 TO NODE    363.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  390.00  DOWNSTREAM ELEVATION(FEET) =  358.00
  STREET LENGTH(FEET) =   461.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.13
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.25
    HALFSTREET FLOOD WIDTH(FEET) =    6.04
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.42
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.09
  STREET FLOW TRAVEL TIME(MIN.) =   1.74   Tc(MIN.) =    3.41
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
```

```
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.44      SUBAREA RUNOFF(CFS) =    2.61
  TOTAL AREA(ACRES) =        0.6        PEAK FLOW RATE(CFS) =       3.44

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.68
  FLOW VELOCITY(FEET/SEC.) =  4.85   DEPTH*VELOCITY(FT*FT/SEC.) =   1.36
  LONGEST FLOWPATH FROM NODE    361.00 TO NODE    363.00 =     561.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    363.00 TO NODE    355.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   355.00  DOWNSTREAM(FEET) =   350.00
  FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.82
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.44
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    3.44
  LONGEST FLOWPATH FROM NODE    361.00 TO NODE    355.00 =     588.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    355.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.44
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.44

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      150.05    13.43        3.482         54.30
      2        3.44     3.44        6.587          0.58

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       41.87     3.44       6.587
      2      151.86    13.43       3.482

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     151.86   Tc(MIN.) =   13.43
  TOTAL AREA(ACRES) =       54.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    355.00 =    3965.76 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    355.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    371.00 TO NODE    372.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    448.00
  DOWNSTREAM ELEVATION(FEET) =    438.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.596
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.59
  TOTAL AREA(ACRES) =      0.44   TOTAL RUNOFF(CFS) =      1.59

****************************************************************************
  FLOW PROCESS FROM NODE    372.00 TO NODE    373.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   400.00  DOWNSTREAM(FEET) =   359.00
  FLOW LENGTH(FEET) =   461.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.11
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.59
  PIPE TRAVEL TIME(MIN.) =   0.84    Tc(MIN.) =    5.44
  LONGEST FLOWPATH FROM NODE    371.00 TO NODE    373.00 =     561.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    372.00 TO NODE    373.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.239
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    1.28   SUBAREA RUNOFF(CFS) =    4.39
  TOTAL AREA(ACRES) =        1.7   TOTAL RUNOFF(CFS) =       5.90
  TC(MIN.) =    5.44

****************************************************************************
  FLOW PROCESS FROM NODE    373.00 TO NODE    383.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   355.00  DOWNSTREAM(FEET) =   353.00
  FLOW LENGTH(FEET) =    37.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.17
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.90
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    5.49
  LONGEST FLOWPATH FROM NODE    371.00 TO NODE    383.00 =     598.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    383.00 TO NODE    383.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.49
  RAINFALL INTENSITY(INCH/HR) =   6.20
  TOTAL STREAM AREA(ACRES) =     1.72
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.90

****************************************************************************
  FLOW PROCESS FROM NODE    381.00 TO NODE    382.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    400.00
  DOWNSTREAM ELEVATION(FEET) =    390.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.671
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.65
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.65

****************************************************************************
  FLOW PROCESS FROM NODE    382.00 TO NODE    383.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  390.00  DOWNSTREAM ELEVATION(FEET) =  357.00
  STREET LENGTH(FEET) =   458.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.75
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.34
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.34
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
  STREET FLOW TRAVEL TIME(MIN.) =   1.76   Tc(MIN.) =    3.43
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.37      SUBAREA RUNOFF(CFS) =    2.19
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       2.85

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   6.92
  FLOW VELOCITY(FEET/SEC.) =  4.77   DEPTH*VELOCITY(FT*FT/SEC.) =   1.26
  LONGEST FLOWPATH FROM NODE    381.00 TO NODE    383.00 =     558.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    383.00 TO NODE    383.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.43
  RAINFALL INTENSITY(INCH/HR) =   6.59
```

```
  TOTAL STREAM AREA(ACRES) =     0.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.85

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.90     5.49        6.198          1.72
      2        2.85     3.43        6.587          0.48

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        6.53     3.43       6.587
      2        8.58     5.49       6.198

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       8.58   Tc(MIN.) =    5.49
  TOTAL AREA(ACRES) =        2.2
  LONGEST FLOWPATH FROM NODE    371.00 TO NODE    383.00 =     598.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    383.00 TO NODE    355.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   350.00  DOWNSTREAM(FEET) =   340.00
  FLOW LENGTH(FEET) =    11.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  34.01
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.58
  PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    5.50
  LONGEST FLOWPATH FROM NODE    371.00 TO NODE    355.00 =     609.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    355.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        8.58     5.50       6.194        2.20
  LONGEST FLOWPATH FROM NODE    371.00 TO NODE    355.00 =     609.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      151.86    13.43       3.482       54.88
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    355.00 =    3965.76 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1      70.75       5.50        6.194
      2     156.69      13.43        3.482

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     156.69   Tc(MIN.) =   13.43
  TOTAL AREA(ACRES) =       57.1

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    355.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
```

```
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    355.00 TO NODE    223.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   350.00  DOWNSTREAM(FEET) =   330.00
  FLOW LENGTH(FEET) =    90.69   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  42.80
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     156.69
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   13.47
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    223.00 =    4056.45 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    384.00 TO NODE    385.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    792.00
  DOWNSTREAM ELEVATION(FEET) =    482.00
  ELEVATION DIFFERENCE(FEET) =    310.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.596
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.87
  TOTAL AREA(ACRES) =      0.24   TOTAL RUNOFF(CFS) =      0.87

****************************************************************************
  FLOW PROCESS FROM NODE    385.00 TO NODE    386.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    482.00  DOWNSTREAM(FEET) =    402.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   591.00   CHANNEL SLOPE =  0.1354
  NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.87
  FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.08   Tc(MIN.) =    6.67
  LONGEST FLOWPATH FROM NODE    384.00 TO NODE    386.00 =     691.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    385.00 TO NODE    386.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.468
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    8.88   SUBAREA RUNOFF(CFS) =   26.71
  TOTAL AREA(ACRES) =        9.1   TOTAL RUNOFF(CFS) =      27.43
  TC(MIN.) =    6.67
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    386.00 TO NODE    387.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   402.00  DOWNSTREAM(FEET) =   390.00
  FLOW LENGTH(FEET) =   170.76   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.24
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.43
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    6.83
  LONGEST FLOWPATH FROM NODE    384.00 TO NODE    387.00 =     861.76 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    387.00 TO NODE    387.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.83
  RAINFALL INTENSITY(INCH/HR) =   5.39
  TOTAL STREAM AREA(ACRES) =     9.12
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.43

****************************************************************************
  FLOW PROCESS FROM NODE    388.00 TO NODE    389.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =    437.00
  DOWNSTREAM ELEVATION(FEET) =    435.50
  ELEVATION DIFFERENCE(FEET) =      1.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.093
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      3.92
  TOTAL AREA(ACRES) =      0.70   TOTAL RUNOFF(CFS) =      3.92

****************************************************************************
  FLOW PROCESS FROM NODE    389.00 TO NODE    390.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   428.90  DOWNSTREAM(FEET) =   418.00
  FLOW LENGTH(FEET) =   536.58   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.92
  PIPE TRAVEL TIME(MIN.) =   1.28    Tc(MIN.) =    4.37
  LONGEST FLOWPATH FROM NODE    388.00 TO NODE    390.00 =     611.58 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    389.00 TO NODE    390.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
```

```
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    3.77   SUBAREA RUNOFF(CFS) =   21.11
  TOTAL AREA(ACRES) =        4.5   TOTAL RUNOFF(CFS) =      25.03
  TC(MIN.) =    4.37

****************************************************************************
  FLOW PROCESS FROM NODE    390.00 TO NODE    387.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   418.00  DOWNSTREAM(FEET) =   390.00
  FLOW LENGTH(FEET) =   614.46   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.08
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      25.03
  PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =    5.05
  LONGEST FLOWPATH FROM NODE    388.00 TO NODE    387.00 =    1226.04 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    390.00 TO NODE    387.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.544
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    5.02   SUBAREA RUNOFF(CFS) =   27.92
  TOTAL AREA(ACRES) =        9.5   TOTAL RUNOFF(CFS) =      52.79
  TC(MIN.) =    5.05

****************************************************************************
  FLOW PROCESS FROM NODE    391.00 TO NODE    387.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.544
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    3.13   SUBAREA RUNOFF(CFS) =   17.41
  TOTAL AREA(ACRES) =       12.6   TOTAL RUNOFF(CFS) =      70.20
  TC(MIN.) =    5.05

****************************************************************************
  FLOW PROCESS FROM NODE    387.00 TO NODE    387.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.05
  RAINFALL INTENSITY(INCH/HR) =   6.54
  TOTAL STREAM AREA(ACRES) =    12.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     70.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       27.43     6.83        5.388          9.12
      2       70.20     5.05        6.544         12.62

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
```

```
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       90.49     5.05       6.544
      2       85.22     6.83       5.388

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      90.49   Tc(MIN.) =    5.05
  TOTAL AREA(ACRES) =       21.7
  LONGEST FLOWPATH FROM NODE    388.00 TO NODE    387.00 =    1226.04 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    387.00 TO NODE    392.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   390.00  DOWNSTREAM(FEET) =   350.00
  FLOW LENGTH(FEET) =   717.13   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.90
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      90.49
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =    5.60
  LONGEST FLOWPATH FROM NODE    388.00 TO NODE    392.00 =    1943.17 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    392.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.60
  RAINFALL INTENSITY(INCH/HR) =   6.13
  TOTAL STREAM AREA(ACRES) =    21.74
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     90.49

****************************************************************************
  FLOW PROCESS FROM NODE    440.00 TO NODE    441.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    450.00
  DOWNSTREAM ELEVATION(FEET) =    440.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      3.48
  TOTAL AREA(ACRES) =      0.88   TOTAL RUNOFF(CFS) =      3.48

****************************************************************************
  FLOW PROCESS FROM NODE    441.00 TO NODE    442.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   426.00
  FLOW LENGTH(FEET) =   831.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.34
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.48
  PIPE TRAVEL TIME(MIN.) =   2.19    Tc(MIN.) =    6.36
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    442.00 =     931.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    441.00 TO NODE    442.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.638
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =   14.55   SUBAREA RUNOFF(CFS) =   49.22
  TOTAL AREA(ACRES) =       15.4   TOTAL RUNOFF(CFS) =      52.20
  TC(MIN.) =    6.36

****************************************************************************
  FLOW PROCESS FROM NODE    442.00 TO NODE    443.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   402.00  DOWNSTREAM(FEET) =   395.00
  FLOW LENGTH(FEET) =   193.24   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.37
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      52.20
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =    6.56
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    443.00 =    1124.24 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    443.00 TO NODE    392.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   390.00  DOWNSTREAM(FEET) =   340.00
  FLOW LENGTH(FEET) =  1856.73   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.83
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      52.20
  PIPE TRAVEL TIME(MIN.) =   2.09    Tc(MIN.) =    8.65
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    392.00 =    2980.97 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    392.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.65
  RAINFALL INTENSITY(INCH/HR) =   4.63
  TOTAL STREAM AREA(ACRES) =    15.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     52.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       90.49     5.60        6.125         21.74
      2       52.20     8.65        4.627         15.43

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      124.27     5.60       6.125
```

```
      2      120.55     8.65       4.627

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     124.27   Tc(MIN.) =    5.60
  TOTAL AREA(ACRES) =       37.2
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    392.00 =    2980.97 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    392.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    437.00 TO NODE    438.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    425.00
  DOWNSTREAM ELEVATION(FEET) =    420.50
  ELEVATION DIFFERENCE(FEET) =      4.50
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.497
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      8.06
  TOTAL AREA(ACRES) =      1.44   TOTAL RUNOFF(CFS) =      8.06

****************************************************************************
  FLOW PROCESS FROM NODE    438.00 TO NODE    439.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   415.00  DOWNSTREAM(FEET) =   385.00
  FLOW LENGTH(FEET) =   499.05   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.65
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.06
  PIPE TRAVEL TIME(MIN.) =   0.66    Tc(MIN.) =    3.15
  LONGEST FLOWPATH FROM NODE    437.00 TO NODE    439.00 =     589.05 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    438.00 TO NODE    439.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    4.29   SUBAREA RUNOFF(CFS) =   24.02
  TOTAL AREA(ACRES) =        5.7   TOTAL RUNOFF(CFS) =      32.08
  TC(MIN.) =    3.15

****************************************************************************
  FLOW PROCESS FROM NODE    439.00 TO NODE    392.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   385.00  DOWNSTREAM(FEET) =   340.00
  FLOW LENGTH(FEET) =   502.15   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.9 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.76
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      32.08
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    3.56
  LONGEST FLOWPATH FROM NODE    437.00 TO NODE    392.00 =    1091.20 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    439.00 TO NODE    392.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    5.70   SUBAREA RUNOFF(CFS) =   31.91
  TOTAL AREA(ACRES) =       11.4   TOTAL RUNOFF(CFS) =      63.99
  TC(MIN.) =    3.56

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    392.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.56
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =    11.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     63.99

****************************************************************************
  FLOW PROCESS FROM NODE    444.00 TO NODE    445.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    85.00
  UPSTREAM ELEVATION(FEET) =    425.00
  DOWNSTREAM ELEVATION(FEET) =    422.45
  ELEVATION DIFFERENCE(FEET) =      2.55
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.877
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      9.69
  TOTAL AREA(ACRES) =      1.73   TOTAL RUNOFF(CFS) =      9.69

****************************************************************************
  FLOW PROCESS FROM NODE    445.00 TO NODE    443.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   418.00  DOWNSTREAM(FEET) =   413.80
  FLOW LENGTH(FEET) =   260.88   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.06
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.69
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =    3.42
  LONGEST FLOWPATH FROM NODE    444.00 TO NODE    443.00 =     345.88 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    445.00 TO NODE    443.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    1.81   SUBAREA RUNOFF(CFS) =   10.13
  TOTAL AREA(ACRES) =        3.5   TOTAL RUNOFF(CFS) =      19.82
  TC(MIN.) =    3.42

****************************************************************************
  FLOW PROCESS FROM NODE    443.00 TO NODE    446.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   413.80  DOWNSTREAM(FEET) =   400.00
  FLOW LENGTH(FEET) =   655.06   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.52
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.82
  PIPE TRAVEL TIME(MIN.) =   1.04    Tc(MIN.) =    4.45
  LONGEST FLOWPATH FROM NODE    444.00 TO NODE    446.00 =    1000.94 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    443.00 TO NODE    446.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    4.96   SUBAREA RUNOFF(CFS) =   27.77
  TOTAL AREA(ACRES) =        8.5   TOTAL RUNOFF(CFS) =      47.59
  TC(MIN.) =    4.45

****************************************************************************
  FLOW PROCESS FROM NODE    446.00 TO NODE    447.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   400.00  DOWNSTREAM(FEET) =   380.00
  FLOW LENGTH(FEET) =   582.46   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.79
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      47.59
  PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =    5.07
  LONGEST FLOWPATH FROM NODE    444.00 TO NODE    447.00 =    1583.40 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    446.00 TO NODE    447.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.529
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    7.92   SUBAREA RUNOFF(CFS) =   43.95
  TOTAL AREA(ACRES) =       16.4   TOTAL RUNOFF(CFS) =      91.13
  TC(MIN.) =    5.07

****************************************************************************
  FLOW PROCESS FROM NODE    447.00 TO NODE    392.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   380.00  DOWNSTREAM(FEET) =   340.00
  FLOW LENGTH(FEET) =   580.93   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  24.07
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      91.13
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    5.47
  LONGEST FLOWPATH FROM NODE    444.00 TO NODE    392.00 =    2164.33 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    447.00 TO NODE    392.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.215
  *USER SPECIFIED(SUBAREA):
  FARMSTEADS COVER RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.8500
  SUBAREA AREA(ACRES) =    4.90   SUBAREA RUNOFF(CFS) =   25.89
  TOTAL AREA(ACRES) =       21.3   TOTAL RUNOFF(CFS) =     112.63
  TC(MIN.) =    5.47

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    392.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.47
  RAINFALL INTENSITY(INCH/HR) =   6.22
  TOTAL STREAM AREA(ACRES) =    21.32
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    112.63

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       63.99     3.56        6.587         11.43
      2      112.63     5.47        6.215         21.32

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      137.23     3.56       6.587
      2      173.02     5.47       6.215

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     173.02   Tc(MIN.) =    5.47
  TOTAL AREA(ACRES) =       32.8
  LONGEST FLOWPATH FROM NODE    444.00 TO NODE    392.00 =    2164.33 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    392.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      173.02     5.47       6.215       32.75
  LONGEST FLOWPATH FROM NODE    444.00 TO NODE    392.00 =    2164.33 FEET.
```

```
  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      124.27     5.60       6.125       37.17
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    392.00 =    2980.97 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     294.51       5.47        6.215
      2     294.78       5.60        6.125

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     294.78   Tc(MIN.) =    5.60
  TOTAL AREA(ACRES) =       69.9

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    392.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    392.00 TO NODE    394.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   340.00  DOWNSTREAM(FEET) =   335.00
  FLOW LENGTH(FEET) =   141.15   MANNING'S N =  0.013
  DEPTH OF FLOW IN  51.0 INCH PIPE IS  39.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  24.85
  ESTIMATED PIPE DIAMETER(INCH) =  51.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     294.78
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    5.69
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    394.00 =    3122.12 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    394.00 TO NODE    223.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   335.00  DOWNSTREAM(FEET) =   330.00
  FLOW LENGTH(FEET) =   103.62   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  37.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  27.87
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     294.78
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =    5.75
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    223.00 =    3225.74 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      294.78     5.75       6.017       69.92
  LONGEST FLOWPATH FROM NODE    440.00 TO NODE    223.00 =    3225.74 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      156.69    13.47       3.476       57.08
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    223.00 =    4056.45 FEET.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     361.71       5.75        6.017
      2     326.98      13.47        3.476

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     361.71   Tc(MIN.) =    5.75
  TOTAL AREA(ACRES) =      127.0

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    190.00 TO NODE    191.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    454.40
  DOWNSTREAM ELEVATION(FEET) =    453.60
  ELEVATION DIFFERENCE(FEET) =      0.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.271
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.366
  SUBAREA RUNOFF(CFS) =      1.43
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.43

****************************************************************************
  FLOW PROCESS FROM NODE    191.00 TO NODE    192.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  450.75  DOWNSTREAM ELEVATION(FEET) =  445.00
  STREET LENGTH(FEET) =   250.68   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.13
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.30
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.12
  STREET FLOW TRAVEL TIME(MIN.) =   1.27   Tc(MIN.) =    6.54
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.540
  *USER SPECIFIED(SUBAREA):
```

```
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7200
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.725
  SUBAREA AREA(ACRES) =    1.35      SUBAREA RUNOFF(CFS) =    5.39
  TOTAL AREA(ACRES) =        1.7        PEAK FLOW RATE(CFS) =       6.63

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.97
  FLOW VELOCITY(FEET/SEC.) =  3.68   DEPTH*VELOCITY(FT*FT/SEC.) =   1.42
  LONGEST FLOWPATH FROM NODE    190.00 TO NODE    192.00 =     330.68 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    192.00 TO NODE    198.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   439.00
  FLOW LENGTH(FEET) =    16.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.02
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.63
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    6.56
  LONGEST FLOWPATH FROM NODE    190.00 TO NODE    198.00 =     347.18 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.56
  RAINFALL INTENSITY(INCH/HR) =   5.53
  TOTAL STREAM AREA(ACRES) =     1.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.63

****************************************************************************
  FLOW PROCESS FROM NODE    195.00 TO NODE    196.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    461.65
  DOWNSTREAM ELEVATION(FEET) =    461.00
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.520
  SUBAREA RUNOFF(CFS) =      1.08
  TOTAL AREA(ACRES) =      0.22   TOTAL RUNOFF(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    196.00 TO NODE    197.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  461.00  DOWNSTREAM ELEVATION(FEET) =  445.00
  STREET LENGTH(FEET) =   377.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
```

```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.58
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.78
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.21
  STREET FLOW TRAVEL TIME(MIN.) =   1.56   Tc(MIN.) =    6.64
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.485
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.21      SUBAREA RUNOFF(CFS) =    4.98
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       5.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.84
  FLOW VELOCITY(FEET/SEC.) =  4.55   DEPTH*VELOCITY(FT*FT/SEC.) =   1.56
  LONGEST FLOWPATH FROM NODE    195.00 TO NODE    197.00 =     442.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    197.00 TO NODE    198.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   440.00  DOWNSTREAM(FEET) =   439.00
  FLOW LENGTH(FEET) =    16.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.63
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.88
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    6.66
  LONGEST FLOWPATH FROM NODE    195.00 TO NODE    198.00 =     458.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    198.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.66
  RAINFALL INTENSITY(INCH/HR) =   5.47
  TOTAL STREAM AREA(ACRES) =     1.43
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.63     6.56        5.528          1.65
      2        5.88     6.66        5.472          1.43

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       12.42     6.56       5.528
      2       12.45     6.66       5.472
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.45   Tc(MIN.) =    6.66
  TOTAL AREA(ACRES) =        3.1
  LONGEST FLOWPATH FROM NODE    195.00 TO NODE    198.00 =     458.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    198.00 TO NODE    199.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   439.00  DOWNSTREAM(FEET) =   421.00
  FLOW LENGTH(FEET) =   360.42   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.45
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    7.12
  LONGEST FLOWPATH FROM NODE    195.00 TO NODE    199.00 =     818.92 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    199.00 TO NODE    199.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =    441.00
  DOWNSTREAM ELEVATION(FEET) =    440.35
  ELEVATION DIFFERENCE(FEET) =      0.65
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.079
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.520
  SUBAREA RUNOFF(CFS) =      3.28
  TOTAL AREA(ACRES) =      0.67   TOTAL RUNOFF(CFS) =      3.28

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    208.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  440.35  DOWNSTREAM ELEVATION(FEET) =  434.90
  STREET LENGTH(FEET) =   143.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.30
    HALFSTREET FLOOD WIDTH(FEET) =    8.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.79
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.13
  STREET FLOW TRAVEL TIME(MIN.) =   0.63   Tc(MIN.) =    5.71
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.047
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    1.45      SUBAREA RUNOFF(CFS) =    6.58
  TOTAL AREA(ACRES) =        2.1        PEAK FLOW RATE(CFS) =       9.61

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  10.22
  FLOW VELOCITY(FEET/SEC.) =  4.14   DEPTH*VELOCITY(FT*FT/SEC.) =   1.37
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    208.00 =     208.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    209.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   428.00  DOWNSTREAM(FEET) =   423.00
  FLOW LENGTH(FEET) =   625.30   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.21
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.61
  PIPE TRAVEL TIME(MIN.) =   1.68    Tc(MIN.) =    7.39
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    209.00 =     833.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    209.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.39
  RAINFALL INTENSITY(INCH/HR) =   5.12
  TOTAL STREAM AREA(ACRES) =     2.12
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.61

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    213.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    437.10
  DOWNSTREAM ELEVATION(FEET) =    436.40
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.271
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.366
  SUBAREA RUNOFF(CFS) =      1.43
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.43

****************************************************************************
  FLOW PROCESS FROM NODE    213.00 TO NODE    214.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  434.20  DOWNSTREAM ELEVATION(FEET) =  428.60
  STREET LENGTH(FEET) =   561.43   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.95
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.40
    HALFSTREET FLOOD WIDTH(FEET) =   13.66
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.50
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.00
  STREET FLOW TRAVEL TIME(MIN.) =   3.75   Tc(MIN.) =    9.02
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.503
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.05      SUBAREA RUNOFF(CFS) =    6.92
  TOTAL AREA(ACRES) =        2.3        PEAK FLOW RATE(CFS) =       7.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.00
  FLOW VELOCITY(FEET/SEC.) =  2.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.23
  LONGEST FLOWPATH FROM NODE    212.00 TO NODE    214.00 =     631.43 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    209.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   423.60  DOWNSTREAM(FEET) =   423.00
  FLOW LENGTH(FEET) =    16.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.47
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.94
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    9.04
  LONGEST FLOWPATH FROM NODE    212.00 TO NODE    209.00 =     647.93 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    209.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.04
  RAINFALL INTENSITY(INCH/HR) =   4.49
  TOTAL STREAM AREA(ACRES) =     2.35
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.94

****************************************************************************
  FLOW PROCESS FROM NODE    216.00 TO NODE    217.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    438.10
  DOWNSTREAM ELEVATION(FEET) =    437.40
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.271
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.366
  SUBAREA RUNOFF(CFS) =      1.10
  TOTAL AREA(ACRES) =      0.23   TOTAL RUNOFF(CFS) =      1.10

****************************************************************************
```

```
  FLOW PROCESS FROM NODE    217.00 TO NODE    218.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  436.40  DOWNSTREAM ELEVATION(FEET) =  428.60
  STREET LENGTH(FEET) =   656.63   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.84
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.39
    HALFSTREET FLOOD WIDTH(FEET) =   13.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.67
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.03
  STREET FLOW TRAVEL TIME(MIN.) =   4.11   Tc(MIN.) =    9.38
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.391
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    2.23      SUBAREA RUNOFF(CFS) =    7.34
  TOTAL AREA(ACRES) =        2.5        PEAK FLOW RATE(CFS) =       8.10

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.00
  FLOW VELOCITY(FEET/SEC.) =  3.01   DEPTH*VELOCITY(FT*FT/SEC.) =   1.34
  LONGEST FLOWPATH FROM NODE    216.00 TO NODE    218.00 =     726.63 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    218.00 TO NODE    209.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   423.60  DOWNSTREAM(FEET) =   423.00
  FLOW LENGTH(FEET) =    16.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.53
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.10
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    9.40
  LONGEST FLOWPATH FROM NODE    216.00 TO NODE    209.00 =     743.13 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    209.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.40
  RAINFALL INTENSITY(INCH/HR) =   4.38
  TOTAL STREAM AREA(ACRES) =     2.46
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.10

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        9.61     7.39        5.121          2.12
```

```
     2        7.94     9.04        4.494          2.35
     3        8.10     9.40        4.383          2.46

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       22.46     7.39       5.121
     2       24.17     9.04       4.494
     3       24.07     9.40       4.383

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      24.17   Tc(MIN.) =    9.04
  TOTAL AREA(ACRES) =        6.9
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    209.00 =     833.30 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    199.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       24.17     9.04       4.494        6.93
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    199.00 =     833.30 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1       12.45     7.12       5.244        3.08
  LONGEST FLOWPATH FROM NODE    195.00 TO NODE    199.00 =     818.92 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
     1      31.47       7.12        5.244
     2      34.83       9.04        4.494

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      34.83   Tc(MIN.) =    9.04
  TOTAL AREA(ACRES) =       10.0

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    199.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    199.00 TO NODE    222.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   421.00  DOWNSTREAM(FEET) =   417.50
  FLOW LENGTH(FEET) =   340.73   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.28
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      34.83
  PIPE TRAVEL TIME(MIN.) =   0.61    Tc(MIN.) =    9.66
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    222.00 =    1174.03 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    222.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.66
  RAINFALL INTENSITY(INCH/HR) =   4.31
  TOTAL STREAM AREA(ACRES) =    10.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     34.83

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
  UPSTREAM ELEVATION(FEET) =    445.90
  DOWNSTREAM ELEVATION(FEET) =    445.20
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.271
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.366
  SUBAREA RUNOFF(CFS) =      0.91
  TOTAL AREA(ACRES) =      0.19   TOTAL RUNOFF(CFS) =      0.91

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  441.20  DOWNSTREAM ELEVATION(FEET) =  423.00
  STREET LENGTH(FEET) =   660.47   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 16.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   8.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.29
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.34
    HALFSTREET FLOOD WIDTH(FEET) =   10.78
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.63
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.24
  STREET FLOW TRAVEL TIME(MIN.) =   3.03   Tc(MIN.) =    8.31
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.748
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.750
  SUBAREA AREA(ACRES) =    4.64      SUBAREA RUNOFF(CFS) =   16.52
  TOTAL AREA(ACRES) =        4.8        PEAK FLOW RATE(CFS) =      17.20

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.84
  FLOW VELOCITY(FEET/SEC.) =  4.23   DEPTH*VELOCITY(FT*FT/SEC.) =   1.70
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =     730.47 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    222.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.31
  RAINFALL INTENSITY(INCH/HR) =   4.75
  TOTAL STREAM AREA(ACRES) =     4.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     17.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       34.83     9.66        4.308         10.01
      2       17.20     8.31        4.748          4.83

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       47.16     8.31       4.748
      2       50.44     9.66       4.308

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      50.44   Tc(MIN.) =    9.66
  TOTAL AREA(ACRES) =       14.8
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    222.00 =    1174.03 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    223.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   423.00  DOWNSTREAM(FEET) =   334.00
  FLOW LENGTH(FEET) =   249.94   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  38.62
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      50.44
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    9.76
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    223.00 =    1423.97 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       50.44     9.76       4.278       14.84
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    223.00 =    1423.97 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      361.71     5.75       6.017      127.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    223.00 =    4056.45 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     391.43       5.75        6.017
      2     307.59       9.76        4.278

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     391.43   Tc(MIN.) =    5.75
```

```
  TOTAL AREA(ACRES) =      141.8

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    224.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   334.00  DOWNSTREAM(FEET) =   330.00
  FLOW LENGTH(FEET) =   460.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  75.0 INCH PIPE IS  56.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.86
  ESTIMATED PIPE DIAMETER(INCH) =  75.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     391.43
  PIPE TRAVEL TIME(MIN.) =   0.48    Tc(MIN.) =    6.24
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    224.00 =    4516.45 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    223.00 TO NODE    224.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.712
  *USER SPECIFIED(SUBAREA):
  ANNUAL GRASS (DRYLAND) FAIR COVER RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.7255
  SUBAREA AREA(ACRES) =    1.71   SUBAREA RUNOFF(CFS) =    3.42
  TOTAL AREA(ACRES) =      143.6   TOTAL RUNOFF(CFS) =     594.82
  TC(MIN.) =    6.24

+---------------------------------------------------------------------------+
|                                                                           |
|                                                                           |
|                                                                           |
+---------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    357.00
  DOWNSTREAM ELEVATION(FEET) =    353.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.268
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.59
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.59

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  353.00  DOWNSTREAM ELEVATION(FEET) =  335.00
  STREET LENGTH(FEET) =   299.55   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00
```

```
  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.57
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.23
    HALFSTREET FLOOD WIDTH(FEET) =    5.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.96
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.92
  STREET FLOW TRAVEL TIME(MIN.) =   1.26   Tc(MIN.) =    3.53
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.33      SUBAREA RUNOFF(CFS) =    1.96
  TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =       2.55

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   6.86
  FLOW VELOCITY(FEET/SEC.) =  4.33   DEPTH*VELOCITY(FT*FT/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    401.00 TO NODE    403.00 =     399.55 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    395.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   331.00  DOWNSTREAM(FEET) =   320.00
  FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.40
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.55
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    3.55
  LONGEST FLOWPATH FROM NODE    401.00 TO NODE    395.00 =     424.55 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    395.00 TO NODE    395.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    425.00
  DOWNSTREAM ELEVATION(FEET) =    415.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.596
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.01
  TOTAL AREA(ACRES) =      0.28   TOTAL RUNOFF(CFS) =      1.01
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    413.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   395.00  DOWNSTREAM(FEET) =   336.00
  FLOW LENGTH(FEET) =   317.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.31
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.01
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =    5.11
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    413.00 =     417.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    413.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.497
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    1.13   SUBAREA RUNOFF(CFS) =    4.04
  TOTAL AREA(ACRES) =        1.4   TOTAL RUNOFF(CFS) =       5.04
  TC(MIN.) =    5.11

****************************************************************************
  FLOW PROCESS FROM NODE    413.00 TO NODE    423.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   332.00  DOWNSTREAM(FEET) =   329.00
  FLOW LENGTH(FEET) =    25.50   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.11
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.04
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    5.14
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    423.00 =     442.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    423.00 TO NODE    423.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.14
  RAINFALL INTENSITY(INCH/HR) =   6.47
  TOTAL STREAM AREA(ACRES) =     1.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.04

****************************************************************************
  FLOW PROCESS FROM NODE    421.00 TO NODE    422.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    357.00
  DOWNSTREAM ELEVATION(FEET) =    353.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.268
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
SUBAREA RUNOFF(CFS) =      0.41
TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.41

****************************************************************************
FLOW PROCESS FROM NODE    422.00 TO NODE    423.00 IS CODE =  61
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  353.00  DOWNSTREAM ELEVATION(FEET) =  334.00
STREET LENGTH(FEET) =   287.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.13
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.21
  HALFSTREET FLOOD WIDTH(FEET) =    4.11
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.93
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.82
STREET FLOW TRAVEL TIME(MIN.) =   1.22   Tc(MIN.) =    3.49
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
*USER SPECIFIED(SUBAREA):
RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
S.C.S. CURVE NUMBER (AMC II) =   0
AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
SUBAREA AREA(ACRES) =    0.24      SUBAREA RUNOFF(CFS) =    1.42
TOTAL AREA(ACRES) =        0.3        PEAK FLOW RATE(CFS) =       1.84

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   5.63
FLOW VELOCITY(FEET/SEC.) =  4.22   DEPTH*VELOCITY(FT*FT/SEC.) =   1.01
LONGEST FLOWPATH FROM NODE    421.00 TO NODE    423.00 =     387.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    423.00 TO NODE    423.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =    3.49
RAINFALL INTENSITY(INCH/HR) =   6.59
TOTAL STREAM AREA(ACRES) =     0.31
PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.84

** CONFLUENCE DATA **
STREAM     RUNOFF       Tc      INTENSITY      AREA
NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1        5.04     5.14        6.472          1.41
    2        1.84     3.49        6.587          0.31

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1        5.26     3.49       6.587
```

```
      2        6.84     5.14       6.472

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.84   Tc(MIN.) =    5.14
  TOTAL AREA(ACRES) =        1.7
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    423.00 =     442.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    423.00 TO NODE    395.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   329.00  DOWNSTREAM(FEET) =   325.00
  FLOW LENGTH(FEET) =    11.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  23.03
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.84
  PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    5.15
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    395.00 =     453.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    395.00 TO NODE    395.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        6.84     5.15       6.466        1.72
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    395.00 =     453.50 FEET.

  ** MEMORY BANK #  3 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        2.55     3.55       6.587        0.43
  LONGEST FLOWPATH FROM NODE    401.00 TO NODE    395.00 =     424.55 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1       7.27       3.55        6.587
      2       9.35       5.15        6.466

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       9.35   Tc(MIN.) =    5.15
  TOTAL AREA(ACRES) =        2.2

****************************************************************************
  FLOW PROCESS FROM NODE    395.00 TO NODE    395.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    395.00 TO NODE    463.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   320.00  DOWNSTREAM(FEET) =   306.00
  FLOW LENGTH(FEET) =   460.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.35
  PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =    5.90
```

```
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    463.00 =     913.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    463.00 TO NODE    463.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.90
  RAINFALL INTENSITY(INCH/HR) =   5.92
  TOTAL STREAM AREA(ACRES) =     2.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.35

****************************************************************************
  FLOW PROCESS FROM NODE    461.00 TO NODE    462.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.58
  UPSTREAM ELEVATION(FEET) =    335.00
  DOWNSTREAM ELEVATION(FEET) =    326.20
  ELEVATION DIFFERENCE(FEET) =      8.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.606
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.41
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.41

****************************************************************************
  FLOW PROCESS FROM NODE    462.00 TO NODE    463.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  326.20  DOWNSTREAM ELEVATION(FEET) =  310.00
  STREET LENGTH(FEET) =   333.98   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 22.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  11.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.60
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    5.69
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.62
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.87
  STREET FLOW TRAVEL TIME(MIN.) =   1.54   Tc(MIN.) =    3.14
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.40      SUBAREA RUNOFF(CFS) =    2.37
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       2.79

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.55
  FLOW VELOCITY(FEET/SEC.) =  4.05   DEPTH*VELOCITY(FT*FT/SEC.) =   1.12
  LONGEST FLOWPATH FROM NODE    461.00 TO NODE    463.00 =     424.56 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    463.00 TO NODE    463.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.14
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.79

****************************************************************************
  FLOW PROCESS FROM NODE    471.00 TO NODE    472.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    94.40
  UPSTREAM ELEVATION(FEET) =    334.00
  DOWNSTREAM ELEVATION(FEET) =    326.20
  ELEVATION DIFFERENCE(FEET) =      7.80
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    1.730
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.41
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.41

****************************************************************************
  FLOW PROCESS FROM NODE    472.00 TO NODE    473.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  326.20  DOWNSTREAM ELEVATION(FEET) =  310.00
  STREET LENGTH(FEET) =   345.13   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0160
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.69
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    5.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.60
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.88
  STREET FLOW TRAVEL TIME(MIN.) =   1.60   Tc(MIN.) =    3.33
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (10.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .9000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.900
  SUBAREA AREA(ACRES) =    0.43      SUBAREA RUNOFF(CFS) =    2.55
  TOTAL AREA(ACRES) =        0.5        PEAK FLOW RATE(CFS) =       2.96

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   7.86
  FLOW VELOCITY(FEET/SEC.) =  4.03   DEPTH*VELOCITY(FT*FT/SEC.) =   1.14
  LONGEST FLOWPATH FROM NODE    471.00 TO NODE    473.00 =     439.53 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    473.00 TO NODE    473.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    3.33
  RAINFALL INTENSITY(INCH/HR) =   6.59
  TOTAL STREAM AREA(ACRES) =     0.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.96

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        9.35     5.90        5.922          2.15
      2        2.79     3.14        6.587          0.47
      3        2.96     3.33        6.587          0.50

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       10.57     3.14       6.587
      2       11.02     3.33       6.587
      3       14.52     5.90       5.922

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      14.52   Tc(MIN.) =    5.90
  TOTAL AREA(ACRES) =        3.1
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    473.00 =     913.50 FEET.

+--------------------------------------------------------------------------+
| Begin Ephemeral spring calculations.                                     |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    435.00 TO NODE    435.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =   7.72   RAIN INTENSITY(INCH/HOUR) =  4.98
  TOTAL AREA(ACRES) =     6.94   TOTAL RUNOFF(CFS) =      2.96

****************************************************************************
  FLOW PROCESS FROM NODE    435.00 TO NODE    436.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   428.50  DOWNSTREAM(FEET) =   420.50
  FLOW LENGTH(FEET) =   350.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.76
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.96
  PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =    8.58
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    436.00 =    1263.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    435.00 TO NODE    436.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.648
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .5700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.1170
  SUBAREA AREA(ACRES) =    0.48   SUBAREA RUNOFF(CFS) =    1.27
  TOTAL AREA(ACRES) =        7.4   TOTAL RUNOFF(CFS) =       4.04
  TC(MIN.) =    8.58

****************************************************************************
  FLOW PROCESS FROM NODE    436.00 TO NODE    600.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   420.50  DOWNSTREAM(FEET) =   387.00
  FLOW LENGTH(FEET) =   686.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.68
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.04
  PIPE TRAVEL TIME(MIN.) =   1.18    Tc(MIN.) =    9.76
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    600.00 =    1949.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    436.00 TO NODE    600.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.277
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .5700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.1435
  SUBAREA AREA(ACRES) =    0.46   SUBAREA RUNOFF(CFS) =    1.12
  TOTAL AREA(ACRES) =        7.9   TOTAL RUNOFF(CFS) =       4.84
  TC(MIN.) =    9.76

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   387.00  DOWNSTREAM(FEET) =   347.00
  FLOW LENGTH(FEET) =   562.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.65
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.84
  PIPE TRAVEL TIME(MIN.) =   0.80    Tc(MIN.) =   10.57
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    601.00 =    2511.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.065
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .5700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.1636
  SUBAREA AREA(ACRES) =    0.39   SUBAREA RUNOFF(CFS) =    0.90
  TOTAL AREA(ACRES) =        8.3   TOTAL RUNOFF(CFS) =       5.50
  TC(MIN.) =   10.57

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  31
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   347.00  DOWNSTREAM(FEET) =   328.00
  FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.50
  PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =   10.89
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    602.00 =    2751.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.988
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .5700
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.1854
  SUBAREA AREA(ACRES) =    0.47   SUBAREA RUNOFF(CFS) =    1.07
  TOTAL AREA(ACRES) =        8.7   TOTAL RUNOFF(CFS) =       6.46
  TC(MIN.) =   10.89

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    433.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   328.00  DOWNSTREAM(FEET) =   309.00
  FLOW LENGTH(FEET) =   186.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.41
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.46
  PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =   11.10
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    433.00 =    2937.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    433.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.938
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.2143
  SUBAREA AREA(ACRES) =    1.07   SUBAREA RUNOFF(CFS) =    1.90
  TOTAL AREA(ACRES) =        9.8   TOTAL RUNOFF(CFS) =       8.28
  TC(MIN.) =   11.10

****************************************************************************
  FLOW PROCESS FROM NODE    433.00 TO NODE    425.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   307.00  DOWNSTREAM(FEET) =   305.00
  FLOW LENGTH(FEET) =    85.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.00
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       8.28
```

```
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =   11.26
  LONGEST FLOWPATH FROM NODE    411.00 TO NODE    425.00 =    3022.50 FEET.

+----------------------------------------------------------------------------+
|                                                                            |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    451.00 TO NODE    452.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    425.00
  DOWNSTREAM ELEVATION(FEET) =    415.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.596
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      1.09
  TOTAL AREA(ACRES) =      0.30   TOTAL RUNOFF(CFS) =      1.09

****************************************************************************
  FLOW PROCESS FROM NODE    452.00 TO NODE    453.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   390.00  DOWNSTREAM(FEET) =   311.00
  FLOW LENGTH(FEET) =   301.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.88
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.09
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =    5.02
  LONGEST FLOWPATH FROM NODE    451.00 TO NODE    453.00 =     401.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    452.00 TO NODE    453.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.572
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.5500
  SUBAREA AREA(ACRES) =    1.33   SUBAREA RUNOFF(CFS) =    4.81
  TOTAL AREA(ACRES) =        1.6   TOTAL RUNOFF(CFS) =       5.89
  TC(MIN.) =    5.02

+----------------------------------------------------------------------------+
|                                                                            |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .6000
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    445.00
  DOWNSTREAM ELEVATION(FEET) =    435.00
  ELEVATION DIFFERENCE(FEET) =     10.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.178
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.587
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.79
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.79

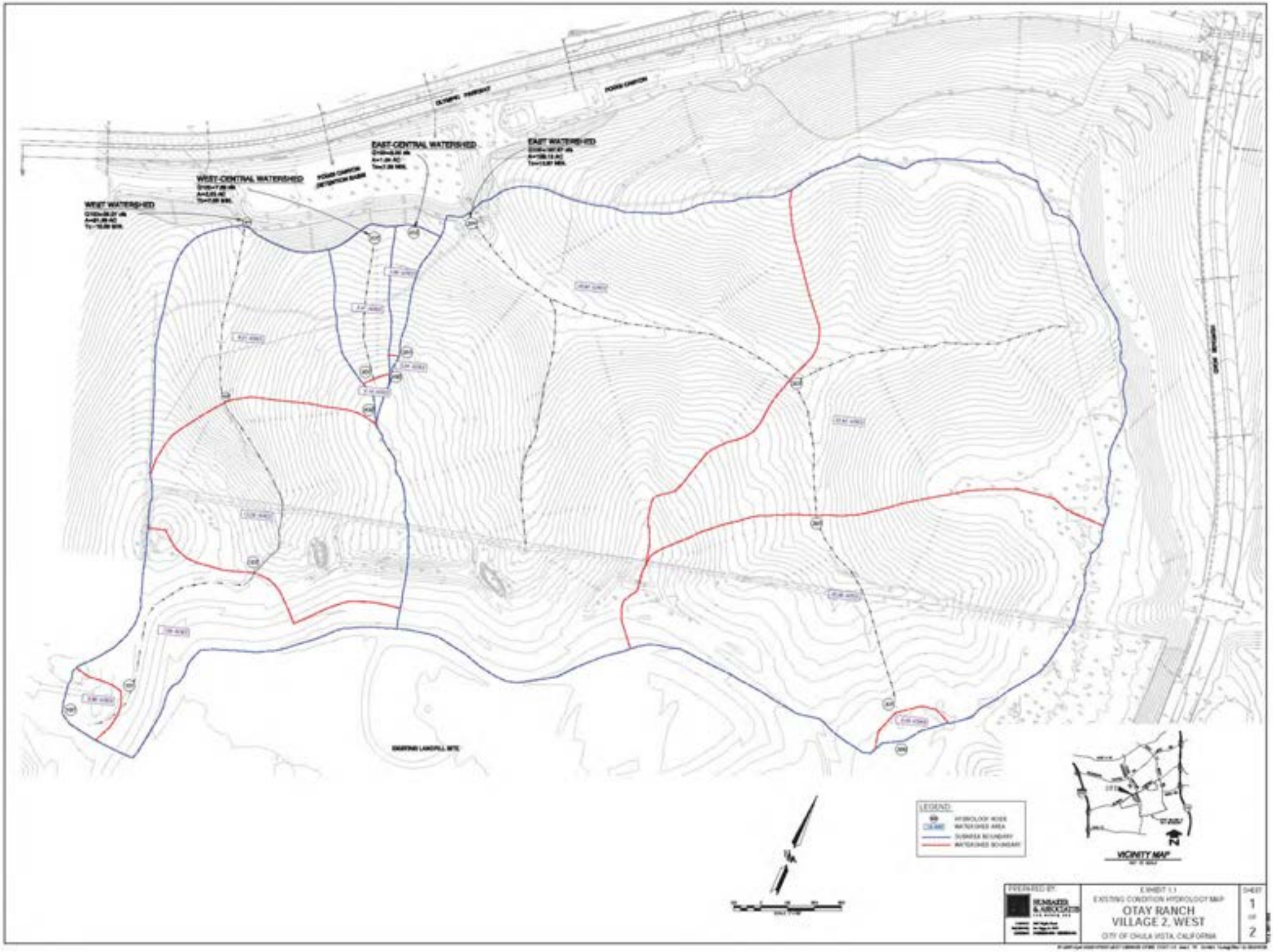
****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   434.00  DOWNSTREAM(FEET) =   301.00
  FLOW LENGTH(FEET) =  1000.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   1.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.51
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.79
  PIPE TRAVEL TIME(MIN.) =   1.96    Tc(MIN.) =    6.14
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =    1100.00 FEET.

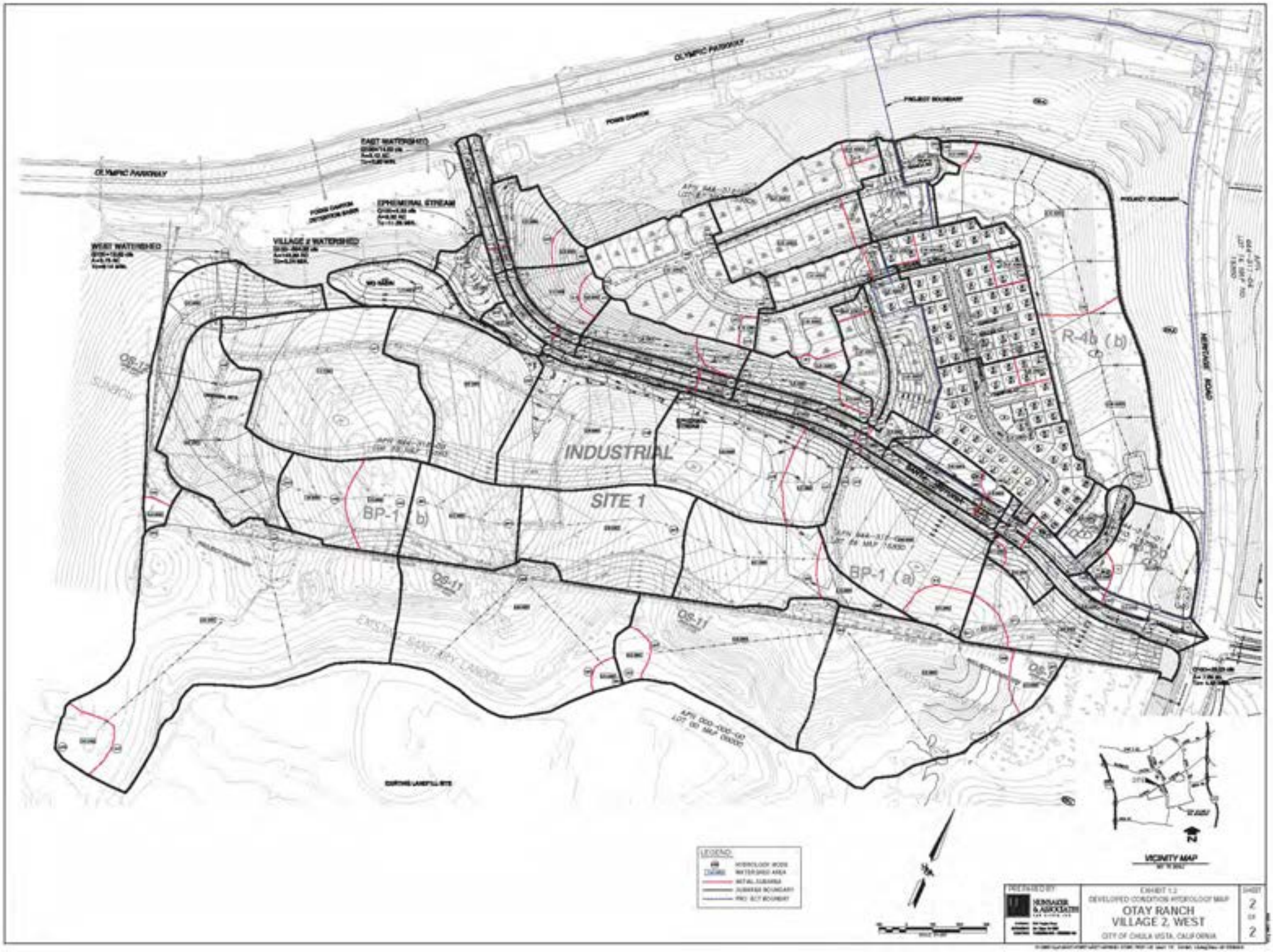
****************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.772
  *USER SPECIFIED(SUBAREA):
  OAK-ASPEN-MOUNTAIN BRUSH FAIR COVER RUNOFF COEFFICIENT = .6000
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6000
  SUBAREA AREA(ACRES) =    3.53   SUBAREA RUNOFF(CFS) =   12.23
  TOTAL AREA(ACRES) =        3.7   TOTAL RUNOFF(CFS) =      12.92
  TC(MIN.) =    6.14
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.7  TC(MIN.) =      6.14
  PEAK FLOW RATE(CFS)   =      12.92
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

CHAPTER 4

EXHIBIT 1.1
PRE-DEVELOPED CONDITION
HYDROLOGY MAP

EXHIBIT 1.2
DEVELOPED CONDITION
HYDROLOGY MAP


WEST WATERSHED
WEST-CENTRAL WATERSHED
EAST-CENTRAL WATERSHED
EAST WATERSHED
EXISTING LANDFILL SITE
LEGEND
HYDROLOGY NODE
WATERSHED AREA
SUBAREA BOUNDARY
WATERSHED BOUNDARY
VICINITY MAP
EXHIBIT 1.1
EXISTING CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, WEST
CITY OF CHULA VISTA, CALIFORNIA
SHEET
1
OF
2


OLYMPIC PARKWAY
POWAY CANYON
PROJECT BOUNDARY
EAST WATERSHED
EPHEMERAL STREAM
POWAY CANYON DETENTION BASIN
VILLAGE 2 WATERSHED
WEST WATERSHED
NO SCALE
INDUSTRIAL
SITE 1
BP-1 (b)
BP-1 (a)
R-4b (b)
OS-11
OS-12
EXISTING SANITARY LANDFILL
EXISTING LANDFILL SITE
HERITAGE ROAD
LEGEND
HYDROLOGY NODE
WATERSHED AREA
INITIAL SUBAREA
SUBAREA BOUNDARY
PROJECT BOUNDARY
VICINITY MAP
N
PREPARED BY
HUNSAKER & ASSOCIATES
EXHIBIT 1.2
DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, WEST
CITY OF CHULA VISTA, CALIFORNIA
SHEET 2 OF 2

APPENDIX A

EXCERPT FROM MASTER DRAINAGE STUDY FOR OTAY RANCH VILLAGES 2, 3, & 4

HUNSAKER
& ASSOCIATES
SAN DIEGO, INC

PLANNING
ENGINEERING
SURVEYING

IRVINE
LOS ANGELES
RIVERSIDE
SAN DIEGO

MASTER DRAINAGE STUDY
for
OTAY RANCH VILLAGES 2, 3 & 4

Includes Addendum to
Poggi Canyon Creek Master Drainage Study

In the City of Chula Vista, California

Prepared for
Otay Ranch Company
350 West Ash Street
Suite 730
San Diego, CA 92101

w.o. 0025-294

July 14, 2005

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ERIC MOSOLGO
No. 62014
Exp. 09/30/07
CIVIL
STATE OF CALIFORNIA

Canyon Creek was the 100 year 6-hour type B rainfall distribution. Methodology and requirements have changed subsequent to the 1999 submittal. Therefore, 24 hour storm distributions for the 100 year, 10 year and 2 year storm have been included for reference in Chapter 4 of this report.

The Vicinity map below shows the locations of Villages 2, 3, and 4.

Figure 1: Vicinity Map

VICINITY MAP

Summary of Existing Conditions

The Otay Ranch Village 2, 3 & 4 sites currently contain no development and are characterized by rolling hills and heavily grazed land. Runoff from the existing sites drain via incised canyons to either Poggi Canyon, Wolf Canyon, or unnamed tributaries of the Otay River.

Poggi Canyon

The constructed Poggi Canyon Creek channel enters the Otay Ranch property just downstream of the existing 7-foot x 8-foot box culverts under La Media. Runoff from the McMillin property south of Olympic Parkway empties into Poggi Canyon Creek via an 84-inch and a 96-inch RCP in the downstream headwall of the 7-foot x 8-foot RCBCs. At that location, the McMillin runoff confluences with runoff from the existing Eastlake Greens development, the Eastlake Land Swap Area, as well as the Otay Ranch Company's portion of Otay Ranch Village 6, Village 12, Village 5 and a portion of Village 2 Phase 1 (Village 2 Northeast from HEC-1 analysis).

The combined runoff then flows in a westerly direction via a constructed channel on the north side of Olympic Parkway through the Otay Ranch Village 1 – Phase 4 area. In this stretch of the channel, a 48-inch RCP conveys flows from the northeastern portion of Otay Ranch Village 2 (south of Olympic Parkway) to the channel.

Poggi Canyon Creek crosses under Olympic Parkway via two existing 12-foot x 8-foot RCBCs near the boundary of Village 1 - Phases 4 and 7. At the downstream headwall, runoff from the existing high school site confluences with runoff in Poggi Canyon Creek.

Between the high school site and Heritage Road, runoff is conveyed via a constructed trapezoidal channel with a bottom width of 40 feet and 3:1 side slopes. Runoff from the undeveloped Village 2 site enters the channel from the south along this reach. Runoff from the developed Otay Ranch Village 1 – Phase 7 site enters the main channel at the intersection of Olympic Parkway and Heritage Road.

Downstream of the Heritage Road culvert structure, runoff flows in a westerly direction via a constructed trapezoidal channel with a bottom width of 50 feet. Again, runoff from the undeveloped Village 2 site drains to the channel from the south.

Near the proposed Village 2 entrance road from Olympic Parkway, runoff from Otay Ranch Village One West enters from the north. The combined runoff flows through two 12-foot x 8-foot RCBCs under the proposed entrance road (stubbed out from Olympic Parkway in existing conditions) and into the existing Poggi Canyon Regional Detention Facility. The existing detention basin is located at the western boundary of the Otay Ranch Company's ownership. HEC RAS output for the 2 year, 10 year and 100 year 6-hour and 24-hour storm events are included in Chapter 5 of this report. Freeboard at various locations throughout the channel is summarized in a table in Chapter 5 of this report.

The existing detention facility was designed to mitigate the 100-year developed condition peak flowrate in Poggi Canyon below the pre-developed 100-year peak flow. Per the October 14, 1999 "Master Drainage Study for Poggi Canyon Creek," the pre–developed 100-year flow at the detention basin location was determined to be roughly 1,300 cfs. Thus, the basin must mitigate developed condition peak flowrates to 1,300 cfs or less.

Wolf Canyon

In existing conditions, the Wolf Canyon watershed contains no development and is characterized by rolling hills and heavily grazed land. The Wolf Canyon area east of the proposed extension of La Media (south of Birch Parkway) will be home to Otay Ranch Village 7 and the proposed Eastern Urban Center.

Wolf Canyon Creek's main drainage course forms the southern and eastern boundary for Otay Ranch Village 2 and the northern boundary the for Otay Ranch Village 4 park site. A large tributary confluences with Wolf Canyon Creek near the downstream limit of the Otay Ranch Village 2 ownership. A significant portion of the undeveloped Village 2 property drains to this tributary while the remainder drains directly to Wolf Canyon Creek.

Following the aforementioned confluence, Wolf Canyon Creek flows in a southerly direction just east of the Village 3 property boundary. Wolf Canyon discharges runoff to the Otay River in the existing rock quarry area.

HEC HMS analyses to quantify existing and developed condition flows to Wolf Canyon Creek are included in Chapters 6 and 7 of this report, respectively. The following table summarizes pre-developed verses developed condition flows at the Village 4 Park site outlet and at the location at which Wolf Canyon Creek confluences with the Village 2 basin outflows.

Table 1: Wolf Canyon HEC HMS Summary

Location	Pre-Development Drainage Area (ac)	Pre-Development Q100 (cfs)	Developed Drainage Area (ac)	Routed Outflow (cfs)
Wolf Canyon Creek at Village 4 Outfall	523	537	533 (+10)	494 (-43)
Wolf Canyon Creek at Village 2 confluence	822	859	832 (+10)	704 (-118)

Otay Valley Road Watershed

Runoff from the Village 3 property drains to one of two unnamed tributaries of the Otay River. Both of these tributaries are located west of the confluence of Wolf Canyon and the Otay River. In existing conditions, this area of the watershed contains no development.

Summary of Developed Conditions

Development of Otay Ranch Village 2 will include the construction of single-family residential homes, multi-family homes, commercial sites, industrial sites, park sites, multi-use areas and major traffic arterials while development of Village 3 will include the construction of industrial sites. Development of Village 4 will consist of a neighborhood park.

The overall drainage divides between Poggi Canyon and Wolf Canyon will vary only slightly as compared to existing conditions. Runoff within the developed Village 2 site will be directed toward either Poggi or Wolf Canyon Creeks via internal storm drain systems. Existing and developed areas and 100-year flows for each watershed are summarized in the following table.

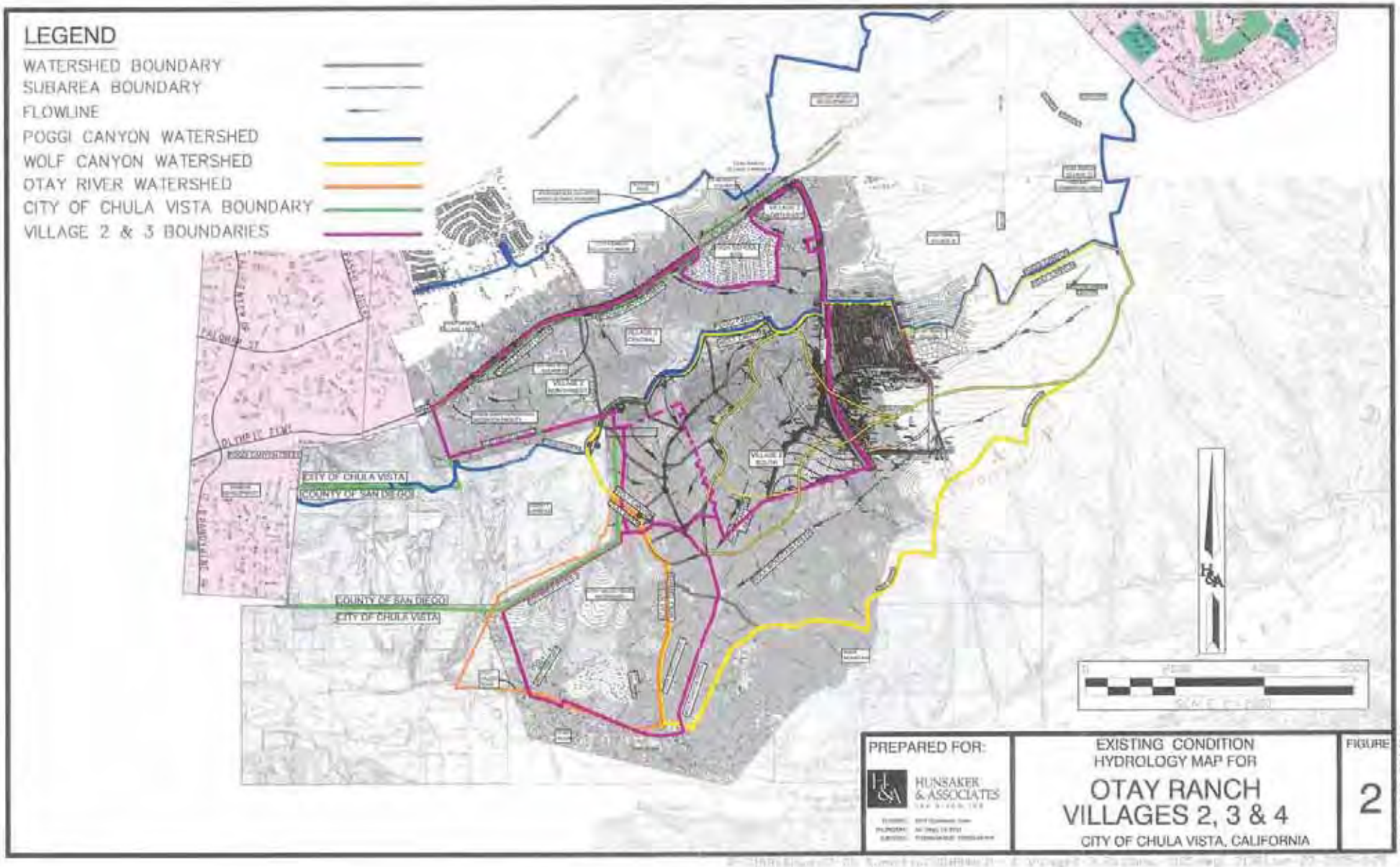

LEGEND
WATERSHED BOUNDARY
SUBAREA BOUNDARY
FLOWLINE
POGGI CANYON WATERSHED
WOLF CANYON WATERSHED
OTAY RIVER WATERSHED
CITY OF CHULA VISTA BOUNDARY
VILLAGE 2 & 3 BOUNDARIES
CITY OF CHULA VISTA
COUNTY OF SAN DIEGO
COUNTY OF SAN DIEGO
CITY OF CHULA VISTA
PREPARED FOR:
HUNSAKER & ASSOCIATES
EXISTING CONDITION
HYDROLOGY MAP FOR
OTAY RANCH
VILLAGES 2, 3 & 4
CITY OF CHULA VISTA, CALIFORNIA
FIGURE
2
W.O.# 0025-394/543

Table 2: Poggi Canyon, Wolf Canyon & Otay River Pre vs. Post Development Flow Summary

Watershed	Pre-Development Drainage Area (ac)	Pre-Development Q100 (cfs)	Developed Drainage Area (ac)	Routed Outflow (cfs)	Freeboard (ft)
*Poggi Canyon @ Regional Detention Basin	2,070	1,320	2,093 (+23)	1,115 (-205)	1.5
**Wolf Canyon (from Village 2 Site only) @ Detention Site	227	330	247 (+20)	187 (-143)	2.01
***Otay River (Village 3 Site only)	324	823	379 (+55)	375 (-448)	3.99

* Pre-Development Poggi Canyon data taken from "Master Drainage Study for Poggi Canyon Creek", dated October 1999; 23 acre diversion from grading subsequent to 1999 study preparation

** Composite Wolf Canyon analysis to be provided at final engineering phase; 28 acre diversion to unnamed tributary from other portion of existing Wolf Canyon watershed (In other words, diversion is internal and not from out of basin effects)

*** Diversion from Wolf Canyon Watershed

Runoff to Poggi Canyon will be routed through the existing Poggi Canyon Regional Detention Facility. After slight modification to the detention basin (raising of the berm), calculations predict a developed-condition basin outflow of 1,115 cfs (significantly lower than the pre-developed condition flow of 1,320 cfs). Therefore, the Poggi Canyon Regional Detention Facility effectively attenuates the 100-year developed peak flow for the 100 year 6-hour storm.

The majority of runoff to Wolf Canyon will be routed through a proposed detention basin located in the unnamed tributary just upstream of its confluence with Wolf Canyon Creek. Village 2, Neighborhood R-16 will be built as part of Phase 1 and will drain to the storm drain system located in La Media Road which will be built in association with Otay Ranch Village 7. Details regarding flows from this area and hydraulics for the Village 7 La Media Road storm drain system can be found in the Master Drainage study for Village 7, dated April 1, 2005.

The majority of Village 2 Phase 1 straddles Santa Victoria Road. Rational method hydrology analysis for Village 2 Phase is contained in the Otay Ranch Village 2, Phase 2 Rough Grading Hydrology Study prepared by Hunsaker & Associates. The Phase 1 area has been divided into three watersheds. A portion of the Village 2 Phase 1 site will discharge into the existing natural channel located west, north west

of the existing Otay Ranch School site. Flows to this tributary in developed conditions will be considerably less than in existing conditions. A Detailed HEC RAS analysis for this channel will be provided at the final engineering stage for Village 2 Phase 1. The remainder of this planning area will discharge to existing storm drain systems and ultimately will discharge to Poggi Canyon Channel. Hydraulic analyses of these systems are included in the Otay Ranch Village 2, Phase 2 Rough Grading Hydrology Study prepared by Hunsaker & Associates also.

Water quality treatment will be addressed with flow based treatment units at several locations through Villages 2, 3 & 4. Flow from Village R-15 will be treated in the Vortechs unit located to the east of La Media Road upstream of the Otay Ranch Village 7 detention basin. Additional details regarding water quality treatment can be found in the *"Water Quality Technical Report for Otay 2, 3, 4"* and *"Water Quality Technical Report for Village 7"* prepared by Hunsaker & Associates.

All runoff from Village 3 will be routed via storm drain to a basin north of the intersection of Heritage Road and Otay Valley Road. Attenuated peak flows from this detention basin will discharge into the Otay River south of Otay Valley Road. Water quality treatment for village 3 will take place in a flow based treatment unit upstream of the basin. A diversion structure will direct the 85th percentile flow to the unit while allowing flow in excess of this amount to proceed to the detention facility. Additional details regarding the water quality treatment of these flows can be found in the *"Water Quality Technical Report for Otay 2, 3, 4"* prepared by Hunsaker & Associates.

HEC-HMS output and stage-storage-discharge information for the Otay Ranch Village 3 basin are located in Chapter 11 of this report. Inflow and outflow hydrographs are also provided in Chapter 11.

The drainage areas contributing to the Wolf Canyon Basin and Otay Valley Road basin are each less than one square mile, thus a 100-year 6 hour rational method analysis was prepared for each of these watersheds. AES output for the Wolf Canyon Basin and Otay Valley Road basin appears in Chapters

Summary of Results & Recommendations

The original watershed model for Poggi Canyon was prepared in association with the "Master Drainage Study for Poggi Canyon Creek," dated October 1999 and approved by the City of Chula Vista. This report includes an addendum prepared to update assumptions made regarding ultimate condition watershed boundaries, curve numbers, and mitigation grading which reduced the storage volume of the Poggi Canyon regional detention basin. Detention basin storage volume reductions, associated with the mitigation grading, are proposed to be offset by the raised berm design modeled in this analysis.

The Poggi Canyon addendum analysis is consistent with methodology approved for the October 1999 Master Drainage Study. The following list summarizes

methodology used in the Poggi Canyon hydrologic analysis and discusses updates to methodology between the original 1999 study and the current addendum.

- 6-Hour, Type B Rainfall Distribution per 1993 San Diego County Hydrology Manual (effective at the time of 1999 Master Drainage Study)
- 24-Hour, Type B Rainfall Distribution Output for the Poggi Canyon watershed has been included in this report for reference; However, the approved methodology remains the 6-Hour Type B distribution.
- 100-Year, 6-Hour Rainfall Depth = 2.5 inches
- 100-Year, 24-hour Rainfall Depth = 4.1 inches
- Curve Numbers Determined Based on Antecedent Moisture Condition = 2.0 (this standard was approved by City of Chula Vista and Dr. David Williams of West Consultants);
- Curve number for Village 2 development have been updated based on PZN adjustment factor of 2.3, per city's request
- Soil group D assumed for each subbasin
- Curve numbers for 1999 study selected based on criteria set forth in 1993 San Diego County Hydrology Manual (CN = 98 for major arterials, CN = 92 for commercial areas, CN = 91 for school and mixed-use sites, CN = 90 for high-density residential sites, CN = 88 for medium-density residential sites, CN = 82 for open areas).
- Curve numbers for current study included in this report selected based on criteria set forth in 2003 San Diego County Hydrology Manual (CN = 98 for major arterials, CN = 95 for commercial areas, CN = 91 for school and mixed-use sites, CN = 92 for high-density residential sites, CN = 87 for medium-density residential sites, CN = 82 for open areas); developed-condition composite sub basin curve numbers for the Otay Ranch areas range from 86 to 92.
- Kinematic Wave Method used to transform excess rainfall to runoff; overland flow planes assumed to have Manning's overland roughness value ranging from 0.2 to 0.3; shallow concentrated gutter flow regime assumed to have Manning's roughness value of 0.015 and a length of 1,000 feet; collector storm drain flow regime assumed to have Manning's roughness value of 0.013; Poggi Canyon channel element assumed to have Manning's roughness value of 0.06.

The table on the following page summarizes developed condition input and output data for both the 1999 Master Drainage Study and the 2004 Addendum analysis.

Results contained in Table 1 are conditional pending final approval of Tentative Maps for Otay Ranch Villages 2, 7 and the Eastern Urban Center.

TABLE 3: POGGI CANYON WATERSHED MODEL DATA
100 Year 6 Hour Type B Distribution
Developed Conditions

Location	1999 Master Drainage Study for Poggi Canyon			2005 Addendum to Master Drainage Study		
	Drainage Area (acres)	Composite Upstream Curve No.	Q_{100} (cfs)	Drainage Area (acres)	Composite Upstream Curve No.	Q_{100} (cfs)
Upstream of East Palomar Crossing	495	86.6	455	588	89.6	753
Downstream of East Palomar Crossing	590	87.1	560	690	89.5	877
Upstream of La Media Crossing	670	87.3	630	804	89.7	1,020
Downstream of La Media Crossing	1,240	87.2	1,175	1,275	90.1	1,651
Upstream of Olympic Parkway Crossing	1,305	87.1	1,215	1,430	90.3	1,854
Downstream of Olympic Parkway Crossing	1,490	87.0	1,345	1,485	90.4	1,909
Downstream of Heritage Road Crossing	1,730	87.0	1,490	1,760	90.2	2,111
Inflow to Poggi Canyon Regional Detention Basin	2,075	86.8	1,675	2,093	n/a	2,295
Outflow from Poggi Canyon Regional Detention Basin	2,075	86.8	950	2,093	n/a	1,115
Brandywine Culvert Headwall	2,450	86.7	1,070	2,477	n/a	1,236

TABLE 4: POGGI CANYON WATERSHED MODEL DATA
Developed Conditions
100 year, 10 Year and 2 Year HEC-1 Results
For 6-Hour and 24-Hour Type B Rainfall Distributions

Location	6 Hour Type B			24-Hour Type B Distribution		
	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
Upstream of East Palomar Crossing	140	367	753	297	553	825
Downstream of East Palomar Crossing	162	425	877	349	648	967
Upstream of La Media Crossing	189	494	1,020	398	749	1,124
Downstream of La Media Crossing	312	798	1,651	647	1,203	1,793
Upstream of Olympic Parkway Crossing	354	896	1,854	709	1,336	2,002
Downstream of Olympic Parkway Crossing	365	922	1,909	739	1,389	2,077
Downstream of Heritage Road Crossing	409	1,011	2,111	818	1,581	2,414
Inflow to Poggi Canyon Regional Detention Basin	448	1,089	2,295	893	1,761	2,733
Outflow from Poggi Canyon Regional Detention Basin	359	684	1,115	679	1,145	2,596
Brandywine Culvert Headwall	390	748	1,236	768	1,402	2,959

HEC-1 detention routing calculations show the Poggi Canyon regional detention basin capable of mitigating the 100-year, 6-hour design runoff below the pre-development flow level at both the Otay Ranch – Sunbow boundary and downstream at Brandywine Avenue. Raising of the detention basin berm will provide 2 feet of freeboard within the basin as required by the soon to be enacted revisions to freeboard requirements within the City of Chula Vista Subdivision Manual.

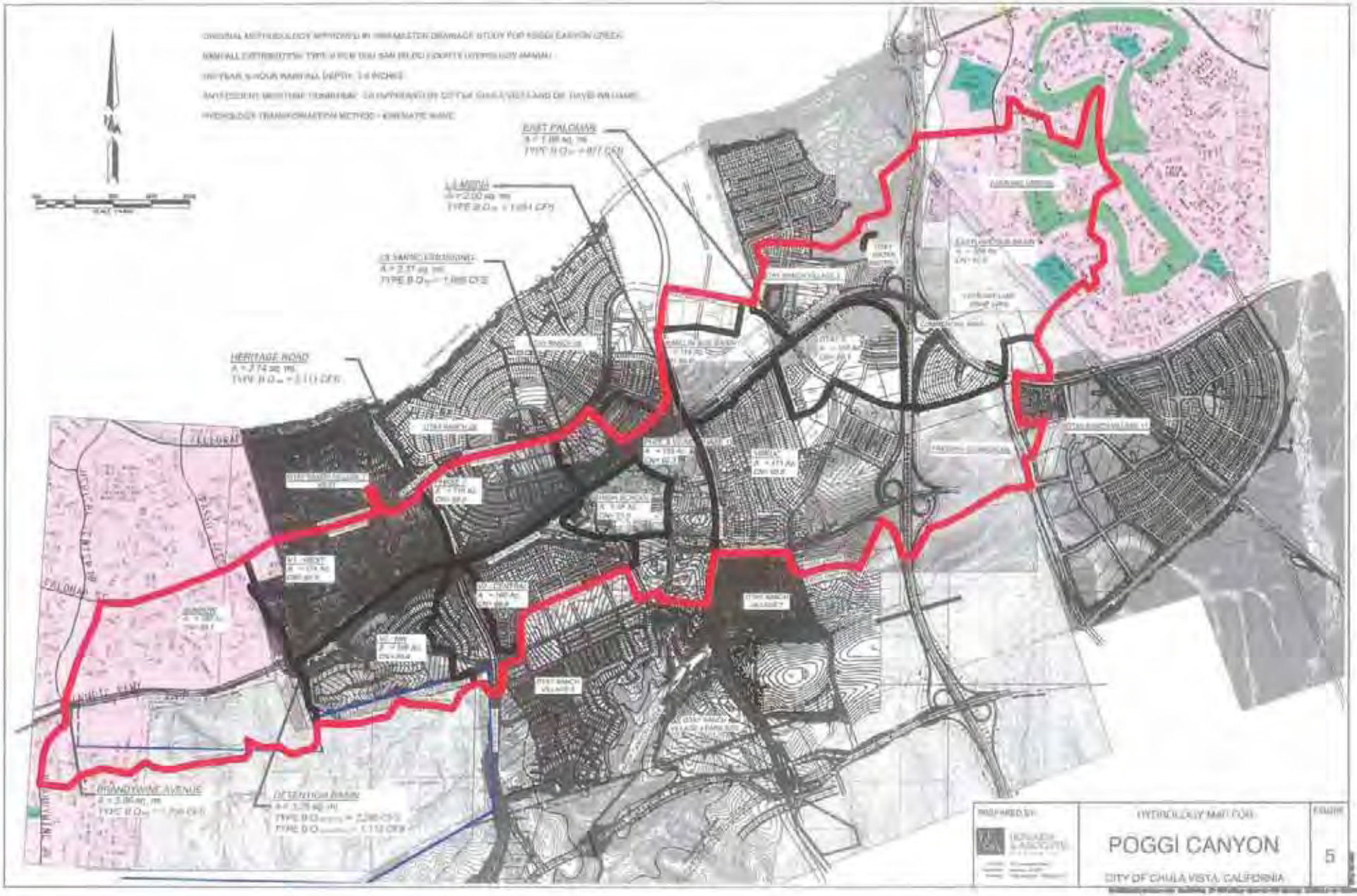
HEC RAS results for the Poggi Canyon Channel from the proposed SR125 to the Poggi Canyon Regional Detention Facility are included in Chapter 5 of this report. Stationing for Poggi Canyon Channel corresponds to channel centerline stationing as provided on the improvement plans for Olympic Parkway (Drawing Number 0-2024-01) Velocities in the Poggi Channel are at non erosive levels at all locations with the exception of the drop structures which are designed to create a hydraulic drop by increasing velocity. The following table demonstrate that WSE at culverts are at acceptable levels based on the higher flows and will not adversely impact upstream storm drain systems.

Table 5
Culvert Performance Data
100 Year Storm

Location	Culvert Type and Dimensions	Road Weir Elevation (ft)	100-Year WSE (ft)
East Palomar	(2) 8' x 6' RCBCs	505.4	500.86
La Media	(2) 7' x 8' RCBCs	446.0	440.0
Olympic Parkway Culvert	(2) 12' x 8' RCBCs	403.0	398.73
Paseo Ranchero	(2) 12' x 8' RCBCs	353.7	349.26
Village 2 Entrance Road	(2) 12' x 8' RCBCs	306.6	302.02
Detention Basin	(2) 8' x 4' RCBCs	298.0	295.64

Methodology used for the hydrologic analyses for the Wolf Canyon and the Otay Village 3 basins is consistent with criteria set forth in the 2003 "San Diego County Hydrology Manual". Since the contributing drainage area to both proposed detention basins is less than 1 square mile, rational method analyses were used to determine 100-year basin inflows. The HEC HMS computer program was used to route flows through the detention basins.

Tables 6-8 below summarize the 100-year, 10-year and 2-year pre and post-development results for the Wolf Canyon and Otay Village 3 detention facilities.


EAST PALOMAR
HERITAGE ROAD
BRANDYWINE AVENUE
DETENTION BASIN
PREPARED BY:
HYDROLOGY MAP FOR:
POGGI CANYON
CITY OF CHULA VISTA, CALIFORNIA
FIGURE
5

WATER QUALITY TECHNICAL REPORT
FOR
OTAY RANCH VILLAGE 2 NORTH
TENTATIVE MAP

City of Chula Vista, California

Prepared for:
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W.O. 2807-35

November 13, 2013

Hunsaker & Associates
San Diego, Inc.

Alisa S. Vialpando, R.C.E. 47945
Principal

REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
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STATE OF CALIFORNIA

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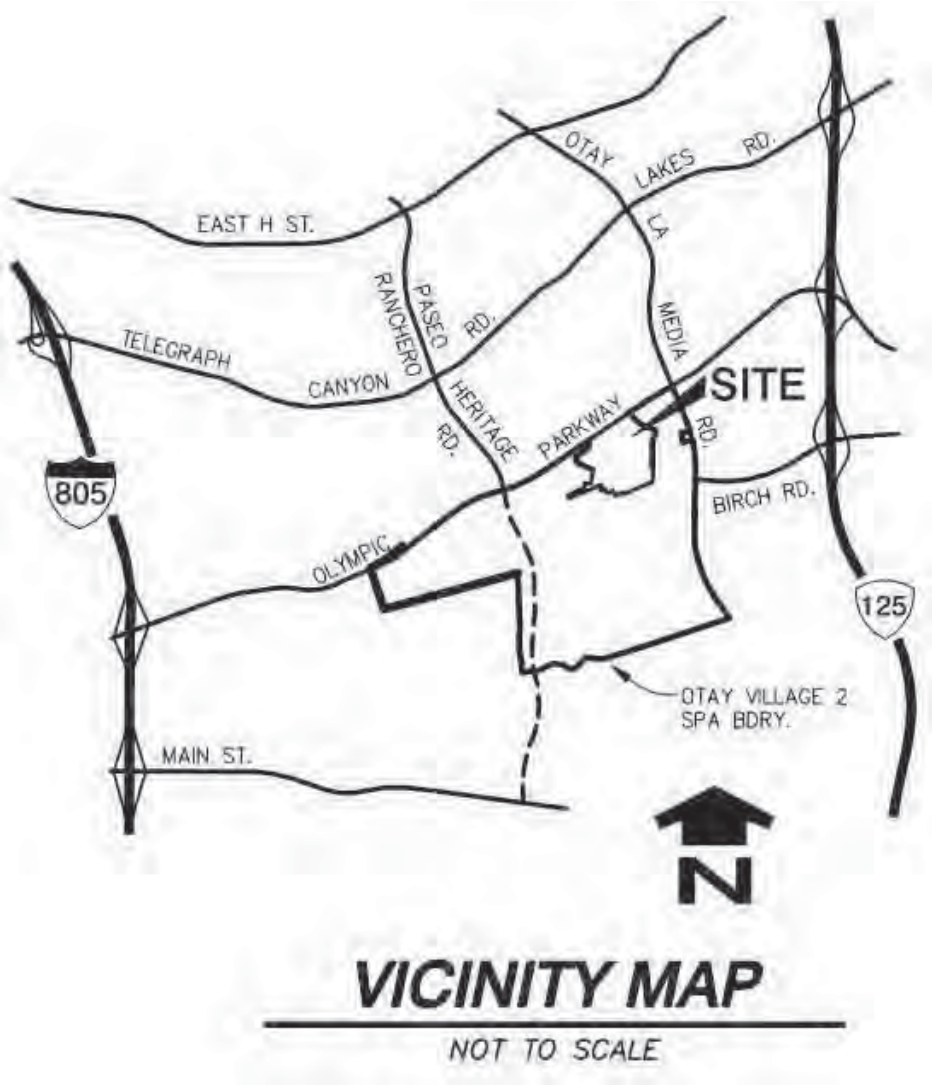
CHAPTER 1 – EXECUTIVE SUMMARY

This Water Quality Technical Report (WQTR) addresses the treatment of 85th percentile runoff from the proposed development of Otay Ranch Village 2 North for Baldwin & Sons, Inc. The design will utilize on site Low Impact Development (LID), Best Management Practices (BMPs) and Bioretention Integrated Management Practices (IMP's) Treatment Controls to treat the 85th percentile flow from the development.

1.1 – Introduction

The Otay Ranch Village 2 North Tentative Map project site is located within the City of Chula Vista, south of Olympic Parkway and north of Santa Diana Road. Neighborhoods R-8a, R-8b, and R-9b are to the west and it is located immediately west of Santa Victoria Road. See Vicinity Map below. The gross subdivision acreage is 36.46 acres which will include lots for multi-family units, open spaces, a park, and two CPF sites.



Per the City of Chula Vista's *"Development Storm Water Manual"* dated January 2011 and FORM 5500 (Permanent Storm Water BMPs Applicability Checklist), the Otay Ranch Village 2 North project is classified as a priority project. As such, it is subject to the Standard Urban Storm Water Mitigation Plans (SUSMP) requirements set forth in Section 3 of the *"Development Storm Water Manual"*.

This WQTR for Otay Ranch Village 2 North Tentative Map has been prepared pursuant to requirements set forth in the City of Chula Vista's "*Development Storm Water Manual*." All calculations are consistent with criteria set forth by the Regional Water Quality Control Board's Order No. R9-2007-0001, and the "*County of San Diego SUSMP"* dated August 2012. This project has been declared exempt from hydromodification requirements. According to technical memorandums prepared by Tory Walker Engineering, Inc., the Village 2 West project qualifies for an infill exemption and does not need to include any hydromodification measures. See Section 1.4 below for further discussion.

This WQTR recommends conceptual locations and sizes of site Best Management Practices (BMPs) which include bio-clean media filters at inlet locations, pervious pavers within the courtyards and driveways, and a bioretention basin for treatment of runoff from Neighborhood R-8C. Approved downstream facilities (Vortech and Stormfilter) will also manage these flows. It should be noted that the proposed BMPs and methodologies on this TM are consistent with the approved *Tentative Map CVT 11-05 (Village 2 R-8a, R-8b & R-9b, R-5b, R-10b, R-11)* approved in February 2012.

The proposed land uses for this Village 2 North TM: multi-family residential, open spaces, a park, and two community purpose facility sites. Such urban land uses are typical generators of pollutants such as sediment, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, bacteria and viruses, and pesticides. If not mitigated, these pollutants can degrade urban runoff and impair receiving waters. This project proposes to reduce potential urban pollution by implementing Best Management Practices (BMP's), including Low Impact Development site design, source control, and treatment control BMP's.

Detailed plans are not yet available for the residential areas, therefore building footprints, sidewalks, and driveways have been estimated to size IMPs to comply with water quality requirements per the City of Chula Vista Standard Urban Stormwater Mitigation Plan. Individual developers/builders will be responsible for implementing and maintaining all BMP's until new homeowners or sub-associations take responsibility for the maintenance of post-construction BMP's into perpetuity. To provide additional water quality treatment for flows generated by the public streets within the TM area, bio-clean media filters will be included at each affected inlet. The CPF site will require the builder/developer to submit site-specific Water Quality Technical Reports for City review and approval prior to obtaining any land development permits.

This report also determines anticipated project pollutants, pollutants of concern in the receiving watersheds, conditions of concern in receiving waters, recommended source control BMPs, recommended maintenance, sampling, and monitoring requirements and methodology used for the design of BMPs.

1.2 Summary of Pre-Developed Conditions

The topography for existing Village 2 North project area is characterized by flat un-vegetated sloped areas along its western and eastern boundaries where rough grading has occurred for Neighborhoods R-8b, R-9b, R-5, and the future park. The western portion drains towards the northwest corner of the overall Village 2 North development. The eastern portion within the existing park pad drains towards an existing sediment basin. The northern boundary of the site consist of a natural steep vegetated slope which drains to the north into a natural drainage course located between the site and the Otay Ranch High School.

Per the *TM Drainage Study for Otay Ranch Village 2 North* (November 2013), the site was divided into two watersheds; Western and Eastern. The Hydrology Map from that study is located in Chapter 11, Exhibit 1.1. It outlines the current western watershed. The western watershed values shown on the map were established by the delineated watersheds which were part of the *Rough Grading Hydrology Study for Otay Ranch Village 2 North* dated March 2, 2007. The storm drain infrastructure throughout much of the western watershed has been constructed per the calculated 'developed' flows established in the 2007 report. As such, the values obtained at the western boundary of this watershed have established the existing peak flow limit for this watershed.

The eastern watershed is currently comprised of open space natural steep slopes and a rough graded pad which is a future park site. The park pad slopes towards the north at about 2% and contains a sediment basin, riser, and outlet pipe. The park pad was originally designed as part of the *Rough Grading Hydrology Study for Otay Ranch Village 2, Phase 1* dated May 24, 2006. The storm drain from the park pad connects to an existing system which extends both upstream and downstream of the park per the Rough Grading Plans for Otay Ranch Village 2, Phase 1. The hydrologic analysis for this watershed is included in the *TM Drainage Study for Otay Ranch Village 2 North*. The hydrologic model extends downstream to coincide with the downstream point defined on the proposed condition hydrology map (Exhibit 1.2). The runoff from this watershed continues downstream and confluences with Poggi Canyon flows.

Table 1 below summarizes the 50-year pre-development peak flows to each of the delineated watersheds. Per the City of Chula Vista Subdivision Manual, runoff coefficients of 0.30 and 0.60 were assumed for the park pad and steep vegetated slopes, respectively.

TABLE 1 - Summary of Pre-Developed Flows to Poggi Canyon

Watershed Name	Drainage Area (ac)	50-Year Peak Flow (cfs)
Western	67.32	177.55
Eastern	83.26	166.35
TOTAL	**150.58**	**343.90**

1.3 – Summary of Proposed Development

The Otay Ranch Village 2 North Tentative Map will consist of multi-family units, open spaces, a park, and two CPF sites. Relative to the existing condition, the park site will be extended west, a CPF site has been added within the eastern portion of the park area, the slope area along the northern portion has been moved north, and the proposed residential areas and streets within Neighborhoods R-8b and R-9b have been increased.

As with the Pre-developed analysis discussed above, the Developed Condition for this study was separated into two watersheds. For comparison purposes, the downstream points for both the pre and post condition models were made to coincide. Please refer to the Developed Condition Hydrology Map, Exhibit 1.2 in Chapter 11.

The hydrologic model for the western watershed was integrated with the downstream hydrologic model which was prepared as part of the *Rough Grading Hydrology Study for Otay Ranch Village 2 North* dated March 2, 2007. The downstream value for the western watershed is as shown on Table 2 below and the developed condition map.

Similar to the existing condition hydrologic analysis, the eastern model integrated the upstream data from the approved *Rough Grading Hydrology Study for Otay Ranch Village 2, Phase 1* dated May 24, 2006. The downstream value for the eastern watershed is as shown on Table 2 below and the Developed Condition Hydrology Map (Exhibit 1.2).

Table 2 below summarizes the 50-year post-development peak flows to each of the delineated watersheds. Runoff coefficients assumed for the proposed roads, multi-family development, single family development, CPF sites, and park sites are per the City of Chula Vista Subdivision Manual.

TABLE 2 - Summary of Developed Flows to Poggi Channel

Watershed Name	Drainage Area (ac)	50-Year Peak Flow (cfs)
Western	59.38	140.12
Eastern	84.33	185.52
Total	**143.71**	**325.64**

Supporting calculations for the data presented in Table 2 is located in Chapter 3 of the *TM Drainage Study for Otay Ranch Village 2 North* (November 2013).

The downstream end of the western watershed ties in to the existing storm drain which connects to the Heritage Road storm drain. This storm drain outlets into Poggi Canyon at the southwestern corner of the Heritage Road-Olympic Parkway intersection. The water quality treatment of runoff from the western watershed is accomplished via vortech-stormfilter treatment units located upstream of the outlet into Poggi Canyon at Heritage Road. The newly permitted areas per this TM study will include additional water quality measures to comply with City of Chula Vista SUSMP requirements.

Water quality treatment for Neighborhood R-8C will be accomplished with a bioretention basin located at the bottom of the constructed slope south of Poggi Canyon. The additional areas in the eastern watershed relative to the approved Otay Ranch Village 2 Phase 1 Grading Plans will need to address any water quality measures necessary to comply with current City of Chula Vista SUSMP requirements. These areas include the park and the CPF site. The park is essentially self-treating and will not require any additional BMP measures. The future builders of the new CPF site, however, will need to address stormwater quality in accordance with the governing water quality requirements. The downstream end of the eastern watershed outlets immediately upstream of its confluence with Poggi Canyon northwest of the Otay Ranch High School. A headwall and rip rap will be included to reduce velocities at the outlet. A vortechnic-stormfilter treatment train has been approved per the Otay Ranch Village 2 Phase 1 Grading Plans to treat the developed areas upstream of the outlet excluding flows from Neighborhood R-8C. The units will be located approximately 775' west of Santa Victoria Road.

All runoff from the Otay Ranch Village 2 North TM project site outlets into Poggi Canyon downstream. The Regional Water Quality Control Board has identified the Poggi Canyon as part of the Otay Hydrologic Unit and the Otay Valley Hydrologic Area (basin number 910.20).

Landform grading has been incorporated to mimic natural conditions wherever possible. It is intended for the stormwater from the manufactured slopes to sheet flow and follow towards the existing drainage patterns. These open space areas shall be designated "self-treating" areas.

1.4 – Results and Recommendations

Per the three studies entitled *Technical Memorandum: Susceptibility Analysis of Poggi Creek* (January 2013), *Technical Memorandum: Urban Infill Hydromodification Exemption, The Expansion of Neighborhood R-8A, Otay Ranch Village 2 North* (January 2013), and *Technical Memorandum: Urban Infill Hydromodification Exemption for Otay Ranch Village 2 North Project* (January 2013) prepared by Tory Walker Engineering, Inc., 'the Otay Ranch Village 2 West project satisfies the conditions for an infill exemption' and 'is exempt from hydromodification compliance'. The two studies in conjunction with each other state that 'the recommended BMPs must only satisfy water quality constraints per the City of Chula Vista SUSMP requirements'.

Multiple LID-based BMP's are proposed to treat the 85th percentile runoff from the site prior to discharge to the proposed storm drain within the Village 2 North development. The proposed BMPs and methodologies on this TM are consistent with the recently approved *Tentative Map CVT 11-05 (Village 2 R-8a, R-8b & R-9b, R-5b, R-10b, R-11)* approved in February 2012.

Runoff from Neighborhood R-8C will receive water quality treatment downstream of the neighborhood via a water quality basin sized with a 4% sizing factor per Section 3 of the City of Chula Vista Development Storm Water Manual.

The proposed park area will consist of pervious area and be considered self-treating. The CPF site located east of the park will be privately owned and maintained. The respective builder of the CPF site will be responsible for the treatment of stormwater flows in accordance with the governing water quality requirements at the time of construction prior to the receiving storm drain system. Runoff generated by any interim mass graded pad (such as the park and CPF

sites) will drain to a desilt basin to be sized and located for each respective pad. For mass graded pads, the only potential pollutant of concern generated by these pads is sediment. Desilt basins will target this sole pollutant prior to discharging flows to the receiving storm drain system. Applicable erosion control measures for permanent stabilization will comply with CASQA Handbook measures and as indicated by each area's Storm Water Pollution Prevention Plan.

Locations of the BMP's described above are shown on the BMP Location Exhibit 1.3 in Chapter 11.

Low Impact Design (LID) BMP's have been implemented on the project site to the maximum extent practicable to ensure water quality treatment is maximized throughout the development.

Many alternate treatment BMPs, including media filters, drainage inserts, hydrodynamic separators, tree wells, and wet ponds were explored and evaluated (see Chapter 5 for a full comparison on all treatment BMPs considered). Bioretention IMPs and LID Site Design BMPs were deemed to be the most effective and feasible BMP treatment for the Otay Ranch Village 2 North development.

1.5 – Conclusion

The combination of proposed construction and permanent BMP's will reduce, to the maximum extent practicable, the expected project pollutants and will not adversely impact the beneficial uses of the receiving waters.

1.6 – References

"County of San Diego SUSMP", County of San Diego, August 1, 2012.

"Development Storm Water Manual", City of Chula Vista, January 2011.

"Final Hydromodification Management Plan" prepared for County of San Diego, California, March 2011

"Low Impact Development Handbook, Stormwater Management Strategies", County of San Diego, California July 20, 2007.

"Order No. R9-2007-0001,NPDES No.CAS0108758–Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, San Diego Unified Port District and the San Diego County Regional Airport Authority", California Regional Water Quality Control Board–San Diego Region; January 24, 2007.

"TM Drainage Study for Otay Ranch Village 2 North" prepared by Hunsaker & Associates San Diego, November 2013.

Rough Grading Hydrology Study for Otay Ranch Village 2, Phase 1 prepared by Hunsaker & Associated, May 24, 2006.

Rough Grading Hydrology Study for Otay Ranch Village 2 North prepared by Hunsaker & Associated, March 2, 2007.

"San Diego County Hydrology Manual", County of San Diego Department of Public Works – Flood Control Section; June 2003.

City of Chula Vista Subdivision Manual; Engineering Department and Land Development; Section 3, 2011.

"*Technical Memorandum: Susceptibility Analysis of Poggi Creek*", Tory Walker Engineering, Inc., January 2013

"*Technical Memorandum: Urban Infill Hydromodification Exemption, Otay Ranch Village 2 North Project*", Tory Walker Engineering, Inc., January 2013

"*Technical Memorandum: Urban Infill Hydromodification Exemption, The Expansion of Neighborhood R-8A, Otay Ranch Village 2 North Project*", Tory Walker Engineering, Inc., January 2013

CHAPTER 2 – STORM WATER TREATMENT CRITERIA

2.1 – Regional Water Quality Control Board Criteria

All runoff conveyed in the proposed storm drain systems will be treated in compliance with Regional Water Quality Control Board (RWQCB) regulations and National Pollutant Discharge Elimination System (NPDES) criteria prior to discharging to natural watercourses. California Regional Water Quality Control Board Order No. R9-2007-0001 dated January 24, 2007, sets the waste discharge requirements for discharges of urban runoff from municipal storm separate drainage systems draining the watersheds of San Diego County.

Per the RWQCB Order, post-development runoff from a site shall not contain pollutant loads which cause or contribute to an exceedance of receiving water quality objectives or which have not been reduced to the maximum extent practicable. Post-construction Best Management Practices (BMPs), which refer to specific storm water management techniques that are applied to manage construction and post-construction site runoff and minimize erosion, include source control – aimed at reducing the amount of sediment and other pollutants – and treatment controls that keep soil and other pollutants onsite once they have been loosened by storm water erosion.

Post construction pollutants are a result of the urban development of the property and the effects of automobile use. Runoff from paved surfaces can contain both sediment (in the form of silt and sand) as well as a variety of pollutants transported by the sediment. Landscape activities by homeowners are an additional source of sediment.

All BMPs shall be located to infiltrate, filter, or treat the required runoff volume or flow (based on the 85th percentile rainfall) prior to its discharge to any receiving watercourse supporting beneficial uses.

2.2 – City of Chula Vista SUSMP Criteria

Per the City of Chula Vista SUSMP, the Otay Ranch Village 2 North project is classified as a Priority Project and subject to the City's Permanent Storm Water BMP Requirements.

The Standard Urban Storm Water Mitigation Plans Permanent Storm Water BMPs Applicability Checklist (FORM 5500), which must be included along with Grading Plan applications, is included in the following page.

Otay Ranch
Village 2 North TM

CITY OF CHULA VISTA	**DEVELOPMENT SERVICES DEPARTMENT** 276 Fourth Avenue, Chula Vista, CA 91910 Phone: (619) 691-5021 Fax: (619) 691-5171	**PERMANENT STORM WATER BMPs APPLICABILITY CHECKLIST**
	FORM 5500	

Complete the following checklist to determine the project's permanent Best Management Practices requirements. This form must be completed and submitted with the permit application.

If one or more questions in the checklist are answered "Yes", the project is a Priority Development Project subject to the Standard Urban Storm Water Mitigation Plan (SUSMP) requirements in Section 3 of this Manual. If all answers are "No", please complete Form 5501 to select applicable Standard Permanent BMPs for your proposed project.

Project category descriptions in the following checklist are abbreviated for clarity. Please refer to the definitions in the NPDES Municipal Permit, Order No. R9-2007-0001, or Sections 3.1 and 9 of this Manual for expanded definitions of "Priority Development Projects" and "Redevelopment."

Does the project meet the definition of one or more of the Priority Development Project Categories below?

	Priority Development Project Categories	Yes	No
1	Housing subdivisions of 10 or more dwelling units.	X	
2	Commercial developments greater than one acre	X	
3	Developments of heavy industry greater than one acre		X
4	Automotive repair shops		X
5	Restaurants		X
6	All Hillside development greater than 5,000 square feet	X	
7	Development within or adjacent to Environmentally Sensitive Areas		X
8	Parking lots 5,000 square feet or more or with 15 or more parking spaces and potentially exposed to urban runoff	X	
9	Streets, roads, highways, and freeways	X	
10	Retail Gasoline Outlets		X
11	Development Projects that result in the disturbance of one acre or more of land	X	
12	Redevelopment projects that create, add, or replace at least 5,000 square feet of impervious surfaces on an already developed site that falls under the project categories or locations listed above	X	

Limited Exclusion: Trenching and resurfacing work associated with utility projects are not considered Priority Development Projects unless the project results in new impervious surfaces. Parking lots, buildings, and other structures associated with utility projects are Priority Development Projects if one or more of the criteria is met.

CHAPTER 3 – IDENTIFICATION OF TYPICAL POLLUTANTS

3.1 – Anticipated Pollutants from Project Site

The following table details typical anticipated and potential pollutants generated by various land use types. This WQTR covers the proposed development of Otay Ranch Village 2 North consisting of paved servicing roads, sidewalks, multi- family residential, park, community purpose facilities and public utilities. The applicable categories have been highlighted below to clearly illustrate which general pollutant categories are anticipated from the project area.

	General Pollutant Categories								
Priority Project Categories	**Sediments**	**Nutrients**	**Heavy Metals**	**Organic Compounds**	**Trash & Debris**	**Oxygen Demanding Substances**	**Oil & Grease**	**Bacteria & Viruses**	**Pesticides**
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development >100,000 ft^2	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft^2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

3.2 – Sediment

Soils or other surface materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, smother bottom dwelling organisms, and suppress aquatic vegetative growth.

3.3 – Nutrients

Inorganic substances, such as nitrogen and phosphorous, that commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

3.4 – Trash & Debris

Examples include paper, plastic, leaves, grass cuttings, and food waste, which may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. In areas where stagnant water is present, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

3.5 – Oxygen-Demanding Substances

Biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.

3.6 – Oil & Grease

Characterized as high high-molecular weight organic compounds. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, oils, waxes, and high-molecular weight fatty acids. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

3.7 – Pesticides

Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

3.8 – Organic Compounds

Organic compounds are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease and grime retained in the cleaning fluid or rinse water may also adsorb level of organic compounds that are harmful or hazardous to aquatic life.

3.9 – Bacteria and Viruses

Bacteria and viruses are ubiquitous micro-organisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animals or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

3.10 – Metals

Metals are raw material components in non-metal products such as fuels, adhesives, paints and other coatings. Primary sources of metal pollution in storm water are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooler tower systems. At low concentrations naturally occurring in soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

CHAPTER 4 – CONDITIONS OF CONCERN

4.1 – Receiving Watershed Description

The Regional Water Quality Control Board has identified the Otay River as part of the Otay Hydrologic Unit and Otay Valley Hydrologic Area (basin number 910.20).

The beneficial use for this hydrologic subunit is found in Chapter 2 of the California Regional Water Quality Control Plan for the San Diego Basin, dated April 25, 2007 (Amended).

4.2 – Surface Water Quality Objectives and Beneficial Uses

Per the "Water Quality Plan for the San Diego Basin", the beneficial uses for the Otay River include agricultural supply, potential industrial process supply, potential contact water recreation, non-contact water recreation, warm freshwater habitat, wildlife habitat and rare, threatened or endangered species.

4.3 – 303(d) Status

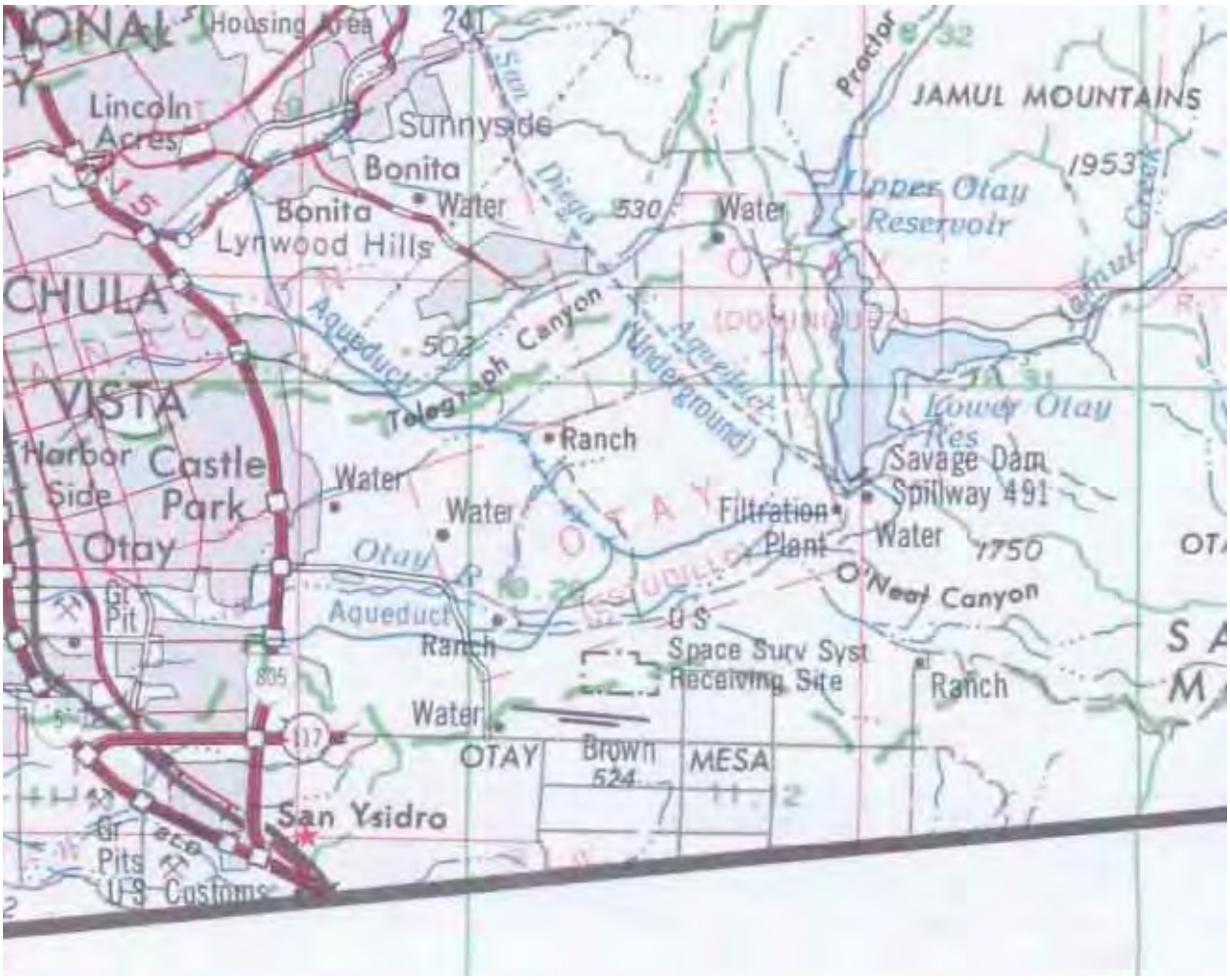
Section 303(d) of the Federal Clean Water Act (CWA) requires the State to identify surface waters that do not meet applicable water quality standards with certain technology-based controls. The State Water Resources Control Board has approved the 2008 *303(d) List of Water Quality Limited Segment*. The revised list approved January 26, 2010 indicates that Poggi Canyon Creek as having impairments.

The project location and watersheds have been compared to the current published 303(d) List of Water Quality Limited Segment. Poggi Canyon Creek lists DDT and Toxicity as Primary Pollutants of Concern.

4.4 – Identification of Primary & Secondary Pollutants of Concern

As stated previously in segment 4.3, the primary pollutants of concern generated by the proposed project site are Pesticides and Nutrients.

Secondary pollutants generated by the project site include Sediment, Trash and Debris, Oxygen Demanding Substances, Organic Compounds, Heavy Metals, Oil & Grease, Bacteria, and Viruses.


Housing Area
241
Lincoln Acres
Sunnyside
Bonita
Bonita
Water
Lynwood Hills
530
Water
Proctor
JAMUL MOUNTAINS
1953
Upper Otay Reservoir
Walnut Creek
CHULA
VISTA
Aqueduct
502
Telegraph Canyon
Aqueduct (Underground)
Lower Otay Res
Ranch
Harbor Side
Castle Park
Otay
Water
Water
Filtration Plant
Savage Dam
Spillway 491
Water
1750
O'Neal Canyon
Otay
Aqueduct
Gr Pit
Ranch
U S Space Surv Syst Receiving Site
Ranch
Water
OTAY
Brown
524
MESA
San Ysidro
Gr Pits
U S Customs

9	Poggi Canyon Creek	River & Stream	91020000 / 18070304	• DDT (Dichlorodiphenyltrichloroethane) ◦ Source Unknown	7.8 Miles	2006	5A	2019
				• Toxicity ◦ Unknown Nonpoint Source ◦ Unknown Point Source ◦ Urban Runoff/Storm Sewers	7.8 Miles	2008	5A	2021

Table 2-2. BENEFICIAL USES OF INLAND SURFACE WATERS

Inland Surface Waters [1, 2]	Hydrologic Unit Basin Number	BENEFICIAL USE														
		MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Otay River Watershed – continued																
Otay River	10.20	+	●	○					○	●		●		●	●	
O'Neal Canyon	10.20	+	●	○					○	●		●		●		
Salt Creek	10.20	+	●	○					○	●		●		●		
Johnson Canyon	10.20	+	●	○					○	●		●		●		
Wolf Canyon	10.20	+	●	○					○	●		●		●		
Dennery Canyon	10.20	+	●	○					○	●		●		●		
Poggi Canyon	10.20	+	●	○					○	●		●		●		
Tijuana River Watershed																
Tijuana River	11.11	+		○					○	●	●	●		●	●	
Moody Canyon	11.11	+		○					○	●		●		●		
Smugglers Gulch	11.11	+		○					○	●		●		●		
Goat Canyon	11.11	+		○					○	●		●		●		
Tijuana River Estuary	11.11	See Coastal Waters – Table 2-3														
Spring Canyon	11.12	+	●	○					○	●		●		●		
Dillon Canyon	11.12	+	●	○					○	●		●		●		
Finger Canyon	11.12	+	●	○					○	●		●		●		
Wruck Canyon	11.12	+	●	○					○	●		●		●		

4.5 – Conditions of Concern in Receiving Waters

4.5.1 – Summary of Hydrologic/Hydraulic Analysis

The "*TM Drainage Study for Otay Ranch Village 2 North*" by Hunsaker & Associates, dated November 2013 has been prepared to assess the pre-developed and developed condition peak runoff rates.

Development of the Otay Ranch Village 2 North results in the net decrease of runoff discharged to the adjacent Poggi Canyon by approximately 18 cfs.

4.6 – Hydromodification Analysis

4.6.1 – Introduction

According to the *City of Chula Vista Development Storm Water Manual*, Priority Development Projects must be designed so that runoff rates and durations are controlled to maintain or reduce downstream erosion conditions and protect stream habitat. However, exemptions to the HMP are included in the San Diego County SUSMP and the Final Hydromodification Plan which include discharges to hardened conveyance systems that extend to exempt systems, as well as discharges to highly urbanized watersheds (greater than 70 % imperviousness). Per the three studies titled *Technical Memorandum: Susceptibility Analysis of Poggi Creek* (January 2013), *Technical Memorandum: Urban Infill Hydromodification Exemption for Otay Ranch Village 2 North Project* (January 2013), and T*echnical Memorandum: Urban Infill Hydromodification Exemption, The expansion of Neighborhood R-8A, Otay Ranch Village 2 North Project* (January 2013), prepared by Tory Walker Engineering, Inc., 'the Otay Ranch Village 2 West project satisfies the conditions for an infill exemption' and 'is exempt from hydromodification compliance'.

Chapter 5 – TREATMENT CONTROL BMP DESIGN

5.1 – BMP Location

Water quality treatment of Neighborhood R-8C will be achieved through the proposed bioretention area located adjacent to Poggi Canyon within the northern portion of the project area. The park site will not contain any impervious surfaces and can be considered to be self-mitigating. Per this TM, the future builder of the CPF site will be responsible for treatment of storm water flows in accordance with the governing water quality requirements at the time of construction prior to the receiving storm drain system.

Additional peak flow attenuation is provided downstream by the existing Poggi Canyon Regional Detention Basin.

According to page 3-37 of the City of Chula Vista Development Stormwater Manual, "All treatment control BMPs for priority development projects shall, at a minimum have high or medium pollutant removal efficiency for the project's most significant category of pollutants of concern….". The BMPs described above are categorized as having "High" pollutant removal efficiency for the primary pollutant of concern for this project, which is pesticides.

The above IMP's will be implemented per the specifications provided by the City of Chula Vista SUSMP. See a reduced scale BMP location exhibit at the end of this chapter and a full scaled exhibit in Chapter 11.

5.2 – Determination of Treatment Flow

Multiple LID-based BMP's are proposed to treat the 85th percentile runoff from the site prior to discharge to the proposed downstream storm drain. To determine the Design Treatment Flow, the 85th percentile design runoff has been calculated using the Rational Method and Equation 4.8 of the "*County of San Diego SUSMP"*. For sizing minimum bioretention IMP areas, Equation 4-7 was used. See end of Chapter 5 for 85th Percentile Rainfall Isopluvial Map.

Per Table 4-2 of the "*County of San Diego SUSMP"*, a runoff factor of 1.0 was used for paved areas and 0.1 for all pervious areas. For Neighborhood R-8C, Darcy's equation was used to help size the bioretention basin based on the infiltration rate of the engineered fill and the amount of ponding depth available in the basin. The bioretention basin was sized to accommodate the 85th percentile water quality volume flowing through the basin's engineered fill. See calculations on the BMP Location Exhibit 1.3 in Chapter 12.

5.3 – Bioretention IMPs

The bioretention IMPs function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. Bioretention removes stormwater pollutants through physical and biological processes, including adsorption,

filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fallout of suspension.

Refer to Chapter 4 of the County SUSMP for further discussion of bioretention facilities.

5.4 – BMP Unit Sizing

Bioretention water quality basin was sizing was determined by routing the 85th percentile flow from the drainage area through the infiltration media of the basin. Using Darcy's equation, a minimum BMP surface area can be determined.

5.5 – Pollutant Removal Efficiency Table

The table below shows the generalized pollutant removal efficiencies for the facilities. The proposed **Bioretention Based IMPs** target trash and debris, sediments, organic compounds oxygen demanding substances, pesticides, oil/hydrocarbons, nutrients and bacterial pollutants.

Table 4. Structural Treatment Control BMP Selection Matrix

Pollutants of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	High-rate biofilters	High-rate media filters*	Trash Racks & Hydro -dynamic Devices*
Coarse Sediment and Trash	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Pollutants that tend to associate with fine particles during treatment	HIGH	HIGH	HIGH	HIGH	HIGH	MEDIUM	MEDIUM	LOW
Pollutants that tend to be dissolved following treatment	MEDIUM	LOW	MEDIUM	HIGH	LOW	LOW	LOW	LOW

*-The Vortech and Stormfilter units are per the approved *2006 Otay Ranch Village 2 – North "Rough Graded" Water Quality Technical Report*.

Pollutant	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	X	X	
Nutrients		X	X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
Oxygen Demanding		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

5.6 – BMP Unit Selection Discussion

5.6.1 Extended Detention Basins

Extended detention basins collect the first flush runoff volume and retain it in the basin for a period of 24-48 hours.

85th percentile runoff volume, contained below the overflow elevation of the basin riser, will be slowly discharged from the treatment control basin via low flow orifices in the basin riser. After

passing through the riser, an outlet pipe will dewater the basin and discharge runoff to the natural drainage course downstream.

Advantages

- Due to the simplicity of design, extended detention basins are relatively easy and inexpensive to construct and operate.
- Extended detentions basins can provide substantial capture of sediment and the toxics fraction associated with particulates.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in the watershed.

Limitations

- Limitation of the diameter of the orifice may not allow use of extended detention in watersheds of less than 5 acres (would require an orifice with a diameter of less than 0.5 inches that would be prone to clogging).
- Dry extended detention ponds have only moderate pollutant removal when compared to some other structural stormwater practices, and they are relatively ineffective at removing soluble pollutants.
- Dry ponds can detract from the value of a home due to the adverse aesthetics of dry, bare areas and inlet and outlet structures.

Conclusion:

Due to large acreage requirements for an extended detention basin, this option was not a feasible alternative.

5.6.2 Vegetated (Linear) Swales

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and stormwater systems, however, if curb is required intermittent curb cuts can be provided to allow the flows to get to the vegetated swale.

Advantages

- If designed as a bioretention facility per the criteria noted in the County SUSMP, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant water quality benefits.
- Low maintenance.
- Easily access for maintenance.

- They can convey high flows while percolating and treating lower flows.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur.
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.

Conclusion:

Per the County of San Diego SUSMP, one of the best uses for vegetated (linear) swales is along roadways. However, the areas requiring treatment are the more local residential areas which could be better treated by the selected alternative.

5.6.3 Infiltration Basins

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principle benefit of infiltration basins is the approximation of pre-development hydrology during which a significant portion of the average rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.
- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.

- Infiltration rates exceeding 2.4 inches/hour, the runoff should be treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Conclusion:

Due to the type D clay soils typically located in the region, onsite infiltration basins are not a feasible option for the Otay Ranch Village 2 North project site.

5.6.4 Wet Ponds

Wet ponds are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetland habitat.
- Ponds are often viewed as a public amenity when integrated with a park setting.
- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvements across a relatively broad spectrum of constituents including dissolved nutrients.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.
- Mosquito and midge breeding is likely to occur in ponds.
- Cannot be placed on steep unstable slopes.
- Need for base flow or supplemental water if water level is to be maintained.
- Require a relatively large footprint.
- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams.

Conclusion:

Due to the large acreage requirements of a wet pond, proximity to residences (vector issues) and the fact that other BMP's are able to treat pollutants of concern with equal efficiency, wet ponds are not a feasible option for the project site.

5.6.5 Media Filters

Stormwater media filters are usually two-chambered including a pre-treatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber.

Advantages

- Relatively high pollutant removal, especially for sediment and associated pollutants.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- More expensive to construct than many other BMP's.
- May require more maintenance than some other BMP's depending upon the sizing of the filter bed.
- Generally require more hydraulic head to operate properly (min 4 feet).
- High solids loads will cause the filter to clog.
- Work best for relatively small, impervious watersheds.
- Filters in residential areas can present aesthetic and safety problems if constructed with vertical concrete walls.
- Certain designs maintain permanent sources of standing water where mosquito's and midge breeding is likely to occur.

Conclusion:

The selected alternative was deemed a better choice for handling water quality from the site.

5.6.6 Drainage Inserts

Drainage inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling to one of three different groups: socks, boxes and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes form of the box. Most box products are one box; that is, the setting area and filtration through media

occur in the same box. Some products consist of one or more trays and mesh grates. The trays may hold different types of media.
Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose and activated carbon.

Advantages

- Does not require additional space as inserts as the drain inserts are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

- Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults.
- Usually not suited for large areas or areas with trash or leaves that can plug the insert.

Conclusion:

The selected alternative was deemed a better choice for handling water quality from the site.

5.6.7 Hydrodynamic Separator Systems

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants that are widely used in storm water treatment. No outside power source is required, because the energy of the flowing water allows the sediments to efficiently separate. Depending on the type of unit, this separation may be by means of swirl action or indirect filtration. Variations of this unit have been designed to meet specific needs. Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables -which can be captured, rather than solids with poor settleability or dissolved pollutants. In addition to the standard units, some vendors offer supplemental features to reduce the velocity of the flow entering the system. This increases the efficiency of the unit by allowing more sediment to settle out.

Advantages

- May provide the desired performance in less space and therefore less cost.
- May be more cost-effective pre-treatment devices than traditional wet or dry basins.
- Mosquito control may be less of an issue than with traditional wet basins.

Limitations

- As some of the systems have standing water that remains between storms, there is concern about mosquito breeding.

- It is likely that vortex separators are not as effective as wet vaults at removing fine sediments, on the order 50 to 100 microns in diameter and less.
- The area served is limited by the capacity of the largest models.
- As the products come in standard sizes, the facilities will be oversized in many cases relative to the design treatment storm, increasing cost.
- The non-steady flows of stormwater decreases the efficiency of vortex separators from what may be estimated or determined from testing under constant flow.
- Do not remove dissolved pollutants.
- A loss of dissolved pollutants may occur as accumulated organic matter (e.g., leaves) decomposes in the units.

Conclusion

The existing storm drain system downstream of the TM project area includes a vortechnic unit and stormfilter treatment train for water quality treatment purposes.

5.6.8 Bioretention Basins

The proposed bioretention basin collects the first flush runoff volume and retains it in the basin for a period of 24-48 hours.

85th percentile runoff volume, contained below the overflow elevation of the basin riser, will be slowly discharged from the treatment control basin via engineered soil layer assuming a percolation rate of 5” per hour. After passing through the engineered soil mix layer, perforated piping within the gravel layer will dewater the basin and discharge runoff downstream.

Advantages

- Due to the simplicity of design, bioretention basins are relatively easy and inexpensive to construct and operate.
- Bioretention basins can provide substantial capture of sediment and the toxics fraction associated with particulates.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in the watershed.

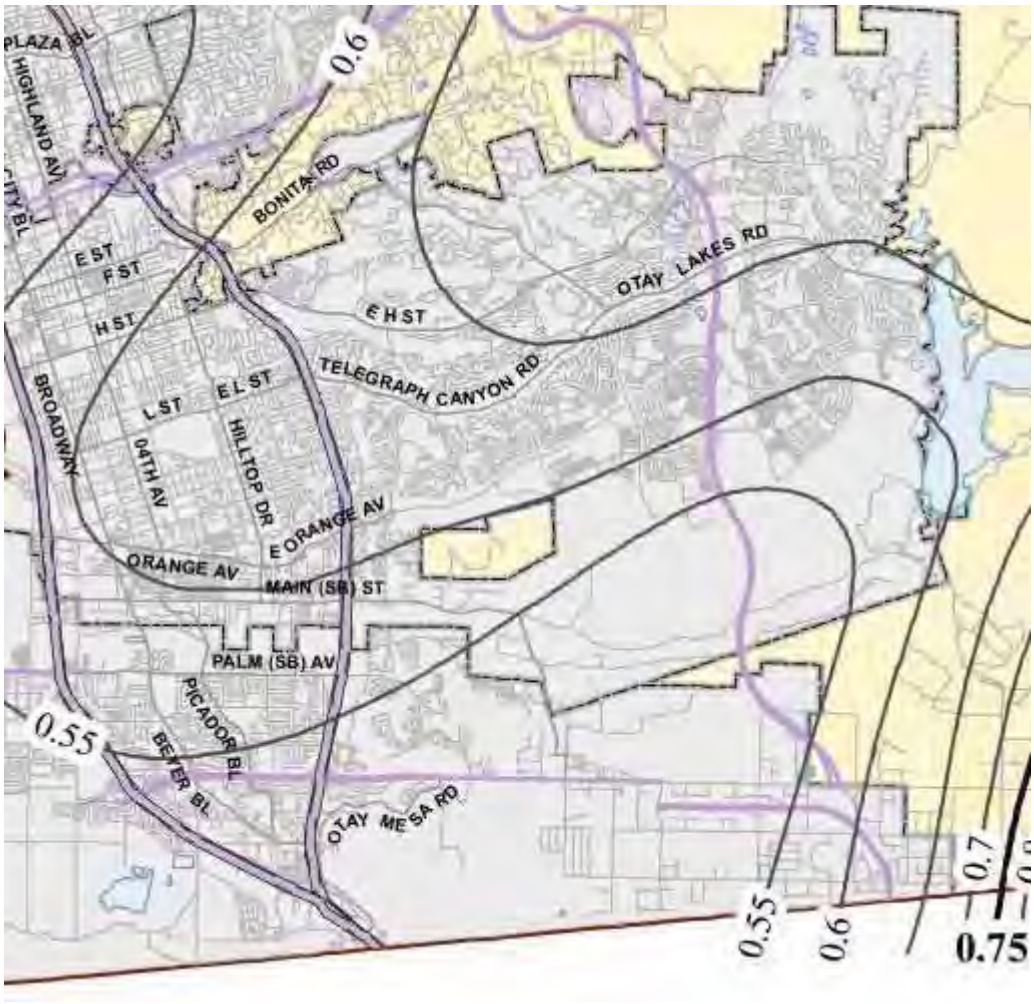
Limitations

- Somewhat complex to design, build and operate.
- Required head for both cistern and bioretention facility.
- Bioretention basins can detract from the value of a home due to the adverse aesthetics of dry, bare areas and inlet and outlet structures.

Conclusion:

The residential areas within Neighborhood R-8C in Village 2 North will direct their 85th percentile flow towards the proposed bioretention basin.

SAN DIEGO COUNTY 85TH PERCENTILE ISOPLUVIALS



PROJECT NAME: Otay Ranch Village 2 NORTH TM
PROJECT LOCATION: Chula Vista
85TH PERCENTILE PRECIPITATION DEPTH (IN): 0.6

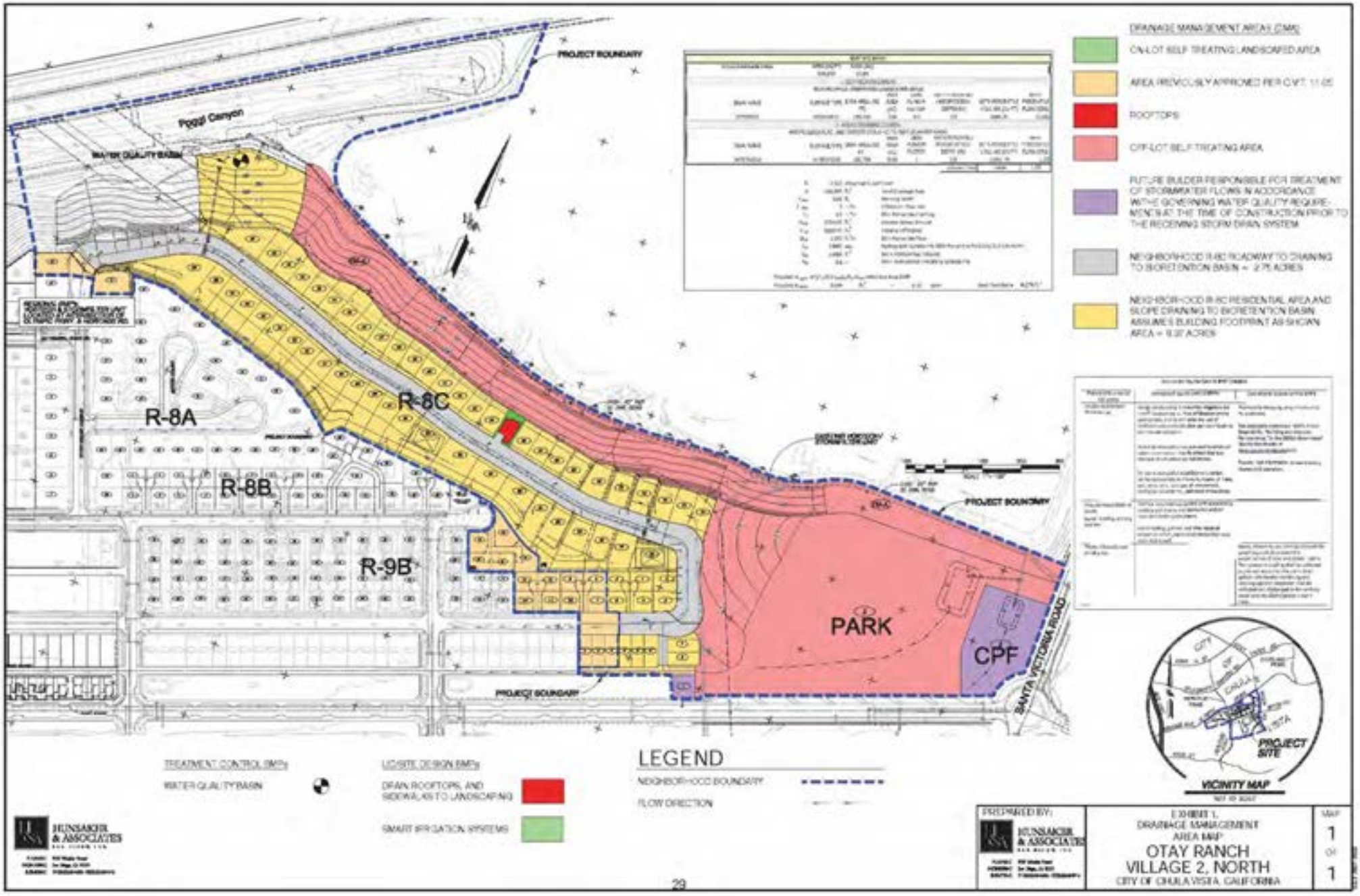
BMP WQ BASIN							
TOTAL DRAINAGE AREA:	**AREA (SQ FT)**	**AREA (AC)**					
	549,996	**12.63**					
I. SELF-TREATING AREAS							
SELF-TREATING VEGETATED/LANDSCAPED AREAS							
DMA NAME	**SURFACE TYPE**	**DMA AREA (SQ FT)**	**DMA AREA (AC)**	**DMA RUNOFF FACTOR**	**85TH PERCENTILE PRECIPITATION DEPTH (IN)**	**85TH PERCENTILE VOLUME (CU FT)**	**85TH PERCENTILE FLOW (CFS)**
PERVIOUS	VEGETATED	289,242	6.64	0.1	0.6	1446.21	0.133
II. AREAS DRAINING TO IMPs							
ROOFS, SIDEWALKS, AND STREETS DRAINING TO IMPS (PLANTER AREA)							
DMA NAME	**SURFACE TYPE**	**DMA AREA (SQ FT)**	**DMA AREA (AC)**	**DMA RUNOFF FACTOR**	**85TH PERCENTILE PRECIPITATION DEPTH (IN)**	**85TH PERCENTILE VOLUME (CU FT)**	**85TH PERCENTILE FLOW (CFS)**
IMPERVIOUS	IMPERVIOUS	260,754	5.99	1	0.6	13037.70	1.20
					Column Total	14484	1.33

C	0.527	Weighted Runoff Coef	
A	549,996	$ft.^2$	Total Drainage Area
h_{BMP}	0.95	ft.	Ponding Depth
f_{BMP}	5	in/hr	infiltration flow rate
I_D	0.2	in/hr	85th Percentile Intensity
V_{TOP}	6254.42	$ft.^3$	Volume Above Ground
V_{INF}	8229.49	$ft.^3$	Volume Infiltrated
Q_{85}	1.330	$ft.^3/s$	85th Percentile Flow
T_{85}	10800	sec.	Hydrograph Duration for 85th Percentile Flo 0.6in/(0.2in/hr)=3 hr
V_{85}	14484	$ft.^3$	85TH PERCENTILE VOLUME
P_{85}	0.6	in	85TH PERCENTILE PRECIPITATION DEPTH

Required $A_{BMP=}$ $A*(CI_D/(12h_{BMP}I_D/P_{85}+f_{BMP}))$=Surface Area BMP

Required $A_{BMP=}$ 6,584 $ft.^2$ = 0.15 acres Area Provided = 6,676 $ft.^2$

R:\1089\Hyd\CALCS\EXCEL\North\WQ_BASIN CALCS.xlsx
2/22/2013


PROJECT BOUNDARY
Poggi Canyon
WATER QUALITY BASIN
R-8A
R-8B
R-8C
R-9B
PARK
CPF
PROJECT BOUNDARY
PROJECT BOUNDARY
SANTA VICTORIA ROAD
DRAINAGE MANAGEMENT AREA (DMA)
ON-LOT SELF TREATING LANDSCAPED AREA
AREA PREVIOUSLY APPROVED PER CVT 11-05
ROOFTOPS
OFF-LOT SELF TREATING AREA
FUTURE BUILDER RESPONSIBLE FOR TREATMENT OF STORMWATER FLOWS IN ACCORDANCE WITH THE GOVERNING WATER QUALITY REQUIREMENTS AT THE TIME OF CONSTRUCTION PRIOR TO THE RECEIVING STORM DRAIN SYSTEM
NEIGHBORHOOD R-8C ROADWAY TO DRAINING TO BIORETENTION BASIN = 2.75 ACRES
NEIGHBORHOOD R-8C RESIDENTIAL AREA AND SLOPE DRAINING TO BIORETENTION BASIN ASSUMES BUILDING FOOTPRINT AS SHOWN AREA = 9.37 ACRES
TREATMENT CONTROL BMPs
WATER QUALITY BASIN
LOWSITE DESIGN BMPs
DRAIN ROOFTOPS, AND SIDEWALKS TO LANDSCAPING
SMART IRRIGATION SYSTEMS
LEGEND
NEIGHBORHOOD BOUNDARY
FLOW DIRECTION
PROJECT SITE
VICINITY MAP
HUNSAKER & ASSOCIATES
PREPARED BY:
HUNSAKER & ASSOCIATES
EXHIBIT 1.
DRAINAGE MANAGEMENT AREA MAP
OTAY RANCH
VILLAGE 2, NORTH
CITY OF CHULA VISTA, CALIFORNIA
MAP 1 OF 1

CHAPTER 6 – SOURCE CONTROL BMPS

The following Source Control BMPs are specific to the development proposed for the Otay Ranch Village 2 North project site which will include the construction of service roads, residential lots, a park, two CPF sites, sidewalks, and utilities.

Future development of the CPF pad will be the responsibility of the future developer, ensuring that all future developed runoff from this aforementioned pad is treated in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system.

6.1 – Design Outdoor Material Storage Areas to Reduce Pollution

Storage areas shall include structural features that prevent pollutants from entering storm drains. Where appropriate, comply with the requirements of local Hazardous Materials Programs.

Grade and berm outdoor storage areas to prevent run-on or run-off from area.

Storage of hazardous materials and wastes shall be in compliance with federal, state, and local laws, ordinances, and regulations.

6.2 – Design Trash Storage Areas to Reduce Pollution Introduction

All outdoor trash storage areas shall meet the following requirements per Design Concept SC-3 in the Chula Vista Development Storm Water Manual dated March 2010 (limited exclusion: detached residential homes):

- Paved with an impervious surface, designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash; and
- Covered with a roof, awning or trash lid to minimize direct precipitation.
- Designed in accordance with Chula Vista Municipal Code Section 19.58.340

6.3 – Integrated Pest Management (IPM) Principles

Integrated pest management (IPM) is an ecosystem-based pollution prevention strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitation manipulation, modification of cultural practices, and use of resistant plant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the

environment. More information may be obtained at the UC Davis website (http://www.ipn.ucdavis.edu/WATER/U/index.html).

6.3.1 - Eliminate and/or reduce the need for pesticide use in the project design by:

- Plant pest-resistant or well-adapted plant varieties such as native plants
- Discourage pests by modifying the site and landscaping design.

In order to achieve this source control BMP objective, native vegetation will be used throughout the project site in accordance with the landscape architects plans.

6.3.2 - Distribute IPM educational materials to future site residents/tenants.

Minimally, educational materials must address the following topics:

- Keeping pests out of buildings and landscaping using barriers, screens, and caulking;
- Physical pest elimination techniques, such as, weeding, squashing, trapping, washing, or pruning out pests;
- Relying on natural enemies to eat pests;
- Proper use of pesticides as a last line of defense.

The homeowners will be made aware of the aforementioned RWQCB regulations through a homeowners' education program.

6.4 – Efficient Irrigation Systems & Landscaping Design

In compliance with the Water Conservation in Landscaping Act, the following methods to reduce excessive irrigation runoff shall be implemented:

- Employ rain shutoff devices to prevent irrigation during and after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Use flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

All maintained landscaped areas will include rain shutoff devices to prevent irrigation during and after precipitation. Flow reducers and shutoff valves triggered by pressure drop will be used to control water loss from broken sprinkler heads or lines.

6.5 – Storm Water Conveyance Systems Stenciling and Signage

The proposed development will incorporate concrete stamping, or equivalent, of all storm water conveyance system inlets and catch basins within the project area with prohibitive language (e.g., "No Dumping – I Live in <<name receiving water>>"), satisfactory to the City Engineer. Stamping may also be required in Spanish.

6.6 – Maintenance of Sidewalks and Parking Lots

Sidewalks and parking lots shall be swept regularly to prevent the accumulation of litter and debris.

CHAPTER 7 – SITE DESIGN & LID BMPS

The following Site Design and LID BMPs are specific to the current development proposed for the Otay Ranch Village 2 North project site which will include the construction of service roads, residential lots, a park, two CPF sites, sidewalks, and utilities.

Future development of the CPF pad will be the responsibility of the future developer, ensuring that all future developed runoff from these aforementioned pads is treated in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system

7.1 – Site Design & LID BMPs

Priority projects, such as the Otay Ranch Village 2 North development, shall be designed to minimize, to the maximum extent practicable, the introduction of pollutants generated from site runoff and address conditions of concern that may impact the receiving watershed and/or downstream water conveyance systems. Site design & LID components can significantly reduce the impact of a project on the environment.

Low Impact Development is an innovative stormwater management approach with the basic principle that is modeled after nature: manage rainfall runoff at the source using uniformly distributed decentralized micro-scale controls.

LID's goal is to mimic a site's predevelopment hydrology by using design practices and techniques that effectively capture, filter, store, evaporate, detain and infiltrate runoff close to its source.

7.2 – Conserve Natural Areas

The Otay Ranch Village 2 North urban development will incorporate open space areas and vegetation throughout the development. Also, the multi-family portion of the project will implement natural landscaped areas to the maximum amount practical. The park site located at the eastern portion of the TM project area accounts for approximately 7.7 acres of the TM project area.

7.3 – Minimize Impervious Footprint

Methods of accomplishing this goal include:

- Increase building density (number of stories above or below ground), where applicable;
- Construct walkways, trails, patios, overflow parking lots and alleys and other low-traffic areas with permeable surfaces, such as pervious concrete, unit pavers, and granular materials, where applicable;
- Construct streets, sidewalks and parking lot aisles to the minimum widths necessary, provided that public safety and a walkable environment for pedestrians are not compromised;
- Minimize the use of impervious surfaces in the landscape design.

7.4 – Minimize Directly Connected Impervious Areas

Methods of accomplishing this goal include:

- Where landscaping is proposed, drain rooftops into adjacent landscaping where it is safe and appropriate and will not cause damage or adverse impacts to any existing and proposed structures, slopes, pavements, or other features prior to discharging to the storm water conveyance system;
- Where landscaping is proposed, drain impervious parking lots, sidewalks, walkways, trails, and patios into adjacent landscaping where it is safe and appropriate and will not cause damage or adverse impacts to any structures, slopes, pavements, or other features.

7.5 – Minimize Soil Compaction in Landscape Areas

Prior to final landscape installation in areas disturbed due to construction and where landscaping will be placed, the subsoils below the topsoil layer shall be scarified at least 6 inches. If upper layers of topsoil exists or is imported, incorporate the upper or topsoil material to avoid stratified layers.

7.6 – Soil Amendments

Landscape top soil improvements play a significant role in maintaining plant and lawn health plus improve the soil's capacity to retain moisture, which will reduce runoff from the water quality design storm and improve water quality. San Diego Landscape regulations will be adhered to for landscaped areas.

7.7 – Protect Slopes, Channels & Energy Dissipation/Erosion Control

Methods of accomplishing this goal include:

- Use of natural drainage systems to the maximum extent practicable.
- Stabilize permanent channel crossings.
- Planting native or drought tolerant vegetation on slopes.
- Energy dissipators, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels.

CHAPTER 8 – BMPS APPLICABLE TO INDIVIDUAL PRIORITY DEVELOPMENT PROJECT CATEGORIES

8.1 –Roads

The design of private roadway drainage shall use at least one of the following:

- Rural swale system- street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings;
- Urban curb/swale system- provide periodic curb cuts to allow street runoff to drain to vegetated swale/bioretention area;
- Dual drainage system- first flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder. Connect high flows directly to storm drainage system.
- Other methods, which are comparable and equally effective within the project, as determined by the City Engineer.

The pervious pavers within the courtyards and driveways will be underlain with a bioretention area to collect the water quality runoff. See BMP Location Map in Chapter 11.

8.2 – Residential Driveways & Guest Parking

Driveways shall have one of the following:

- Shared access;
- Flared entrance (single lane at street);
- Wheelstrips (paving only under tires);
- Porous paving;
- Designed to drain into landscaping prior to discharging to the storm water conveyance system.

Uncovered temporary or guest parking on private residential lots may be:

- Paved with a permeable surface;
- Designed to drain into landscaping prior to discharging to the storm water conveyance system.

This will be incorporated within the site design for multi-family residential lots. See BMP Location Map in Chapter 11 for example multi-family residential areas.

8.3 – Dock Areas

Loading/unloading dock areas shall include the following:

- Cover loading dock areas, or design drainage to preclude urban run-on and runoff;
- An acceptable method of containment and pollutant removal, such as a shut-off valve and containment area.

Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.

This does not apply to the Village 2 North TM.

8.4 – Maintenance Bays

Maintenance bays shall include at least one of the following:

- Repair/ maintenance bays shall be indoors; or
- Designed to preclude urban run-on and runoff

Maintenance bays shall include a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm water conveyance system is prohibited.
This does not apply to the Village 2 North TM

8.5 – Vehicle & Equipment Wash Areas

Areas for washing/steam cleaning of vehicles and areas for outdoor equipment/accessory washing and steam cleaning shall be:

- Self-contained to preclude run-on and run-off, covered with a roof or overhang, and equipped with a clarifier or other pretreatment facility;
- Properly connected to a sanitary sewer.

This does not apply to the Village 2 North TM

8.6 – Outdoor Processing Areas

Outdoor processing areas shall:

- Cover or enclose areas that would be the most significant source of pollutants; or slope the area toward a dead-end sump; or, discharge to the sanitary sewer system.
- Grade or berm processing area to prevent run-on from surrounding areas.
- Installation of storm drains in areas of equipment repair is prohibited.

This does not apply to the Village 2 North TM

8.7 – Surface Parking Areas

Where landscaping is proposed in surface parking areas (both covered and uncovered), incorporate landscape areas into the drainage design. Overflow parking (parking in excess of the project's minimum parking requirements) may be constructed with permeable paving.

On-street parking is proposed to drain to tree wells directly adjacent or a combination of tree wells and permeable pavers will be incorporated throughout the project on non-residential single family streets.

8.8 – Non-Retail Fueling Areas

Non-Retail fueling areas shall be designed with the following:

- Fuel dispensing area that is: (1) paved with Portland cement concrete or equivalent smooth impervious surface (asphalt concrete is prohibited); (2) designed to extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less; (3) sloped to prevent ponding; (4) separated from the rest of the site by a grade break that prevents run-on of urban runoff;

and (5) designed to drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.

- Overhanging roof structure or canopy that is: (1) equal to or greater than the area within the fuel dispensing area's grade break; and (2) designed not to drain onto or across the fuel dispensing area.

This does not apply to the Village 2 North TM

8.9 – Steep Hillside Landscaping

Steep hillside areas disturbed by project development shall be landscaped with deep rooted, drought tolerant and/or native plant species selected for erosion control, satisfactory to the City of Chula Vista.

Table 8.1

Priority Project Category	Site Design BMPs[1]	Source Control BMPs[2]	Requirements Applicable to Individual Priority Project Categories[(3)]										
			a. Private Roads	b. Residential Driveways & Guest Parking	c. Dock Areas	d. Maintenance Bays	e. Vehicle Wash Areas	f. Outdoor Processing Areas	g. Equipment Wash Areas	h. Parking Areas	i. Roadways	j. Fueling Areas	k. Hillside Landscaping
Detached Residential Development	R	R	R	R									R
Attached Residential Development	R	R	R										
Commercial Development	R	R			R	R	R	R					
Automotive Repair Shop	R	R			R	R	R		R			R	
Restaurants	R	R			R				R				
Hillside Development	R	R	R										R
Parking Lots	R	R								R[(4)]			
Streets, Highways, & Freeways	R	R									R		

R = Required; select BMPs as required from the applicable steps in Section 3.6.2.a & b, or equivalent as identified in Section 3.6.2 of the Development Storm Water Manual.

(1) Refer to Section 3.6.2.a of the Development Storm Water Manual.
(2) Refer to Section 3.6.2.b of the Development Storm Water Manual.
(3) Priority project categories must apply specific storm water BMP requirements, where applicable. Projects are subject to the requirements of all priority project categories that apply.
(4) Applies if the paved area totals>5,000 square feet or with>15 parking spaces and is potentially exposed to urban runoff.

Per Table 8.1, the future development shall incorporate Site Design and Source Control BMPs as well as the requirements applicable individual priority projects as highlighted above.

CHAPTER 9 – OPERATIONS & MAINTENANCE PLAN

9.1 – Maintenance Requirements

Maintenance of the bioretention area within the project boundary areas will be the responsibility of Baldwin & Sons, Inc. and to be funded by Baldwin & Sons, Inc. until a formal agreement with a HOA is developed. A cost sharing center will be established to address maintenance required for the BMP's within these residential areas. A maintenance plan will be developed and will include the following information:

Specification of routine and non-routine maintenance activities to be performed.

A schedule for maintenance activities.

Name, qualifications, and contact information for the parties responsible for maintaining the BMPs.

The Vortech and Stormfilter units will be maintained by through the CFD-14.

The CPF site will be privately owned and will be maintained by the future owner.

Refer to BMP Location Exhibit (1.3) for designation of areas.

9.2 – Operations and Maintenance Plan

9.2.1 – Bioretention IMPs

Target Maintenance Dates – March 15th, September 15th
Maintenance Activity – Inspection and removal of foreign debris, silt, mulch and trash. Evaluate filter media and recharge as necessary. Evaluate health of plant and prune or replace as necessary. Replace mulch.

For proper maintenance to be performed, all storm water treatment facilities must be accessible to both maintenance personnel and their equipment and materials.

9.3 – Annual Operations & Maintenance Costs

The following costs are intended only to provide a magnitude of the costs involved in maintaining BMPs within the public right-of-way. Funding shall be provided by the Community Facilities District for the Otay Ranch Village 2 North project site and the HOA.

Approximate annual maintenance costs for the proposed Bioretention BMPs are outlined below.

9.3.1 – Bioretention Basin

Inspection and Maintenance

Assume 100% Silt in Bioretention Storage Area = 0.15 acre-feet
= 247 CY

Annual Silt Removal Costs = 247 CY @ $10/CY = $2,473

Annual Vegetation Removal = ½ Clearing of Footprint of First Flush Storage Area
= ½ (0.15 acres)

Annual Vegetation Removal Costs = 0.08 acres @ $3,000/ac = $230

Annual Inspection by Engineer = $500

Periodic and Post-Major Rainfall Inspections and Trash/Debris/Sediment Cleanout…assume (2) periodic/post-major rainfall inspections per year…assume (3) man crew…assume ½ -day cleanout time…assume $50 hourly rate…Periodic Inspection and Maintenance Annual Cost = $1,200

Total Maintenance Costs = $4,403

Bioretention Basin Total (inclusive of 10% Contingency) = $4,843

Chapter 10 – FISCAL RESOURCES

10.1 – Agreements (Mechanisms to Assure Maintenance)

There are multiple BMPs within the Otay Ranch Village 2 North site for storm water quality treatment.

Maintenance of the bioretention area within the project area will be the responsibility of Baldwin & Sons, Inc. and to be funded by Baldwin & Sons, Inc. until a formal agreement with a HOA is developed. A maintenance plan will be developed and will include the following information:

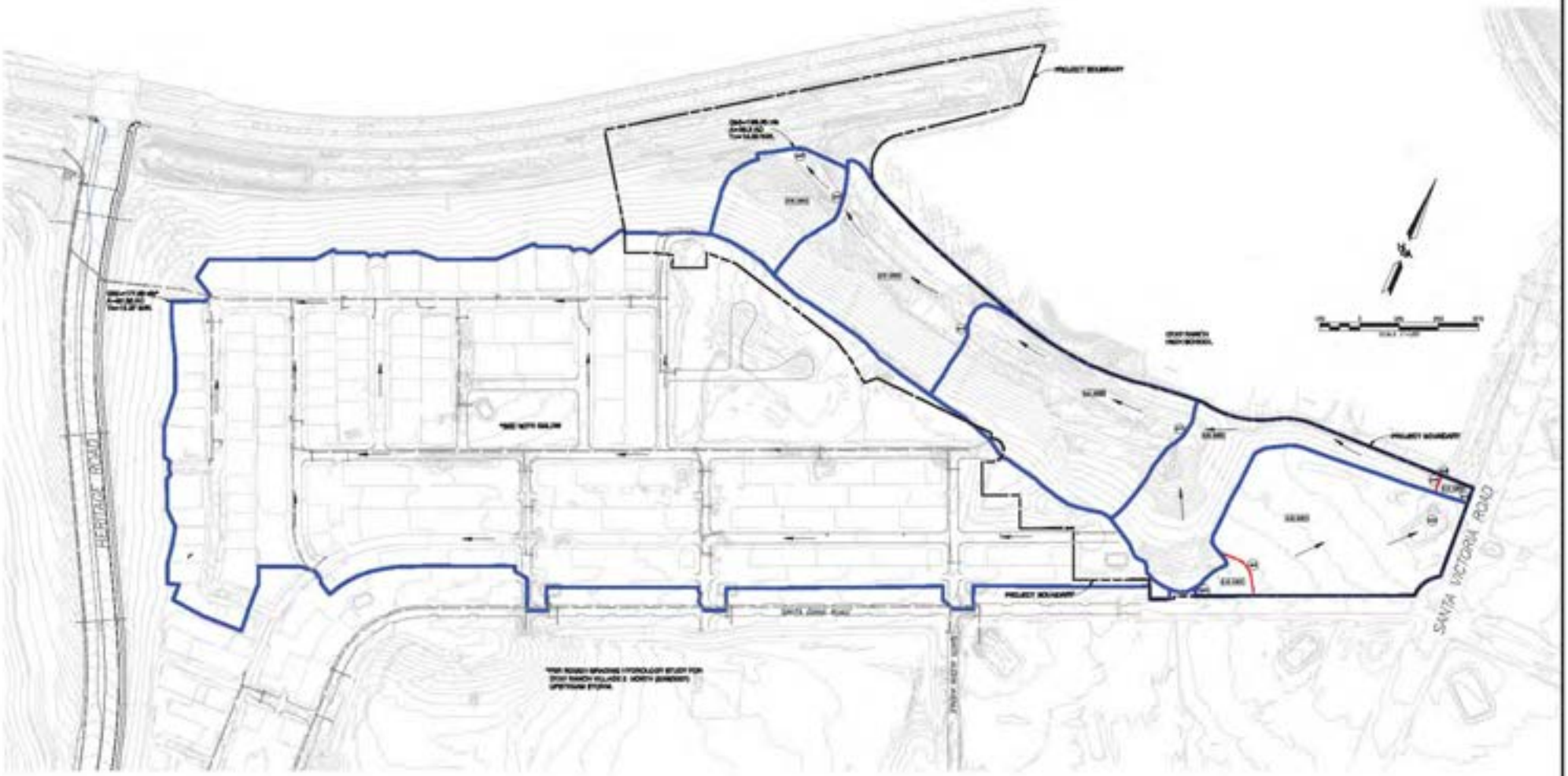
- Specification of routine and non-routine maintenance activities to be performed.
- A schedule for maintenance activities.
- Name, qualifications, and contact information for the parties responsible for maintaining the BMPs.

The Vortech and Stormfilter units will be maintained by through the CFD-14.

The CPF site will be privately owned and will be maintained by the future owner.

The City of Chula Vista Watershed Protection, Stormwater Management, and Discharge Control Ordinance require ongoing maintenance of BMPs to ensure the proper function and operation of theses BMPs. Costs for this maintenance will be the covered by the CFD/HOA following completion and by the contractor during construction of the development.

CHAPTER 11 – EXHIBITS/MAPS



VICINITY MAP

LEGEND:

- HYDROLOGY NODE
- WATERSHED AREA
- SUBAREA BOUNDARY
- WATERSHED BOUNDARY

PREPARED BY:

HUNSAKER & ASSOCIATES

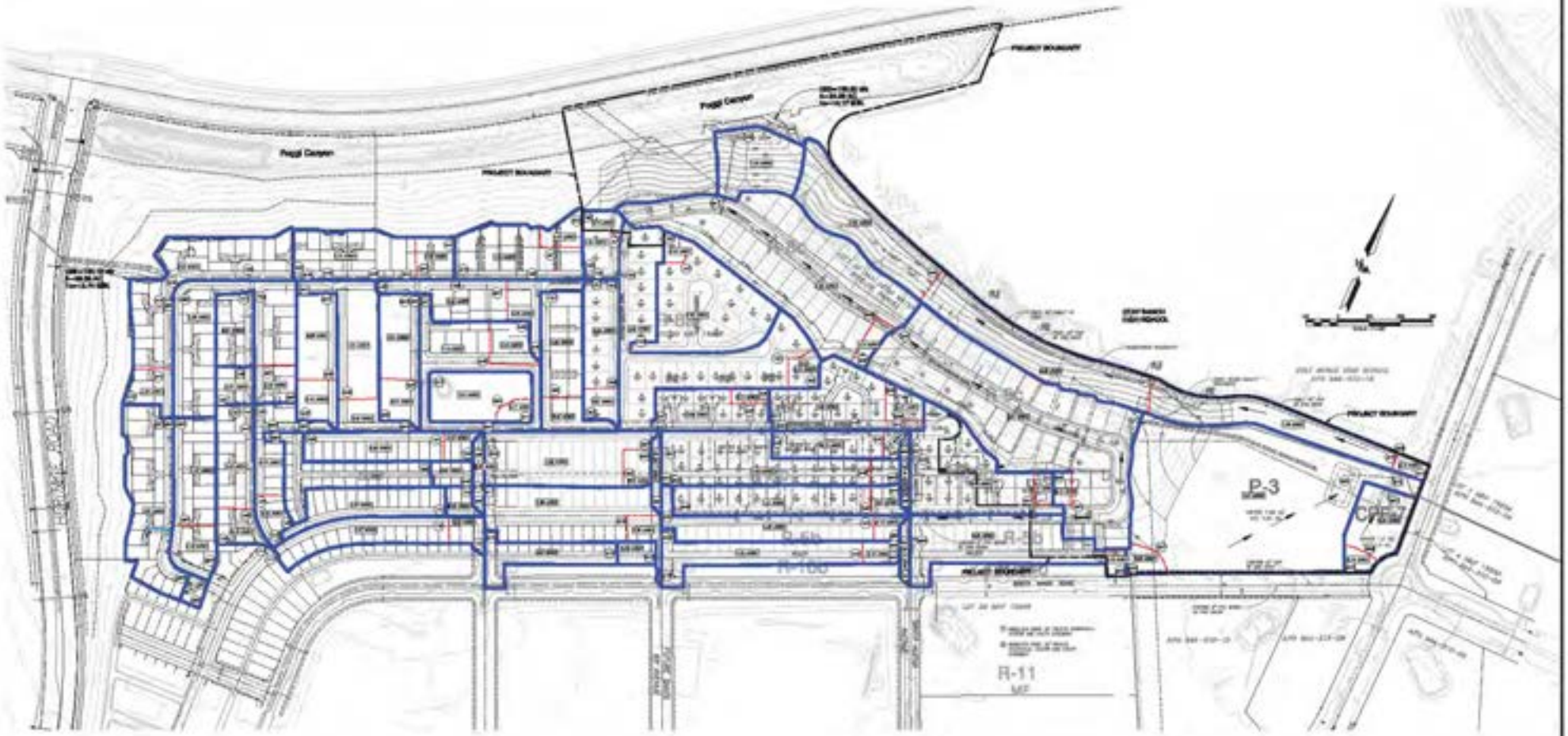
EXHIBIT 1.1

EXISTING CONDITION HYDROLOGY MAP

OTAY RANCH VILLAGE 2 NORTH

CITY OF CHULA VISTA, CALIFORNIA

MAP 1 OF 2



VICINITY MAP

LEGEND:

- HYDROLOGY NODE
- WATERSHED AREA
- SUBAREA BOUNDARY
- WATERSHED BOUNDARY

PREPARED BY:

HUNSAKER & ASSOCIATES

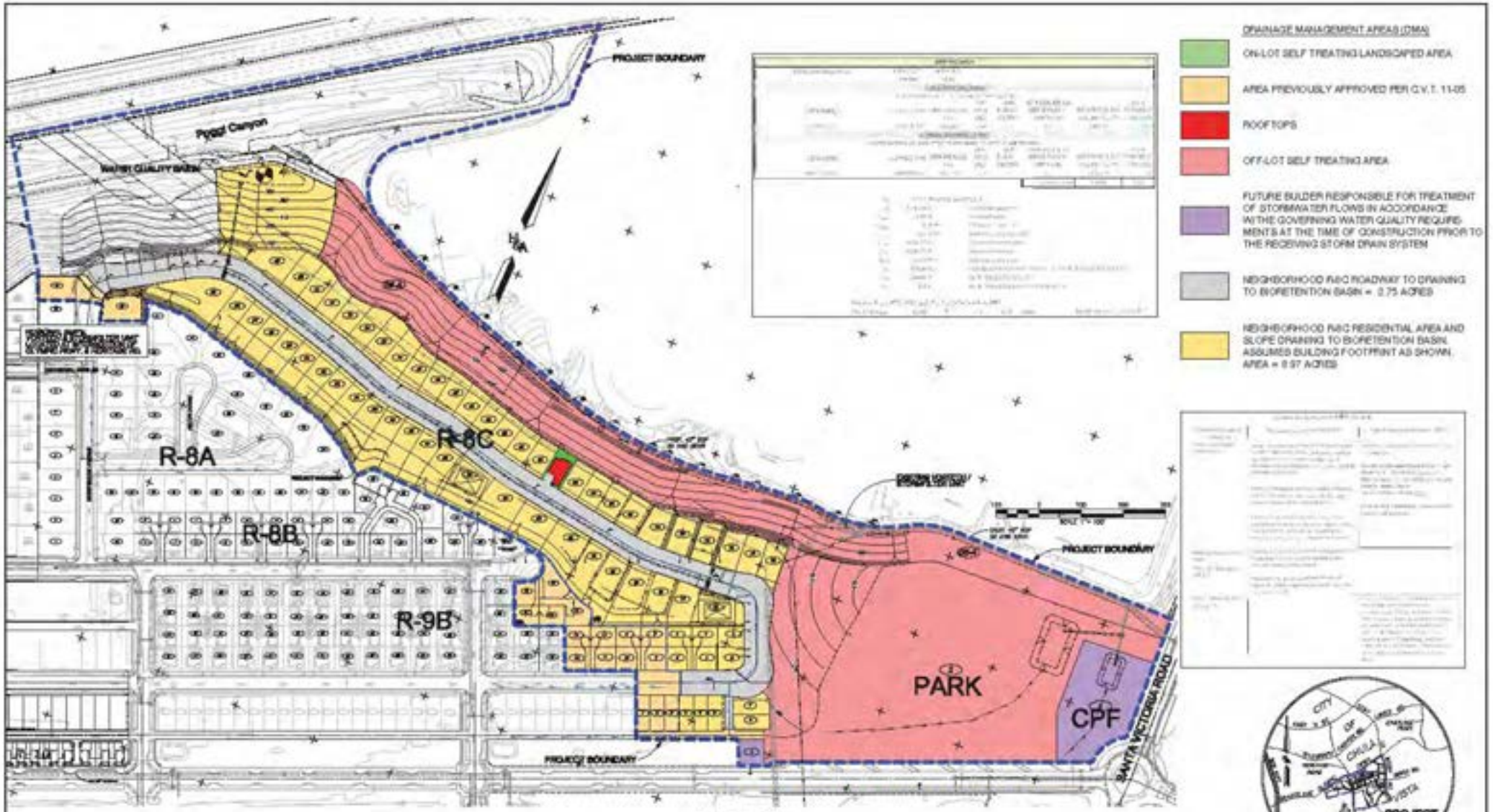
EXHIBIT 1-2

DEVELOPED CONDITION HYDROLOGY MAP

OTAY RANCH VILLAGE 2 NORTH

CITY OF CHULA VISTA, CALIFORNIA

SHEET 2 OF 2


PROJECT BOUNDARY
Poggi Canyon
WATER QUALITY BASIN
R-8A
R-8B
R-8C
R-9B
PARK
CPF
SANTA VICTORIA ROAD
PROJECT BOUNDARY
PROJECT BOUNDARY
DRAINAGE MANAGEMENT AREAS (DMA)
ON-LOT SELF TREATING LANDSCAPED AREA
AREA PREVIOUSLY APPROVED PER C.V.T. 11-05
ROOFTOPS
OFF-LOT SELF TREATING AREA
FUTURE BUILDER RESPONSIBLE FOR TREATMENT OF STORMWATER FLOWS IN ACCORDANCE WITH THE GOVERNING WATER QUALITY REQUIREMENTS AT THE TIME OF CONSTRUCTION PRIOR TO THE RECEIVING STORM DRAIN SYSTEM
NEIGHBORHOOD R&C ROADWAY TO DRAINING TO BIORETENTION BASIN = 0.75 ACRES
NEIGHBORHOOD R&C RESIDENTIAL AREA AND SLOPE DRAINING TO BIORETENTION BASIN. ASSUMES BUILDING FOOTPRINT AS SHOWN. AREA = 0.97 ACRES
TREATMENT CONTROL BMPS
WATER QUALITY BASIN
LID/SITE DESIGN BMPS
DRAIN ROOFTOPS, AND SIDEWALKS TO LANDSCAPING
SMART IRRIGATION SYSTEMS
LEGEND
NEIGHBORHOOD BOUNDARY
FLOW DIRECTION
CITY OF CHULA VISTA
PROJECT SITE
VICINITY MAP
NOT TO SCALE
HUNSAKER & ASSOCIATES
PREPARED BY:
HUNSAKER & ASSOCIATES
EXHIBIT 1.
DRAINAGE MANAGEMENT AREA MAP
OTAY RANCH
VILLAGE 2, NORTH
CITY OF CHULA VISTA, CALIFORNIA
MAP 1 OF 1

WATER QUALITY TECHNICAL REPORT
FOR
OTAY RANCH VILLAGE 2 SOUTH & R-15c
TENTATIVE MAP

City of Chula Vista, California

Prepared for:
Baldwin & Sons, Inc.
610 W. Ash Street
Suite 1500
San Diego, CA 92121

W.O. 2807-35

November 13, 2013

Hunsaker & Associates
San Diego, Inc.

Alisa S. Vialpando, R.C.E. 47945
Principal

REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
No. 47945
Exp. 12/31/13
CIVIL
STATE OF CALIFORNIA

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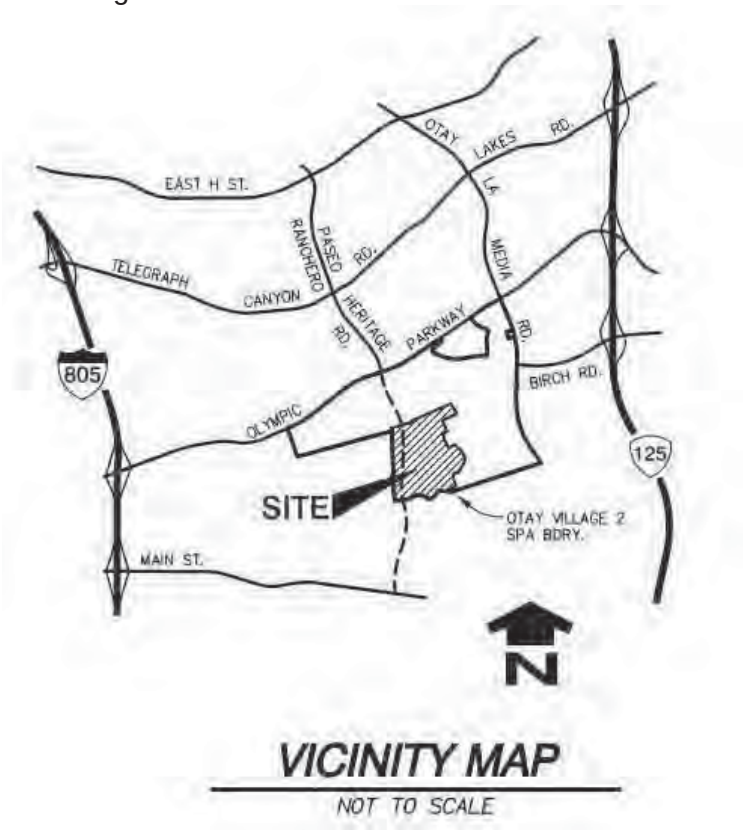
CHAPTER 1 – EXECUTIVE SUMMARY

This Water Quality Technical Report (WQTR) addresses the treatment of 85th percentile runoff from the proposed development of Otay Ranch Village 2 South and R-15c for Baldwin & Sons, Inc. The design will utilize on site Low Impact Development (LID), Best Management Practices (BMPs) and Bioretention Integrated Management Practices (IMP's) Treatment Controls to treat the 85th percentile flow from the development as well as address hydromodification requirements.

1.1 – Introduction

The Otay Ranch Village 2 South Tentative Map (TM) and the Village 2 R-15c TM project sites are located within the City of Chula Vista, California. Village 2 South is approximately one-half mile south of Olympic Parkway, north of Main Street, west of La Media Road, and east of Heritage Road. The Otay Ranch Village 2 North development is located immediately north of the project area. Village 2 R-15c is located northeast of Village 2 South and south of the Anapamu Avenue- Ortega Street intersection. Please refer to the Vicinity Map shown below for the combined project area.

The gross subdivision area for the Village 2 South portion is approximately 174.6 acres and will be developed for single family residential, multi-family residential, a community purposes facility, industrial, and open spaces. The R-15c portion is approximately 0.73 acres. The extension of Heritage Road south to Main Street is included with this TM to allow for site access and as stipulated in the overall Village 2 SPA.



Chapters 1-12 of this report pertain to the combined development of Village 2 South and R-15c since the latter will ultimately drain towards Village 2 South and comingle with Village 2 South flows. Chapter 13 presents discussion on the interim scenario that assumes R-15c is constructed and Village 2 South has not been developed.

Per the City of Chula Vista's *"Development Storm Water Manual"* dated January 2011 and FORM 5500 (Permanent Storm Water BMPs Applicability Checklist), the Otay Ranch Village 2 South/R-15c project is classified as a priority project. As such, it is subject to the Standard Urban Storm Water Mitigation Plans (SUSMP) requirements set forth in Section 3 of the *"Development Storm Water Manual"*.

This WQTR for Otay Ranch Village 2 South and R-15c Tentative Maps have been prepared pursuant to requirements set forth in the City of Chula Vista's "*Development Storm Water Manual*." All calculations are consistent with criteria set forth by the Regional Water Quality Control Board's Order No. R9-2007-0001, and the "*County of San Diego SUSMP"* dated January 2011.

This WQTR recommends the conceptual locations and sizes of site Best Management Practices (BMPs) which include bioretention facilities and linear swales.

The proposed land uses for this Village 2 South/R-15c TM study include single family residential, multi-family residential, a community purposes facility, industrial, and open spaces. Such urban land uses are typical generators of pollutants such as sediment, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, bacteria and viruses, and pesticides. If not mitigated, these pollutants can degrade urban runoff and impair receiving waters. This project proposes to reduce potential urban pollution by implementing Best Management Practices (BMP's), including Low Impact Development site design, source control, and treatment control BMP's.

Detailed site plans are not available at this time for portions of the site such as the industrial areas and some of the residential areas. Developers/builders for those respective planning areas will be required to submit site-specific Water Quality Technical Reports for City review and approval prior to obtaining any land development permits. Individual developers/builders will also be responsible for implementing and maintaining all BMP's until new homeowners or sub-associations take responsibility for the maintenance of post-construction BMP's into perpetuity

This report also determines anticipated project pollutants, pollutants of concern in the receiving watersheds, conditions of concern in receiving waters, recommended source control BMPs, recommended maintenance, sampling, and monitoring requirements and methodology used for the design of BMPs.

Refer to Chapter 12 Exhibits 1.1 through 1.4 for an overview of the existing and proposed drainage patterns of the site. This TM project area has been divided into two general hydrologic watersheds. The 'North Portion' of the Village 2 South development includes single family residential, multi-family residential, a community purpose facility, industrial areas, and open

spaces. This portion drains south and discharges its runoff into Wolf Canyon. An offsite are consisting of 43.3 acres is also included in the North Portion watershed. This offsite area was previously entitled by CVT 06-05 and is owned by Sunwood, LLC. The other general watershed, the 'Heritage Road Portion', is the extension of Heritage Road from the southern boundary of the North Portion to Main Street. This portion drains south and outlets into the Otay River which is located immediately south of Main Street. For consistency with the *Tentative Map Drainage Study for Otay Ranch Village 2 South and R-15c* (November 2013), this naming convention for the two major watersheds will also be used throughout this study.

1.2 Summary of Pre-Developed Conditions

The pre-developed condition hydrology maps (Exhibits 1.1, 1.2) are located in Chapter 12. The North Portion includes areas from the Village 2 North development. Approximately 46 acres from Village 2 North drains through Village 2 South. The topography within the North Portion is varied throughout containing steep slopes, hilly areas, mass graded pads, and areas for stormwater detention. As shown on Exhibit 1.1 for the North Portion, runoff drains towards the south and into Wolf Canyon. Wolf Canyon confluences with the Otay River about one mile downstream of the proposed detention basin for the North Portion.

The topography for existing Heritage Road Portion is as shown in the hydrology Exhibit 1.2 in Chapter 12 and is characterized by farmland, rolling hills, vegetation consisting mainly of brush, and incised canyons that partition the study area into the watersheds shown. For reference purposes, the exhibit shows the proposed Heritage Road extension overlaid. The northern watershed boundary is defined by the grading which has occurred for the Otay Landfill. The westernmost watershed boundary has been set at the limits of the existing commercial businesses mostly consisting of vehicle junkyards and parts stores. The watersheds within this portion all drain directly into the Otay River. The defined 'Heritage Road Portion' watershed has its downstream outlet point located approximately one-half mile downstream of the Wolf Canyon confluence into the Otay River. The Otay River flows from east to west and ultimately empties into the San Diego Bay.

Table 1 below summarizes the 100-year pre-development peak flows to each of the delineated watersheds. Runoff coefficients between 0.35 and 0.60 were used depending on the existing site condition and per the City of Chula Vista Subdivision Manual. The coefficients generally correspond to a vegetated state with flat to steep slopes. Supporting calculations for the data presented in Table 1 are located in Chapter 3 of the *TM Drainage Study for Otay Ranch Village 2 South and R-15c* (November 2013). The corresponding hydrology maps (Exhibits 1.1 and 1.2) are located in Chapter 12.

TABLE 1 - Summary of Pre-Developed Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	100-Year Peak Flow (cfs)
1.1, North Portion	138	Wolf Canyon	251	454
1.2, Heritage Road Portion	105	Otay River	47	64
1.2, Heritage Road Portion	214	Otay River	95	145
1.2, Heritage Road Portion	407	Otay River	118	141
		TOTAL	**511**	**804**

1.3 – Summary of Proposed Development

The Otay Ranch Village 2 South/R-15c Tentative Maps will consist of single family residential, multi-family residential, a community purposes facility, industrial, and open spaces with a gross subdivision area of 167.77 acres. The 'Developed Condition' hydrology maps (Exhibits 1.3, 1.4) are located in Chapter 12. As in the pre-developed analysis, the developed scenario was analyzed separately as two watersheds; the 'North Portion' and the 'Heritage Road Portion'.

Exhibit 1.3 shows the proposed North Portion of the Village 2 South development and shows the proposed drainage subareas delineated as well as the runoff flow direction. Although the gross subdivision area is about 168 acres, the developed areas consisting of single family residential, multi-family residential, community purposes facility, industrial, and open spaces account for the majority of the overall TM project. As in the existing condition, the North Portion developed site slopes towards the south. The proposed storm drain infrastructure will include storm drain, cleanouts, inlets, headwalls, energy dissipating measures, and basins (water quality/ hydromodification /desilt/ detention). The hydrologic analysis for the North Portion is included in Chapter 3 of the *TM Drainage Study for Otay Ranch Village 2 South and R-15c*. In preparing the hydrologic model and exhibit, all proposed developments upstream of the TM boundary were considered in order to correctly recommend the required storm drain infrastructure. Offsite areas tributary to the North Portion watershed include a part of the Village 2 North development as well as an area east of the TM boundary which is owned by Sunwood, LLC and will be built in the future. In addition, runoff from both the slopes west of Heritage Road and a part of Heritage Road itself is included in the North Portion hydrology model.

The development of Village 2 South will increase runoff flowrates relative to the existing condition. To attenuate developed peak flows below existing condition flowrates, a detention basin is proposed at the downstream end of the North Portion prior to outletting into Wolf Canyon. The analysis is included in Chapter 4 of the *TM Drainage Study for Otay Ranch Village 2 South and R-15c* and shows that the proposed basin and outlet riser structure will attenuate peak flows to below the pre-developed condition. This detention basin will also serve

to address hydromdodification relative to the Village 2 South/R-15c TM projects and includes a southern portion of Village 2 North development. In addition to this basin, two other basins located upstream are proposed as water quality and hydromodification BMP measures. Although these two basins will provide peak flow attenuation that would further reduce the downstream developed flowrate, they were not considered in the detention basin analysis. This detention basin was previously approved as part of the Village 2 Master Drainage Study (2005).

The extension of Heritage Road south to Main Street is included with this TM to allow access to the residential and industrial parts of Village 2 South as stipulated in the overall Village 2 SPA. Heritage Road will slope to the south towards Main Street and the Otay River. The hydrologic analysis relative to Heritage Road Portion is included in Chapter 3 of the *TM Drainage Study for Otay Ranch Village 2 South and R-15c.* The related exhibit is located in Chapter 12 (Exhibit 1.4). The proposed road alignment of Heritage Road shown on the exhibit accounts for the future development of Village 3. As was done for the North Portion hydrologic model, an ultimate proposed condition hydrology model was prepared in order to correctly represent the effect of the Village 3 development on the Heritage Road storm drain system. The Village 3 site design shown was obtained from a preliminary TM lotting study for Village 3.

Table 2 on the following sheet summarizes the 100-year developed condition peak flows relative to the development of Village 2 South and R-15c. Supporting calculations for the data presented in Table 2 are located in Chapter 3.4 of the *TM Drainage Study for Otay Ranch Village 2 South and R-15c*. The corresponding hydrology maps (Exhibits 1.3 and 1.4) are located in Chapter 12.

TABLE 2 - Summary of Developed Flows

Exhibit	Node Number on Exhibit	Discharge Location	Drainage Area (ac)	100-Year Peak Flow (cfs)
1.3, North Portion	260	Wolf Canyon	287.5	399*
1.4, Heritage Road Portion	650	Otay River	4	14
1.4, Heritage Road Portion	581	Otay River	258	742
1.4, Heritage Road Portion	715	Otay River	8	19
		TOTAL	**558**	**1,174**

*-Flowrate after detention. Pre-detention flow = 614 cfs

Where possible, landform grading has been incorporated to mimic existing conditions where the proposed grading ties into or daylights with the existing terrain. It is intended that the stormwater from the manufactured slopes will sheet flow and follow the existing drainage patterns.

1.4 – Results and Recommendations

Table 3 summarizes the effects of site development at the receiving Otay River.

TABLE 3 - Summary of Pre vs. Post-Developed Condition Flows to Otay River

Condition	Drainage Area (acres)	100-Year Peak Flow (cfs)
Pre-Developed	511	804
Post-Developed	558	1,174
DIFFERENCE	**+ 47***	**+ 370**

* =Area diverted along eastern project boundary in Heritage Road portion

Development of Otay Ranch Village 2 South and R-15c combined with the preliminary site layout for Village 3 will result in a net cumulative runoff increase of 370 cfs discharged to the Otay River and Wolf Canyon. The increases are attributed to the future development of Village 3 and the area diversion created towards Heritage Road. Overall, calculations for the North Portion indicate a runoff reduction into Wolf Canyon due to the detention basin.

Multiple LID-based BMP's are proposed to treat the 85th percentile runoff from the site prior to discharge to the proposed storm drain within the Village 3 development. To determine the Design Treatment Flow, the 85th percentile design runoff has been calculated using the Rational Method and Equation 4.8 of the "*County of San Diego SUSMP"*. Equation 4-7 was used for sizing minimum bioretention IMP areas.

Per Table 4-2 of the "*County of San Diego SUSMP"*, a runoff factor of 1.0 was used for paved and impervious areas. A runoff factor of 0.1 was used for all pervious surfaces. Per Table 4.6 an IMP sizing factor of 0.04 was used for bioretention facilities.

Stormwater treatment for the Heritage Road Portion will be provided via linear bioretention areas. The 85th percentile flows will be captured along the gutter with intermittent curb cuts that will direct flows to bioretention areas within the available parkway area directly behind the curb.

The proposed bioretention basins within the North Portion of the Village 2 South development will treat the industrial and residential areas and streets which are tributary to them. Basins 1 and 2 are water quality basins and are sized for the water quality volume generated by the onsite upstream areas. Since the North Portion watershed outlets into Wolf Canyon, it will be required to address hydromodification per the City of Chula Vista SUSMP and HMP. Chapter 11 of this report includes the hydromodification analysis performed for the residential portions of Village 2 South. It includes recommended basin sizes, outlet structure design, and calculated results verifying HMP compliance. The Heritage Road portion included in this study will outlet directly into the Otay River downstream of Village 3. The Otay River is listed as an 'Exempt River Reach' per the County of San Diego Final Hydromodification Management Plan. As such, the Heritage Road portion is exempt from addressing HMP requirements. Table 3 below summarizes the point of compliance watershed areas and upper and lower thresholds from the analysis prepared for the North Portion.

TABLE 3 - Summary of Upper and Lower Thresholds for Hydromodification

	Drainage Area (ac)		Upper and Lower Flow Thresholds (cfs)	
	Existing Condition	Proposed Condition	0.1Q2	Q10
POC 1	250.4	262.5	5.13	99.42

Many alternate treatment BMPs, including media filters, drainage inserts, hydrodynamic separators, tree wells, and wet ponds were explored and evaluated (see Chapter 5 for a full comparison on all treatment BMPs considered). Bioretention IMPs and LID Site Design BMPs were deemed to be the most effective and feasible BMP treatment for the Otay Ranch Village 2 South development.

Runoff generated by any interim mass graded pad (such as the industrial and CPF sites) will drain to a desilt basin to be sized and located for each respective pad. For mass graded pads, the only potential pollutant of concern generated by these pads is sediment. Desilt basins will target this sole pollutant prior to discharging flows to the receiving storm drain system. Applicable erosion control measures for permanent stabilization will comply with CASQA Handbook measures and as indicated by each area's Storm Water Pollution Prevention Plan. Potential pollutants of concern for these graded pads were considered assuming buildout.

Locations of the BMP's described above are shown on the BMP Location Exhibits 1.5 in Chapter 12. Typical street details of the proposed BMP's for Heritage Road are also included in Exhibit 1.6 to indicate typical sizes and spacing intervals.

Low Impact Design (LID) BMP's will be implemented on this project site to the maximum extent practicable to ensure water quality treatment is maximized throughout the development.

1.5 – Conclusion

The combination of proposed construction and permanent BMP's will reduce, to the maximum extent practicable, the expected project pollutants and will not adversely impact the beneficial uses of the receiving waters.

1.6 – References

"County of San Diego SUSMP", County of San Diego, January 2011.

"Development Storm Water Manual", City of Chula Vista, January 2011.

"Final Hydromodification Management Plan" prepared for County of San Diego, California, March 2011

"Low Impact Development Handbook, Stormwater Management Strategies", County of San Diego, California July 20, 2007.

"Order No. R9-2007-0001,NPDES No.CAS0108758–Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, San Diego Unified Port District and the San Diego County Regional Airport Authority", California Regional Water Quality Control Board–San Diego Region; January 24, 2007.

"TM Drainage Study for Otay Ranch Village 2 South and R-15c" prepared by Hunsaker & Associates San Diego, November 2013.

Rough Grading Hydrology Study for Otay Ranch Village 2 North prepared by Hunsaker & Associated, March 2, 2007.

"San Diego County Hydrology Manual", County of San Diego Department of Public Works – Flood Control Section; June 2003.

"Master Drainage Study for Otay Ranch Villages 2, 3,& 4", Hunsaker & Associates, July 14, 2005.

CHAPTER 2 – STORM WATER TREATMENT CRITERIA

2.1 – Regional Water Quality Control Board Criteria

All runoff conveyed in the proposed storm drain systems will be treated in compliance with Regional Water Quality Control Board (RWQCB) regulations and National Pollutant Discharge Elimination System (NPDES) criteria prior to discharging to natural watercourses. California Regional Water Quality Control Board Order No. R9-2007-0001 dated January 24, 2007, sets the waste discharge requirements for discharges of urban runoff from municipal storm separate drainage systems draining the watersheds of San Diego County.

Per the RWQCB Order, post-development runoff from a site shall not contain pollutant loads which cause or contribute to an exceedance of receiving water quality objectives or which have not been reduced to the maximum extent practicable. Post-construction Best Management Practices (BMPs), which refer to specific storm water management techniques that are applied to manage construction and post-construction site runoff and minimize erosion, include source control – aimed at reducing the amount of sediment and other pollutants – and treatment controls that keep soil and other pollutants onsite once they have been loosened by storm water erosion.

Post construction pollutants are a result of the urban development of the property and the effects of automobile use. Runoff from paved surfaces can contain both sediment (in the form of silt and sand) as well as a variety of pollutants transported by the sediment. Landscape activities by homeowners are an additional source of sediment.

All BMPs shall be located to infiltrate, filter, or treat the required runoff volume or flow (based on the 85th percentile rainfall) prior to its discharge to any receiving watercourse supporting beneficial uses.

2.2 – City of Chula Vista SUSMP Criteria

Per the City of Chula Vista SUSMP, the Otay Ranch Village 2 South project is classified as a Priority Project and subject to the City's Permanent Storm Water BMP Requirements.

The Standard Urban Storm Water Mitigation Plans Permanent Storm Water BMPs Applicability Checklist (FORM 5500), which must be included along with Grading Plan applications, is included in the following page.

Otay Ranch
Village 2 South TM

CITY OF CHULA VISTA	**DEVELOPMENT SERVICES DEPARTMENT** 276 Fourth Avenue, Chula Vista, CA 91910 Phone: (619) 691-5021 Fax: (619) 691-5171	**PERMANENT STORM WATER BMPs APPLICABILITY CHECKLIST**
	FORM 5500	

Complete the following checklist to determine the project's permanent Best Management Practices requirements. This form must be completed and submitted with the permit application.

If one or more questions in the checklist are answered "Yes", the project is a Priority Development Project subject to the Standard Urban Storm Water Mitigation Plan (SUSMP) requirements in Section 3 of this Manual. If all answers are "No", please complete Form 5501 to select applicable Standard Permanent BMPs for your proposed project.

Project category descriptions in the following checklist are abbreviated for clarity. Please refer to the definitions in the NPDES Municipal Permit, Order No. R9-2007-0001, or Sections 3.1 and 9 of this Manual for expanded definitions of "Priority Development Projects" and "Redevelopment."

Does the project meet the definition of one or more of the Priority Development Project Categories below?

	Priority Development Project Categories	Yes	No
1	Housing subdivisions of 10 or more dwelling units.	X	
2	Commercial developments greater than one acre	X	
3	Developments of heavy industry greater than one acre	X	
4	Automotive repair shops		X
5	Restaurants		X
6	All Hillside development greater than 5,000 square feet	X	
7	Development within or adjacent to Environmentally Sensitive Areas		X
8	Parking lots 5,000 square feet or more or with 15 or more parking spaces and potentially exposed to urban runoff	X	
9	Streets, roads, highways, and freeways	X	
10	Retail Gasoline Outlets		X
11	Development Projects that result in the disturbance of one acre or more of land	X	
12	Redevelopment projects that create, add, or replace at least 5,000 square feet of impervious surfaces on an already developed site that falls under the project categories or locations listed above		X

Limited Exclusion: Trenching and resurfacing work associated with utility projects are not considered Priority Development Projects unless the project results in new impervious surfaces. Parking lots, buildings, and other structures associated with utility projects are Priority Development Projects if one or more of the criteria is met.

CHAPTER 3 – IDENTIFICATION OF TYPICAL POLLUTANTS

3.1 – Anticipated Pollutants from Project Site

The following table details typical anticipated and potential pollutants generated by various land use types. This WQTR covers the proposed development of Otay Ranch Village 2 South and R-15c consisting of paved servicing roads, sidewalks, multi- family residential, industrial, park, community purpose facilities and public utilities. The applicable categories have been highlighted below to clearly illustrate which general pollutant categories are anticipated from the project area.

	General Pollutant Categories								
Priority Project Categories	**Sediments**	**Nutrients**	**Heavy Metals**	**Organic Compounds**	**Trash & Debris**	**Oxygen Demanding Substances**	**Oil & Grease**	**Bacteria & Viruses**	**Pesticides**
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development >100,000 ft^2	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft^2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

3.2 – Sediment

Soils or other surface materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, smother bottom dwelling organisms, and suppress aquatic vegetative growth.

3.3 – Nutrients

Inorganic substances, such as nitrogen and phosphorous, that commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

3.4 – Trash & Debris

Examples include paper, plastic, leaves, grass cuttings, and food waste, which may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. In areas where stagnant water is present, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

3.5 – Oxygen-Demanding Substances

Biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.

3.6 – Oil & Grease

Characterized as high high-molecular weight organic compounds. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, oils, waxes, and high-molecular weight fatty acids. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

3.7 – Pesticides

Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

3.8 – Organic Compounds

Organic compounds are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease and grime retained in the cleaning fluid or rinse water may also adsorb level of organic compounds that are harmful or hazardous to aquatic life.

3.9 – Bacteria and Viruses

Bacteria and viruses are ubiquitous micro-organisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animals or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

3.10 – Metals

Metals are raw material components in non-metal products such as fuels, adhesives, paints and other coatings. Primary sources of metal pollution in storm water are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooler tower systems. At low concentrations naturally occurring in soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

CHAPTER 4 – CONDITIONS OF CONCERN

4.1 – Receiving Watershed Description

The Regional Water Quality Control Board has identified the Otay River as part of the Otay Hydrologic Unit and Otay Valley Hydrologic Area (basin number 910.20).

The beneficial use for this hydrologic subunit is found in Chapter 2 of the California Regional Water Quality Control Plan for the San Diego Basin, dated April 25, 2007 (Amended).

4.2 – Surface Water Quality Objectives and Beneficial Uses

Per the "Water Quality Plan for the San Diego Basin", the beneficial uses for the Otay River include agricultural supply, potential industrial process supply, potential contact water recreation, non-contact water recreation, warm freshwater habitat, wildlife habitat and rare, threatened or endangered species.

4.3 – 303(d) Status

Section 303(d) of the Federal Clean Water Act (CWA) requires the State to identify surface waters that do not meet applicable water quality standards with certain technology-based controls. The State Water Resources Control Board has approved the 2008 *303(d) List of Water Quality Limited Segment*. The revised list approved January 26, 2010 indicates that Poggi Canyon Creek as having impairments.

The project location and watersheds have been compared to the current published 303(d) List of Water Quality Limited Segment. The Otay River hydrologic unit (910.20) is not listed as sensitive to any Primary Pollutant of concern.

4.4 – Identification of Primary & Secondary Pollutants of Concern

As stated previously in segment 4.3, the primary pollutants of concern generated by the proposed project site are Pesticides and Nutrients..

Secondary pollutants generated by the project site include Sediment, Trash and Debris, Oxygen Demanding Substances, Organic Compounds, Heavy Metals, Oil & Grease, Nutrients, Bacteria and Viruses, and Pesticides.

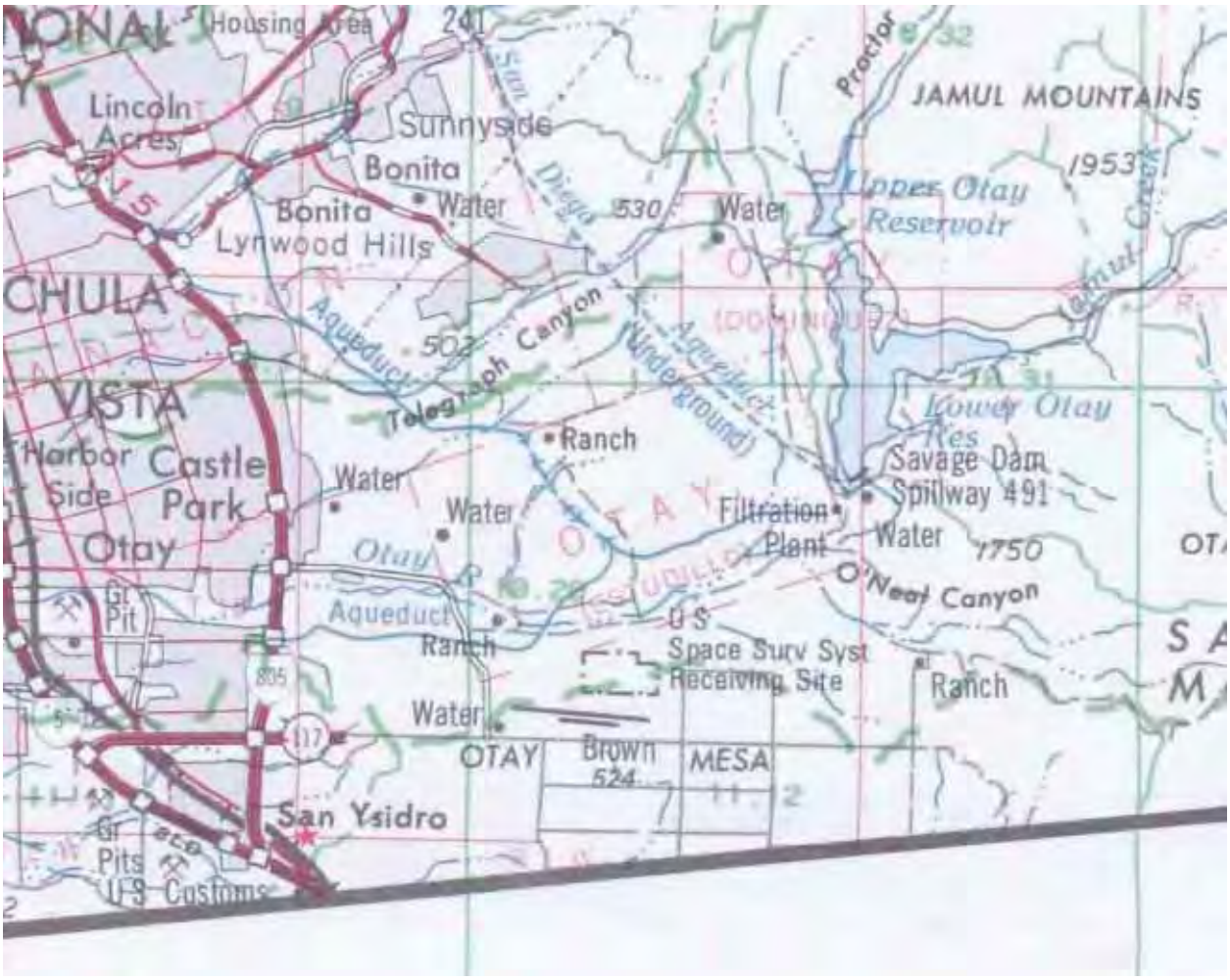

Housing Area
241
Lincoln Acres
Sunnyside
Bonita
Bonita
Water
Lynwood Hills
530
Water
Proctor
JAMUL MOUNTAINS
1953
Upper Otay Reservoir
Walnut Creek
CHULA
VISTA
Aqueduct
502
Telegraph Canyon
Aqueduct (Underground)
Lower Otay Res
Ranch
Harbor Side
Castle Park
Otay
Water
Water
Filtration Plant
Savage Dam
Spillway 491
Water
1750
O'Neal Canyon
Otay
Aqueduct
Gr Pit
Ranch
U S Space Surv Syst Receiving Site
Ranch
805
Water
OTAY
Brown
524
MESA
San Ysidro
Gr Pits
U S Customs

Table 2-2. BENEFICIAL USES OF INLAND SURFACE WATERS

Inland Surface Waters [1, 2]	Hydrologic Unit Basin Number	BENEFICIAL USE														
		MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Otay River Watershed – continued																
Otay River	10.20	+	●	○					○	●		●		●	●	
O'Neal Canyon	10.20	+	●	○					○	●		●		●		
Salt Creek	10.20	+	●	○					○	●		●		●		
Johnson Canyon	10.20	+	●	○					○	●		●		●		
Wolf Canyon	10.20	+	●	○					○	●		●		●		
Dennery Canyon	10.20	+	●	○					○	●		●		●		
Poggi Canyon	10.20	+	●	○					○	●		●		●		
Tijuana River Watershed																
Tijuana River	11.11	+		○					○	●	●	●		●	●	
Moody Canyon	11.11	+		○					○	●		●		●		
Smugglers Gulch	11.11	+		○					○	●		●		●		
Goat Canyon	11.11	+		○					○	●		●		●		
Tijuana River Estuary	11.11	See Coastal Waters – Table 2-3														
Spring Canyon	11.12	+	●	○					○	●		●		●		
Dillon Canyon	11.12	+	●	○					○	●		●		●		
Finger Canyon	11.12	+	●	○					○	●		●		●		
Wruck Canyon	11.12	+	●	○					○	●		●		●		

4.5 – Conditions of Concern in Receiving Waters

4.5.1 – Summary of Hydrologic/Hydraulic Analysis

The *TM Drainage Study for Otay Ranch Village 2 South* by Hunsaker & Associates, dated November 2013 has been prepared to assess the pre-developed and developed condition peak runoff rates.

Development of the Otay Ranch Village 2 South development will be comprised of two watersheds. The 'North Portion' watershed will result in a net decrease of runoff discharged to Wolf Canyon by about 55 cfs after detention via the proposed basin. The 'Heritage Road' watershed will increase its net runoff by approximately 425 cfs into the Otay River. However, as discussed in the *TM Drainage Study for Otay Ranch Village 2 South and R-15c,* the peak flow from the development will enter the Otay River well before the peak flow from the Otay River watershed. Additional measures at the storm drain outlets will be finalized during the Final Engineering phase. However, it is proposed that rip rap and D-41 or APWA Impact Basins will be added to address any erosive velocities at the outfalls.

4.6 – Hydromodification Analysis

4.6.1 – Introduction

According to the 2011 Final Hydromodification Plan (HMP), all priority projects that have the potential to increase unmitigated peak flows, and that do not directly discharge to exempt water bodies are required to perform a hydromodification analysis. This project consist of two major watersheds with two different outlet points. The North Portion outlets into Wolf Canyon and is therefore is subject to hydromodification analysis. The Heritage Road Portion of the Village 2 South development discharges directly into the Otay River which is an exempt water body. Therefore, the developed areas within this latter watershed are exempt from hydromodification requirements. See Chapter 13 for hydromodification discussion relative to R-15c during the interim condition when R-15c is constructed and Village 2 South has not been developed.

Due to the volume of information related to the hydromodification BMPs being proposed for the North Portion watershed, a separate chapter within this WQTR has been dedicated to present the hydromodification analysis for this watershed. Please refer to Chapter 11 for hydromodification analysis, methodology, results, and conclusions. To briefly summarize the findings within Chapter 11, the North Portion of Village 2 South development will include three basins which will serve in various capacities. Please refer to the BMP Location Map for the location of the three basins. Basin 1, the northernmost basin, will serve as a water quality-only basin to treat a part of the North Portion watershed. Basin 2, the central basin, will serve as both a water quality basin and a hydromodification basin for its tributary areas. Basin 3, the southernmost basin, will serve hydromodification purposes and also attenuate peak flows from the developed North Portion. Please refer to the *TM Drainage Study for Otay Ranch Village 2 South* (November 2013) for detention basin discussion and analysis.

4.6.2 – Conclusion

The results of the hydromodification analysis show that the proposed IMPs can be designed and constructed to comply with City of Chula Vista stormwater and hydromodification requirements.

Chapter 5 – TREATMENT CONTROL BMP DESIGN

5.1 – BMP Location

To address water quality, two types IMPs are proposed for the Village 2 South development. For the areas within the Heritage Road Portion of the project, stormwater runoff from the street will be treated via linear bioretention swales located behind the curb. Refer to Exhibit 1.6 for swale location and spacing interval.

For the areas within the North Portion watershed, two water quality basins are proposed at the downstream end of the site approximately 850' east of Heritage Road. Refer to Exhibits 1.5. Basin 1 will serve only as a water quality basin while Basin 2 will also address hydromodification for a portion of the site. Basin 3 will address the remaining portion of hydromodification and also act to attenuate peak flowrates to below existing condition flows.

According to page 3-29 of the City of Chula Vista Development Stormwater Manual, "Treatment Control BMPs with a high or medium pollutant removal efficiency for the project's most significant Pollutant of Concern shall be selected." This project outlets into Wolf Canyon and subsequently to the Otay River. The Otay River is not listed to have any primary Pollutants of Concern. However, the BMPs described above are categorized as having "High" or "Medium" pollutant removal efficiencies for a broad range of primary pollutants of concern.

The above IMP's will be implemented per the specifications provided by the City of Chula Vista SUSMP. See a reduced scale BMP location exhibit at the end of this chapter and a full scaled exhibit in Chapter 12.

5.2 – Bioretention IMPs

The bioretention IMPs function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer, or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area.

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fallout of suspension.

Examples of Bioretention IMPs can be configured as swales, free-form areas, extended detention basins or planters to be integrated with landscape design. Refer to Chapter 4 of the County SUSMP for further discussion of Bioretention facilities.

5.3 – BMP Unit Sizing

The bioretention linear swales which are proposed to treat the Heritage Road runoff have been sized based on runoff factors per the City of Chula Vista Storm Water Manual and a sizing factor of 4%. The BMP Exhibit 1.6 located in Chapter 12 details the swale areas and spacing interval along Heritage Road.

The water quality basins within the North Portion watershed were sized with enough storage for the water quality volume. Although Basin 1 will only address water quality, Basin 2 and 3 will also address hydromodification . The riser structures within Basin 2 and 3 have been designed to allow the project to comply with San Diego County and City of Chula Vista HMP requirements. All three basins will include riser structures which will safely convey the site's peak flow rates. Basin 3 will act as a detention basin to help attenuate the peak flowrates below the existing flow rate amounts.

5.4 – Pollutant Removal Efficiency Table

The table below shows the generalized pollutant removal efficiencies for the facilities. The proposed **Bioretention Based IMPs** target trash and debris, sediments, organic compounds oxygen demanding substances, pesticides, oil/hydrocarbons, nutrients and bacterial pollutants.

Table 4. Structural Treatment Control BMP Selection Matrix

Pollutants of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	High-rate biofilters	High-rate media filters*	Trash Racks & Hydro -dynamic Devices
Coarse Sediment and Trash	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Pollutants that tend to associate with fine particles during treatment	HIGH	HIGH	HIGH	HIGH	HIGH	MEDIUM	MEDIUM	LOW
Pollutants that tend to be dissolved following treatment	MEDIUM	LOW	MEDIUM	HIGH	LOW	LOW	LOW	LOW

Pollutant	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	X	X	
Nutrients		X	X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
Oxygen Demanding		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

5.5 – BMP Unit Selection Discussion

5.5.1 Bioretention Basins

Bioretention facilities are designed to capture runoff or infiltrate slowly through a soil media, which also supports vegetation. Bio retention facilities effectively promote infiltration into native soils. In low-permeability soils such as clay soils, facilities may capture excess treated runoff in an underdrain piped to the municipal storm drain system.

Advantages

- Due to the simplicity of design, bioretention basins are relatively easy and inexpensive to construct and operate.
- Bioretention basins can provide substantial capture of sediment and the toxics fraction associated with particulates.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in the watershed.
- If designed as a bioretention facility per the criteria noted in the County SUSMP, they can serve as an aesthetic, potentially inexpensive urban development feature with significant water quality benefits.
- Low maintenance.
- Easily access for maintenance.
- They can convey high flows while percolating and treating lower flows

Limitations

- Limitation of the diameter of the orifice may not allow use of bioretention basins in watersheds of less than 5 acres (would require an orifice with a diameter of less than 0.5 inches that would be prone to clogging).
- Basins can detract from the value of a home due to possible adverse aesthetics of dry or bare areas and inlet and outlet structures, if not maintained properly.

Conclusion:

The two bioretention basins located at the site will be sized to treat the water quality volume.

5.5.2 Vegetated (Linear) Swales

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and stormwater systems, however, if curb is required intermittent curb cuts can be provided to allow the flows to get to the vegetated swale.

Advantages

- If designed as a bioretention facility per the criteria noted in the County SUSMP, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant water quality benefits.
- Low maintenance.
- Easily access for maintenance.
- They can convey high flows while percolating and treating lower flows.

Limitations

- Can be difficult to avoid channelization.
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.

Conclusion:

Per the County of San Diego SUSMP, one of the best uses for bioretention (linear) swales is along roadways. This treatment control is proposed for use along the southern portion of the TM project area along Heritage Road.

5.5.3 Infiltration Basins

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principle benefit of infiltration basins is the approximation of pre-development hydrology during which a significant portion of the average rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.
- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- Infiltration rates exceeding 2.4 inches/hour, the runoff should be treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.

- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Conclusion:

Due to the type D clay soils typically located in the region, onsite infiltration basins are not a feasible option for the Otay Ranch Village 3 project site.

5.5.4 Wet Ponds

Wet ponds are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetland habitat.
- Ponds are often viewed as a public amenity when integrated with a park setting.
- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvements across a relatively broad spectrum of constituents including dissolved nutrients.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.
- Mosquito and midge breeding is likely to occur in ponds.
- Cannot be placed on steep unstable slopes.
- Need for base flow or supplemental water if water level is to be maintained.
- Require a relatively large footprint.
- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams.

Conclusion:

Due to the large acreage requirements of a wet pond, proximity to residences (vector issues) and the fact that other BMP's are able to treat pollutants of concern with equal efficiency, wet ponds are not a feasible option for the project site.

5.5.5 Media Filters

Stormwater media filters are usually two-chambered including a pre-treatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber.

Advantages

- Relatively high pollutant removal, especially for sediment and associated pollutants.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- More expensive to construct than many other BMP's.
- May require more maintenance than some other BMP's depending upon the sizing of the filter bed.
- Generally require more hydraulic head to operate properly (min 4 feet).
- High solids loads will cause the filter to clog.
- Work best for relatively small, impervious watersheds.
- Filters in residential areas can present aesthetic and safety problems if constructed with vertical concrete walls.
- Certain designs maintain permanent sources of standing water where mosquito's and midge breeding is likely to occur.

Conclusion:

Due to the fact that other BMPs provided equal or higher levels of treatment efficiency for target pollutants of concern, media filters were not implemented within the project site.

5.6.6 Drainage Inserts

Drainage inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling to one of three different groups: socks, boxes and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes form of the box. Most box products are one box; that is, the setting area and filtration through media

occur in the same box. Some products consist of one or more trays and mesh grates. The trays may hold different types of media.
Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose and activated carbon.

Advantages

- Does not require additional space as inserts as the drain inserts are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

- Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults.
- Usually not suited for large areas or areas with trash or leaves that can plug the insert.

Conclusion:

Due to lower levels of treatment efficiency for target pollutants of concern and the size of the project, curb inlet filters were deemed infeasible for this development.

5.5.7 Hydrodynamic Separator Systems

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants that are widely used in storm water treatment. No outside power source is required, because the energy of the flowing water allows the sediments to efficiently separate. Depending on the type of unit, this separation may be by means of swirl action or indirect filtration. Variations of this unit have been designed to meet specific needs. Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables -which can be captured, rather than solids with poor settleability or dissolved pollutants. In addition to the standard units, some vendors offer supplemental features to reduce the velocity of the flow entering the system. This increases the efficiency of the unit by allowing more sediment to settle out.

Advantages

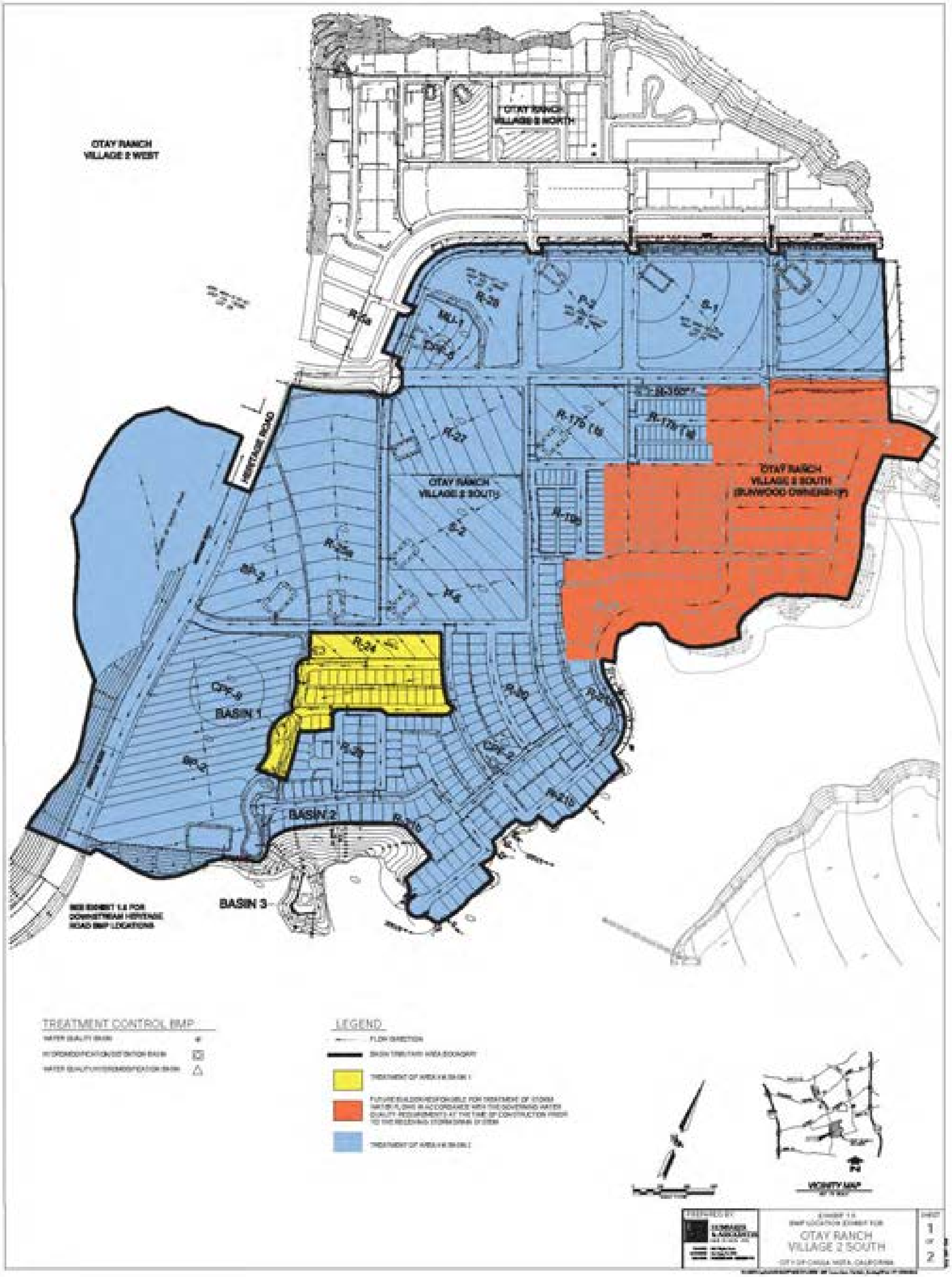
- May provide the desired performance in less space and therefore less cost.
- May be more cost-effective pre-treatment devices than traditional wet or dry basins.
- Mosquito control may be less of an issue than with traditional wet basins.

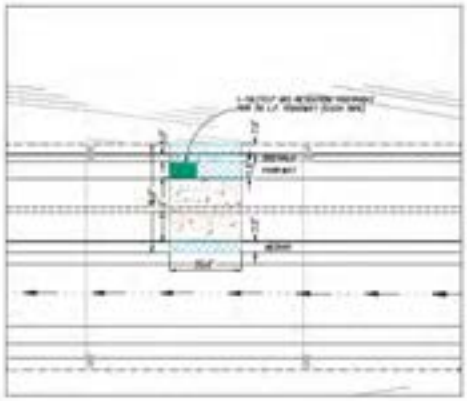
Limitations

- As some of the systems have standing water that remains between storms, there is concern about mosquito breeding.
- It is likely that vortex separators are not as effective as wet vaults at removing fine sediments, on the order 50 to 100 microns in diameter and less.
- The area served is limited by the capacity of the largest models.
- As the products come in standard sizes, the facilities will be oversized in many cases relative to the design treatment storm, increasing cost.
- The non-steady flows of stormwater decreases the efficiency of vortex separators from what may be estimated or determined from testing under constant flow.
- Do not remove dissolved pollutants.
- A loss of dissolved pollutants may occur as accumulated organic matter (e.g., leaves) decomposes in the units.

Conclusion

Due to the fact that other BMPs provided equal or higher levels of treatment efficiency for target pollutants of concern, hydrodynamic separators were not implemented within the project site.


OTAY RANCH
VILLAGE 2 WEST
OTAY RANCH
VILLAGE 2 NORTH
OTAY RANCH
VILLAGE 2 SOUTH
OTAY RANCH
VILLAGE 2 SOUTH
(SUNWOOD OWNERSHIP)
HERITAGE ROAD
BASIN 1
BASIN 2
BASIN 3
SEE EXHIBIT 1.4 FOR
DOWNSTREAM HERITAGE
ROAD BMP LOCATIONS
TREATMENT CONTROL BMP
LEGEND
FLOW DIRECTION
VICINITY MAP
OTAY RANCH
VILLAGE 2 SOUTH
1
2



DETAIL: TYPICAL HERITAGE ROAD

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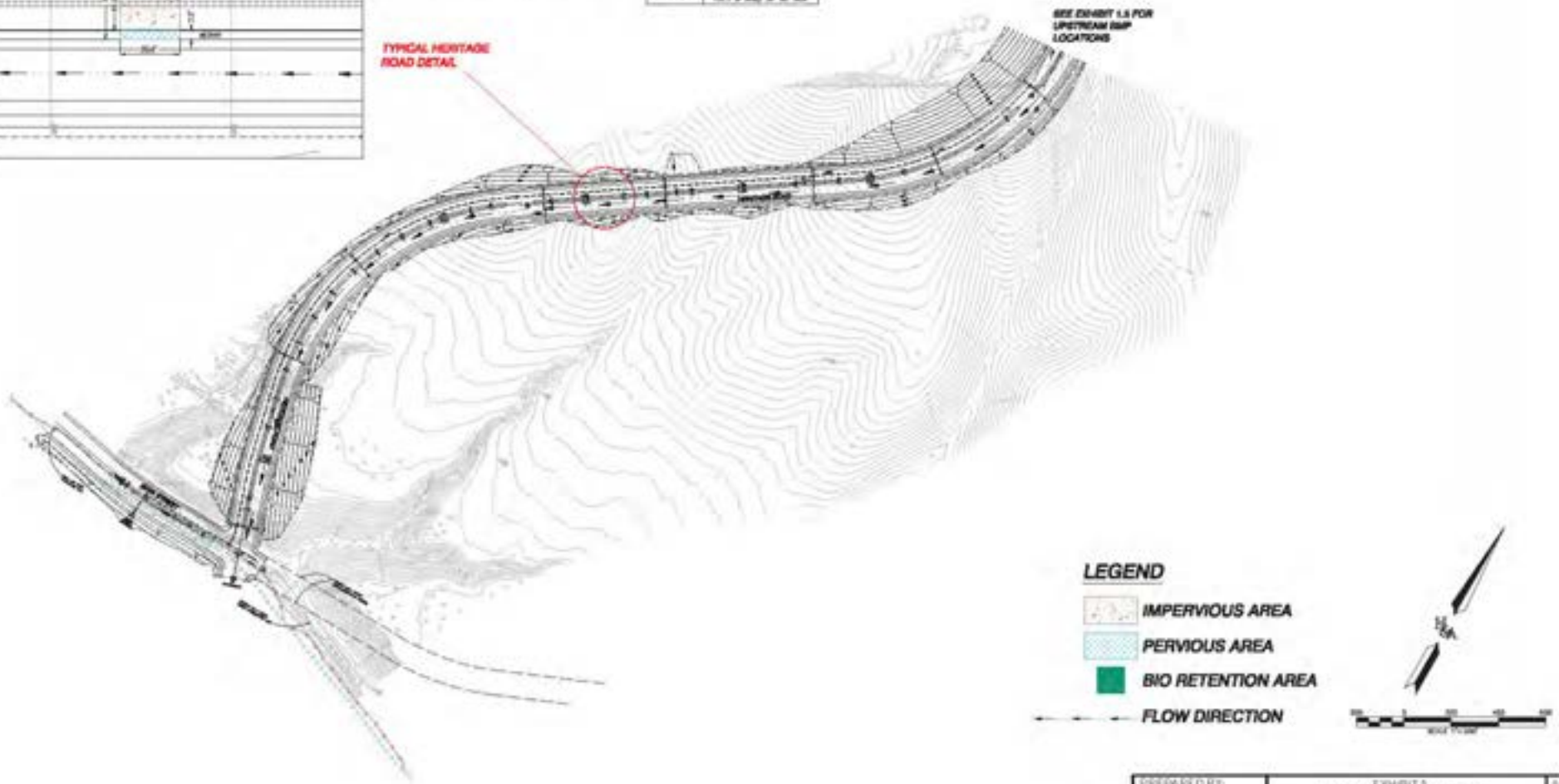


PREPARED BY:
HUNSAKER & ASSOCIATES

EXHIBIT 1.
BMP LOCATION EXHIBIT FOR
OTAY RANCH
VILLAGE 2 SOUTH
CITY OF CHULA VISTA, CALIFORNIA

SHEET 2 OF 2

CHAPTER 6 – SOURCE CONTROL BMPS

The following Source Control BMPs are specific to the development proposed for the Otay Ranch Village 2 South and R-15c project sites which will include the construction of service roads, residential lots, a park, two CPF sites, industrial site, sidewalks, and utilities.

Future development of some of the mass graded pads will be the responsibility of a future developer/ builder. They will be required to ensure that all future developed runoff from the aforementioned pad is treated in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system.

6.1 – Design Outdoor Material Storage Areas to Reduce Pollution

Storage areas shall include structural features that prevent pollutants from entering storm drains. Where appropriate, comply with the requirements of local Hazardous Materials Programs.

Grade and berm outdoor storage areas to prevent run-on or run-off from area.

Storage of hazardous materials and wastes shall be in compliance with federal, state, and local laws, ordinances, and regulations.

6.2 – Design Trash Storage Areas to Reduce Pollution Introduction

All outdoor trash storage areas shall meet the following requirements per Design Concept SC-3 in the Chula Vista Development Storm Water Manual dated March 2010 (limited exclusion: detached residential homes):

- Paved with an impervious surface, designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash; and
- Covered with a roof, awning or trash lid to minimize direct precipitation.
- Designed in accordance with Chula Vista Municipal Code Section 19.58.340

6.3 – Integrated Pest Management (IPM) Principles

Integrated pest management (IPM) is an ecosystem-based pollution prevention strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitation manipulation, modification of cultural practices, and use of resistant plant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the

environment. More information may be obtained at the UC Davis website (http://www.ipn.ucdavis.edu/WATER/U/index.html).

6.3.1 - Eliminate and/or reduce the need for pesticide use in the project design by:

- Plant pest-resistant or well-adapted plant varieties such as native plants
- Discourage pests by modifying the site and landscaping design.

In order to achieve this source control BMP objective, native vegetation will be used throughout the project site in accordance with the landscape architects plans.

6.3.2 - Distribute IPM educational materials to future site residents/tenants.

Minimally, educational materials must address the following topics:

- Keeping pests out of buildings and landscaping using barriers, screens, and caulking;
- Physical pest elimination techniques, such as, weeding, squashing, trapping, washing, or pruning out pests;
- Relying on natural enemies to eat pests;
- Proper use of pesticides as a last line of defense.

The homeowners will be made aware of the aforementioned RWQCB regulations through a homeowners' education program.

6.4 – Efficient Irrigation Systems & Landscaping Design

In compliance with the Water Conservation in Landscaping Act, the following methods to reduce excessive irrigation runoff shall be implemented:

- Employ rain shutoff devices to prevent irrigation during and after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Use flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

All maintained landscaped areas will include rain shutoff devices to prevent irrigation during and after precipitation. Flow reducers and shutoff valves triggered by pressure drop will be used to control water loss from broken sprinkler heads or lines.

6.5 – Storm Water Conveyance Systems Stenciling and Signage

The proposed development will incorporate concrete stamping, or equivalent, of all storm water conveyance system inlets and catch basins within the project area with prohibitive language (e.g., "No Dumping – I Live in <<name receiving water>>"), satisfactory to the City Engineer. Stamping may also be required in Spanish.

6.6 – Maintenance of Sidewalks and Parking Lots

Sidewalks and parking lots shall be swept regularly to prevent the accumulation of litter and debris.

CHAPTER 7 – SITE DESIGN & LID BMPS

The following Site Design and LID BMPs are specific to the current development proposed for the Otay Ranch Village 2 South and R-15c project sites which will include the construction of service roads, residential lots, a park, two CPF sites, industrial sites, sidewalks, and utilities.

Future development of some of the mass graded pads will be the responsibility of a future developer/ builder. They will be required to ensure that all future developed runoff from the aforementioned pad is treated in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system.

7.1 – Site Design & LID BMPs

Priority projects, such as the Otay Ranch Village 2 South and R-15c developments, shall be designed to minimize, to the maximum extent practicable, the introduction of pollutants generated from site runoff and address conditions of concern that may impact the receiving watershed and/or downstream water conveyance systems. Site design & LID components can significantly reduce the impact of a project on the environment.

Low Impact Development is an innovative stormwater management approach with the basic principle that is modeled after nature: manage rainfall runoff at the source using uniformly distributed decentralized micro-scale controls.

LID's goal is to mimic a site's predevelopment hydrology by using design practices and techniques that effectively capture, filter, store, evaporate, detain and infiltrate runoff close to its source.

7.2 – Conserve Natural Areas

The Otay Ranch Village 2 South and R-15c urban development will incorporate open space areas and vegetation throughout the development. Also, the multi-family portion of the project will implement natural landscaped areas to the maximum amount practical.

7.3 – Minimize Impervious Footprint

Methods of accomplishing this goal include:

- Increase building density (number of stories above or below ground), where applicable;
- Construct walkways, trails, patios, overflow parking lots and alleys and other low-traffic areas with permeable surfaces, such as pervious concrete, unit pavers, and granular materials, where applicable;
- Construct streets, sidewalks and parking lot aisles to the minimum widths necessary, provided that public safety and a walkable environment for pedestrians are not compromised;
- Minimize the use of impervious surfaces in the landscape design.

7.4 – Minimize Directly Connected Impervious Areas

Methods of accomplishing this goal include:

- Where landscaping is proposed, drain rooftops into adjacent landscaping where it is safe and appropriate and will not cause damage or adverse impacts to any existing and proposed structures, slopes, pavements, or other features prior to discharging to the storm water conveyance system;
- Where landscaping is proposed, drain impervious parking lots, sidewalks, walkways, trails, and patios into adjacent landscaping where it is safe and appropriate and will not cause damage or adverse impacts to any structures, slopes, pavements, or other features.

7.5 – Minimize Soil Compaction in Landscape Areas

Prior to final landscape installation in areas disturbed due to construction and where landscaping will be placed, the subsoils below the topsoil layer shall be scarified at least 6 inches. If upper layers of topsoil exists or is imported, incorporate the upper or topsoil material to avoid stratified layers.

7.6 – Soil Amendments

Landscape top soil improvements play a significant role in maintaining plant and lawn health plus improve the soil's capacity to retain moisture, which will reduce runoff from the water quality design storm and improve water quality. San Diego Landscape regulations will be adhered to for landscaped areas.

7.7 – Protect Slopes, Channels & Energy Dissipation/Erosion Control

Methods of accomplishing this goal include:

- Use of natural drainage systems to the maximum extent practicable.
- Stabilize permanent channel crossings.
- Planting native or drought tolerant vegetation on slopes.
- Energy dissipators, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels.

CHAPTER 8 – BMPS APPLICABLE TO INDIVIDUAL PRIORITY DEVELOPMENT PROJECT CATEGORIES

8.1 –Roads

The design of private roadway drainage shall use at least one of the following:

- Rural swale system- street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings;
- Urban curb/swale system- provide periodic curb cuts to allow street runoff to drain to vegetated swale/bioretention area;
- Dual drainage system- first flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder. Connect high flows directly to storm drainage system.
- Other methods, which are comparable and equally effective within the project, as determined by the City Engineer.

Curb cuts along the southern portion of Heritage Road will allow water quality flows to enter the linear swale BMPs located behind the curb. See BMP Location Map in Chapter 12 for size and spacing requirements.

8.2 – Residential Driveways & Guest Parking

Driveways shall have one of the following:

- Shared access;
- Flared entrance (single lane at street);
- Wheelstrips (paving only under tires);
- Porous paving;
- Designed to drain into landscaping prior to discharging to the storm water conveyance system.

Uncovered temporary or guest parking on private residential lots may be:

- Paved with a permeable surface;
- Designed to drain into landscaping prior to discharging to the storm water conveyance system.

This will not be incorporated within the site design since the residential areas per this TM will address Water Quality via one of the proposed basins.

8.3 – Dock Areas

Loading/unloading dock areas shall include the following:

- Cover loading dock areas, or design drainage to preclude urban run-on and runoff;
- An acceptable method of containment and pollutant removal, such as a shut-off valve and containment area.

Direct connections to storm drains from depressed loading docks (truck wells) are prohibited. This will apply to future development of at the industrial sites but does does not apply to the residential areas within the Village 2 South TM project area.

8.4 – Maintenance Bays

Maintenance bays shall include at least one of the following:

- Repair/ maintenance bays shall be indoors; or
- Designed to preclude urban run-on and runoff

Maintenance bays shall include a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm water conveyance system is prohibited.

This will apply to future development of at the industrial sites but does does not apply to the residential areas within the Village 2 South TM project area.

8.5 – Vehicle & Equipment Wash Areas

Areas for washing/steam cleaning of vehicles and areas for outdoor equipment/accessory washing and steam cleaning shall be:

- Self-contained to preclude run-on and run-off, covered with a roof or overhang, and equipped with a clarifier or other pretreatment facility;
- Properly connected to a sanitary sewer.

This does not apply to the Village 2 South TM

8.6 – Outdoor Processing Areas

Outdoor processing areas shall:

- Cover or enclose areas that would be the most significant source of pollutants; or slope the area toward a dead-end sump; or, discharge to the sanitary sewer system.
- Grade or berm processing area to prevent run-on from surrounding areas.
- Installation of storm drains in areas of equipment repair is prohibited.

This may apply to future development of at the industrial sites but does does not apply to the residential areas within the Village 2 South TM project area.

8.7 – Surface Parking Areas

Where landscaping is proposed in surface parking areas (both covered and uncovered), incorporate landscape areas into the drainage design. Overflow parking (parking in excess of the project's minimum parking requirements) may be constructed with permeable paving.

This will apply to future development of at the commercial areas, the CPF site(s), and some of the multi-family areas within the Village 2 South TM project area.

8.8 – Non-Retail Fueling Areas

Non-Retail fueling areas shall be designed with the following:

- Fuel dispensing area that is: (1) paved with Portland cement concrete or equivalent smooth impervious surface (asphalt concrete is prohibited); (2) designed to extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1

foot (0.3 meter), whichever is less; (3) sloped to prevent ponding; (4) separated from the rest of the site by a grade break that prevents run-on of urban runoff; and (5) designed to drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.

- Overhanging roof structure or canopy that is: (1) equal to or greater than the area within the fuel dispensing area's grade break; and (2) designed not to drain onto or across the fuel dispensing area.

This does not apply to the Village 2 South TM

8.9 – Steep Hillside Landscaping

Steep hillside areas disturbed by project development shall be landscaped with deep rooted, drought tolerant and/or native plant species selected for erosion control, satisfactory to the City of Chula Vista.

Table 8.1

Priority Project Category	Site Design BMPs[1]	Source Control BMPs[2]	Requirements Applicable to Individual Priority Project Categories[(3)]										
			a. Private Roads	b. Residential Driveways & Guest Parking	c. Dock Areas	d. Maintenance Bays	e. Vehicle Wash Areas	f. Outdoor Processing Areas	g. Equipment Wash Areas	h. Parking Areas	i. Roadways	j. Fueling Areas	k. Hillside Landscaping
Detached Residential Development	R	R	R	R									R
Attached Residential Development	R	R	R										
Commercial Development	R	R			R	R	R	R					
Automotive Repair Shop	R	R			R	R	R		R			R	
Restaurants	R	R			R				R				
Hillside Development	R	R	R										R
Parking Lots	R	R								R[(4)]			
Streets, Highways, & Freeways	R	R									R		

R = Required; select BMPs as required from the applicable steps in Section 3.6.2.a & b, or equivalent as identified in Section 3.6.2 of the Development Storm Water Manual.

(1) Refer to Section 3.6.2.a of the Development Storm Water Manual.
(2) Refer to Section 3.6.2.b of the Development Storm Water Manual.
(3) Priority project categories must apply specific storm water BMP requirements, where applicable. Projects are subject to the requirements of all priority project categories that apply.
(4) Applies if the paved area totals>5,000 square feet or with>15 parking spaces and is potentially exposed to urban runoff.

Per Table 8.1, the future development shall incorporate Site Design and Source Control BMPs as well as the requirements applicable individual priority projects as highlighted above.

CHAPTER 9 – OPERATIONS & MAINTENANCE PLAN

9.1 – Maintenance Requirements

Maintenance of the site BMPs within the Heritage Road public right-of-way (between back of street curb and property line) will be the responsibility of the Landscape Maintenance District to be funded by a Community Facilities District (CFD). The water quality and hydromodification basins will also be maintained through the CFD. A maintenance plan will be developed and will include the following information:

Specification of routine and non-routine maintenance activities to be performed.

A schedule for maintenance activities.

Name, qualifications, and contact information for the parties responsible for maintaining the BMPs.

Refer to BMP Location Exhibit 1.5 in Chapter 12 for designation of areas

9.2 – Operations and Maintenance Plan

9.2.1 – Linear Swales

Target Maintenance Dates – March 15th, September 15th
Maintenance Activity – Inspection and removal of foreign debris, silt, mulch and trash. RE-plant or re-seed barren areas or badly established vegetation. Drain standing water. Evaluate health of plant and prune or replace as necessary. Replace mulch.

9.2.2 – Bioretention Basin

Target Maintenance Dates – March 15th, September 15th
Maintenance Activity – Repair sill, headwall, inlet, outlet, or other structures. Replace rip rap. Remove sediment accumulation. Trim vegetation to 12 inches. Inspection and removal of foreign debris, silt, mulch and trash. Evaluate filter media and recharge as necessary. Evaluate health of plant and prune or replace as necessary. Replace mulch as necessary

For proper maintenance to be performed, all storm water treatment facilities must be accessible to both maintenance personnel and their equipment and materials.

9.3 – Annual Operations & Maintenance Costs

The following costs are intended only to provide a magnitude of the costs involved in maintaining BMPs within the public right-of-way. Funding shall be provided by the Community Facilities District for the Otay Ranch Village 2 South project site and the HOA.

Approximate annual maintenance costs for the proposed Bioretention BMPs are outlined below.

9.3.1 – Linear Swales (Heritage Road)

For streets (Heritage Road) - Inspection and Maintenance ($0.35 per SF x 2 times a year x 20,755 SF) = $14,529

Bioretention Linear Swales Total (inclusive of 10% Contingency) = $15,982

9.3.2 – Bioretention Basin

Inspection and Maintenance

Assume Silt Clogging of bottom 2.0' Dry Weather Storage Area in Basins 1-3 = 2.74 acre-feet
= 4,421 CY

Annual Silt Removal Costs = 4,421 CY @ $10/CY = $44,210

Annual Inspection by Engineer = $2,000

Periodic and Post-Major Rainfall Inspections and Trash/Debris/Sediment Cleanout…assume (10) periodic/post-major rainfall inspections per year…assume (3) man crew…assume ½ -day cleanout time…assume $50 hourly rate…Periodic Inspection and Maintenance Annual Cost = $6,000

Total Maintenance Costs = $52,210

Bioretention Basin Total (inclusive of 10% Contingency) = $57,431

Chapter 10 – FISCAL RESOURCES

10.1 – Agreements (Mechanisms to Assure Maintenance)

There are multiple BMPs within the Otay Ranch Village 2 South site for storm water quality and hydromodification treatment.

Funding for water quality treatment BMP's within the public right-of-way for Heritage Road and the water quality/hydromodification basins will be provided by the Community Facilities Maintenance District (CFD) for the Otay Ranch Village 2 South and R-15c developments. The CFD will be responsible to perform the maintenance activities and ensure adequate funding into perpetuity.

The City of Chula Vista Watershed Protection, Stormwater Management, and Discharge Control Ordinance require ongoing maintenance of BMPs to ensure the proper function and operation of theses BMPs. Costs for this maintenance will be the covered by the CFD following completion and acceptance and by the contractor during construction of the development.

The CFD for the development will be fiscally responsible for the maintenance and upkeep of the onsite BMPs indefinitely.

Additionally, a BMP Maintenance Agreement with Easement and/or Covenant will be entered into with the City of Chula Vista. The agreement will commit the land to being used only for purposes of the BMP; the agreement will include an obligation to maintain the facilities in accordance with the water quality technical report. The final map will include an easement giving the City the right to enter onto the land for access to inspect the BMPs.

CHAPTER 11 – HYDROMODIFICATION ANALYSIS

Hydromodification Management Plan

INTRODUCTION

This report summarizes the approach used to model the proposed Otay Ranch Village 2 South project site in Chula Vista, CA using the Environmental Protection Agency (EPA) Storm Water Management Model 5.0 (SWMM). SWMM models were prepared for the pre and post developed conditions at the site in order to determine if the proposed bioretention and detention basin facilities have sufficient footprint to meet the current Hydromodification Management Plan (HMP) requirements from the Regional Water Quality Control Board (RWQCB).

Note that this HMP addresses the areas owned by Baldwin & Sons only and per the Developed Condition Hydromodification map in attachment 10 there are areas within the development listed as Not A Part (NAP). These areas correspond to portions of the Otay Ranch Village 2 South development owned by Sunwood which will address Hydromodification and Water Quality independently. The drainage study for this project addresses the impact of full buildout however this HMP sizes facilities for the Baldwin & Sons portion of the development only.

SWMM MODEL DEVELOPMENT

Two (2) SWMM models were prepared for this study, one for existing conditions and the second for the proposed condition. SWMM was used since we have found it to be more comparable to San Diego area watersheds than the more widely used San Diego Hydrology Model (SDHM). For both SWMM models, flow duration curves were prepared to determine if the proposed bioretention & detention basin footprint was sufficient to meet the current HMP requirements.

The inputs required to develop SWMM models include rainfall, watershed characteristics, and BMP configurations. The Lindberg Rain Gage from the Project Clean Water website was used for this study, since it is the most representative of the project site precipitation among the three gages used for modeling the characteristics of the county by the approved calculator (Lindbergh, Wohlford and Oceanside).

Evaporation for the site was modeled using average monthly values from the county hourly dataset. The site was modeled with hydrologic soil group D soils as determined from both the San Diego County Hydrology Manual soil map and the USGS Survey web-based Soil Survey Map. Other SWMM inputs for the subareas are discussed in the appendix to this document where the selection of the parameters is explained in detail.

BIORETENTION MODELING

Developed storm water runoff is routed through two (2) bioretention basins and one (1) detention basin located near the southern portion of the site. Flows from the proposed project drain to these aforementioned bioretention basins via proposed onsite storm drain system. Discharge from the two bioretention basins then confluence together to discharge to the detention basin. The detention basin then discharges to a tributary of Wolf Canyon south of the project site at the project point of compliance.

Basin Discussion:

Flow will exit Basin #1 via one (1) 3" sub drain, Basin #2 via one (1) 4" sub drain, and Basin #3 via six (6) orifices. Each basin also contains an emergency overflow riser box. Once flows exceed the rim elevation of the riser, runoff will drain over the weir and enter discharge pipe. Refer to the Basin Table below for depths and dimensions, and Attachment 5 for the typical bioretention cross section.

Basin Table

	Basin #1	Basin #2	Basin #3
Basin Height (ft)*	5.0'	10.0'	20.0'
Riser Height (ft)*	3.3'	7.0'	11.0
Amended Soil Depth (in)	18"	18"	N/A
Class 2 Perm. Depth (in)	18"	48"	N/A
Sub Drain			
	3"	4"	N/A
Low Orifice			
No. of Orifices	N/A	N/A	3
Diameter (in)	N/A	N/A	3"
Invert Height (ft)*	N/A	N/A	0.00'
Middle Orifice			
No. of Orifices	N/A	N/A	3
Diameter (in)	N/A	N/A	3"
Invert Height (ft)*	N/A	N/A	3.00'
Top Orifice			
No. of Orifices	N/A	N/A	N/A
Diameter (in)	N/A	N/A	N/A
Invert Height (ft)*	N/A	N/A	N/A

*From finish grade

Once flows have been routed through the respective basin outlet structures, flows are conveyed via a storm drain pipe, discharging to a tributary of Wolf Canyon at the project point of compliance. Flows then continue in a southerly direction along this tributary and confluence with flows within Wolf Canyon, eventually discharging to Otay River.

The bioretention basins were modeled using the bioretention LID module within SWMM. The bioretention module can model the underground gravel storage layer, underdrain with an orifice plate, amended soil layer, and a surface storage pond up to the elevation of the invert of the orifice. A separate diversion and detention basin were used to model the portion of the storage pond between the base orifice invert elevations and the spillway elevation from the bioretention basin, according to the assumptions explained in the appendix.

FLOW DURATION CURVE COMPARISON

The Flow Duration Curve (FDC) for the site was compared at the Point of Compliance (POC-1) by exporting the hourly runoff time series results from SWMM to a spreadsheet. FDC was compared between 10% of the existing condition Q_2 up to the existing condition Q_{10}. The Q_2 and Q_{10} were determined using a partial duration statistical analysis of the runoff time series in an Excel spreadsheet using the Cunnane plotting position method (which is the preferred plotting methodology in the HMP Permit). As the SWMM Model is a statistical analysis based on the Weibull Plotting Position Method, the Weibull Method was also used within the spreadsheet to ensure that the results were similar to those obtained by the SWMM Model.

The range between 10% of Q_2 and Q_{10} was divided into 100 equal time intervals; the number of hours that each flow rate was exceeded was counted from the hourly series. Additionally, the intermediate peaks with a return period "i" were obtained (Q_i with i=3 to 9). For the purpose of the plot, the values were presented as percentage of time exceeded for each flow rate.

FDC comparison at POC-1 is illustrated in Figure 1 in both normal and logarithmic scale. POC-1 corresponds with the point located downstream of the discharge of Basin #3. Attachment 10 provides detailed drainage exhibit for the post-developed condition.

As can be seen in Figure 1, the FDC for the proposed condition with the three (3) basin system is within 110% of the curve for the existing condition. The additional runoff volume generated from developing the site will be released to the downstream storm drain at a flow rate below the 10% Q_2 lower threshold. Additionally, the project will also not increase peak flow rates between the Q_2 and the Q_{10}, as shown in the graphic and also in the attached table.

SUMMARY

This study has demonstrated that the proposed bioretention footprint at the Otay Ranch Village 2 South site is sufficient to meet the current HMP criteria if the bioretention cross-section areas and volumes recommended within this technical memorandum are incorporated within the proposed project site.

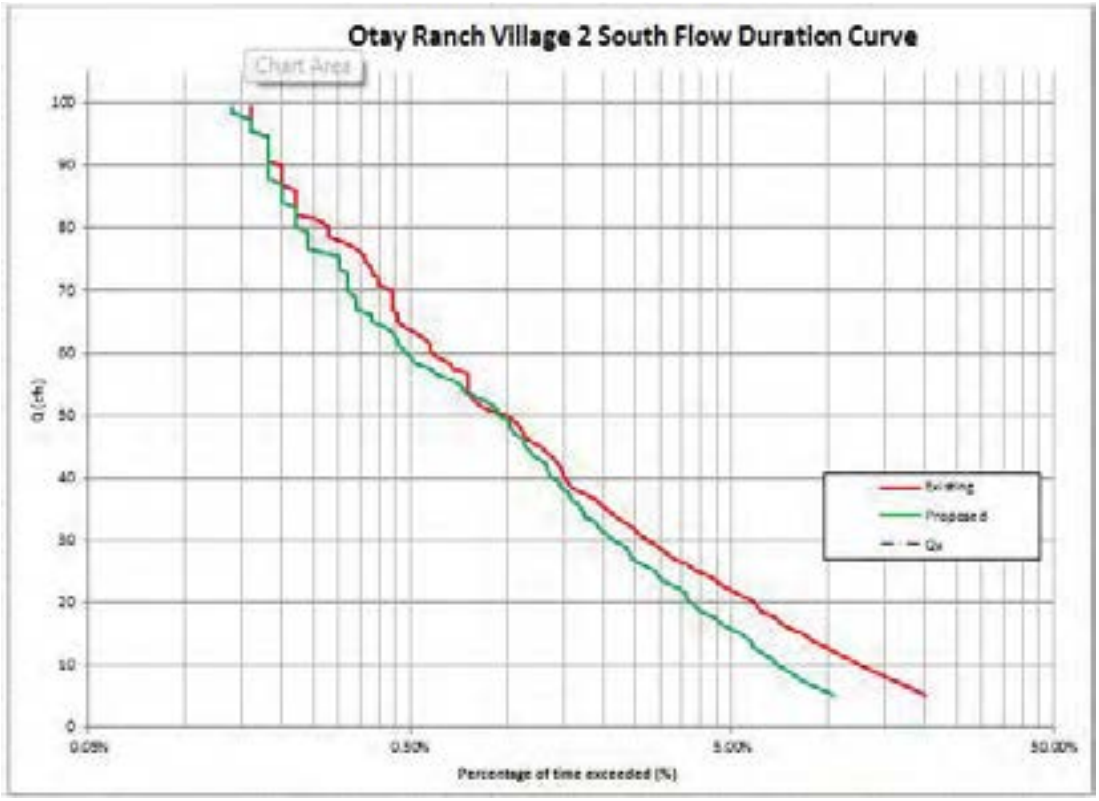
KEY ASSUMPTIONS

1. D Soils are representative of the existing condition site.

ATTACHMENTS

1. Q_2 to Q_{10} Comparison Table
2. Flow Duration Curve Analysis, Plot (log and natural "x" scale) and Table.
3. List of the "n" largest Peaks: Pre-Development and Post-Development Conditions
4. Elevation vs. Area Curves and Elevations vs. Discharge Curves to be used in SWMM
5. Project Plan and Bioretention section sketches
6. SWMM Input Data in Input Format (Existing and Proposed Models)

7. SWMM Screens and Explanation of Significant Variables
8. Drying Time of the Surface Layer of Bio-retention cells
9. USGS Soil Map for justification of Soil Type D Conditions
10. Hydromodification Watershed Maps



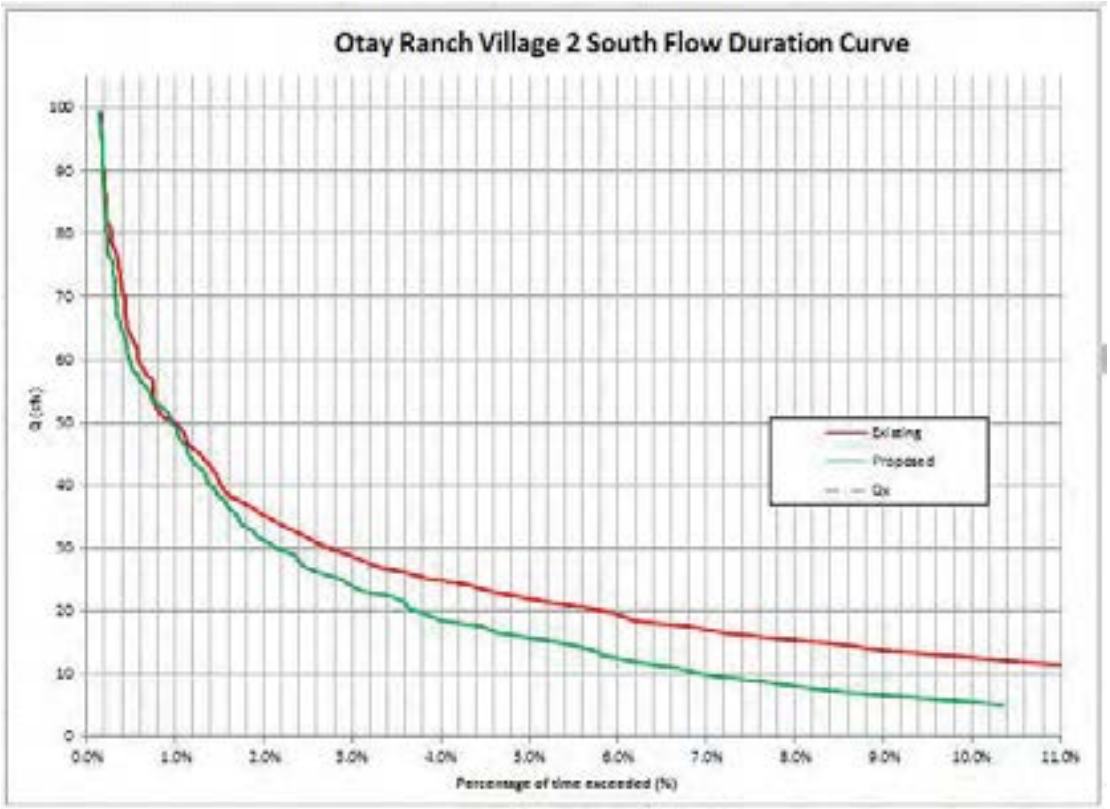


Figure 1a and 1b. Flow Duration Curve Comparison (logarithmic and normal "x" scale)

ATTACHMENT 1

Q_2 to Q_{10} Comparison Table

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
2-year	51.30	46.29	5.01
3-year	60.38	56.70	3.68
4-year	72.54	64.12	8.42
5-year	77.21	75.78	1.44
6-year	80.88	76.75	4.13
7-year	83.59	85.19	-1.60
8-year	88.52	90.37	-1.85
9-year	92.91	95.52	-2.61
10-year	99.42	97.69	1.73

ATTACHMENT 2

Flow Duration Curve Analysis, Plot & Table

Flow duration curve shall not exceed the existing conditions by more than 10% neither in peak flow nor duration.

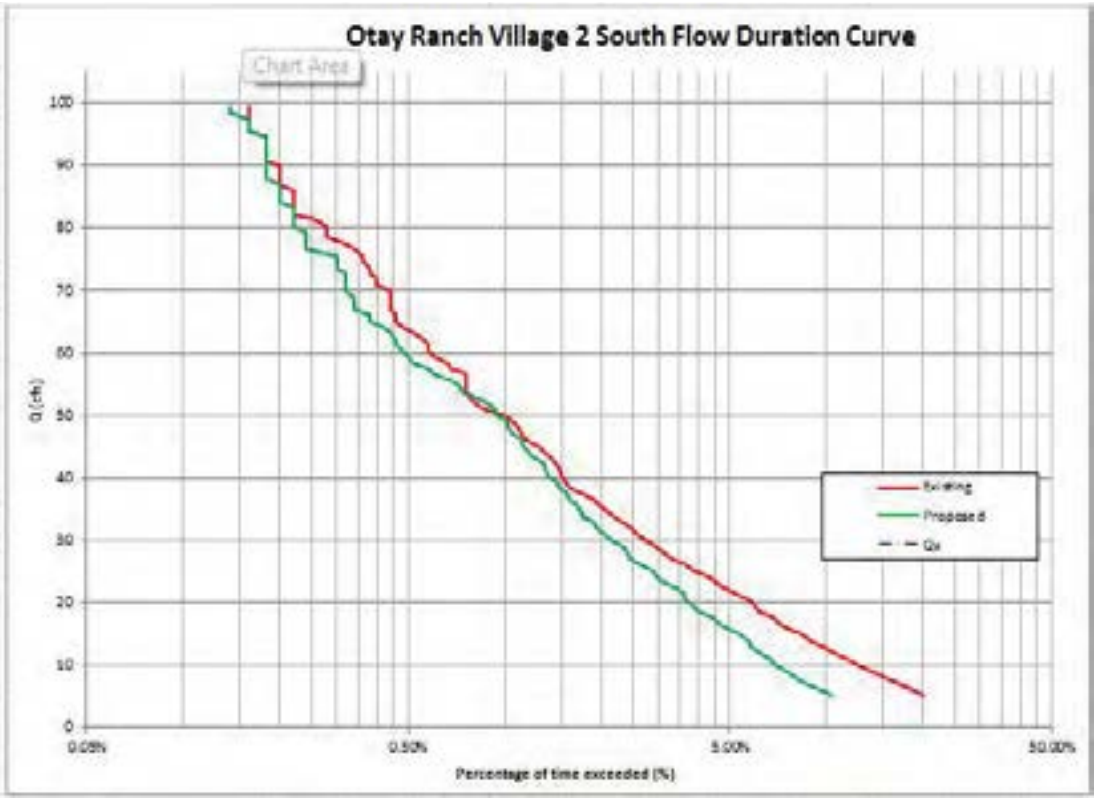
The figure on the following page illustrates that the flow duration curve in post-development conditions after the proposed BMPs is below the existing flow duration curve. The flow duration curve table following the curve shows that if the interval 0.10Q 2 – Q 10 is divided in 100 sub-intervals, then a) the post development divided by pre-development durations are never larger than 110% (the permit allows up to 110%); and b) there are no more than 10 intervals in the range 101%-110% which would imply an excess over 10% of the length of the curve (the permit allows less than 10% of excesses measured as 101-110%).

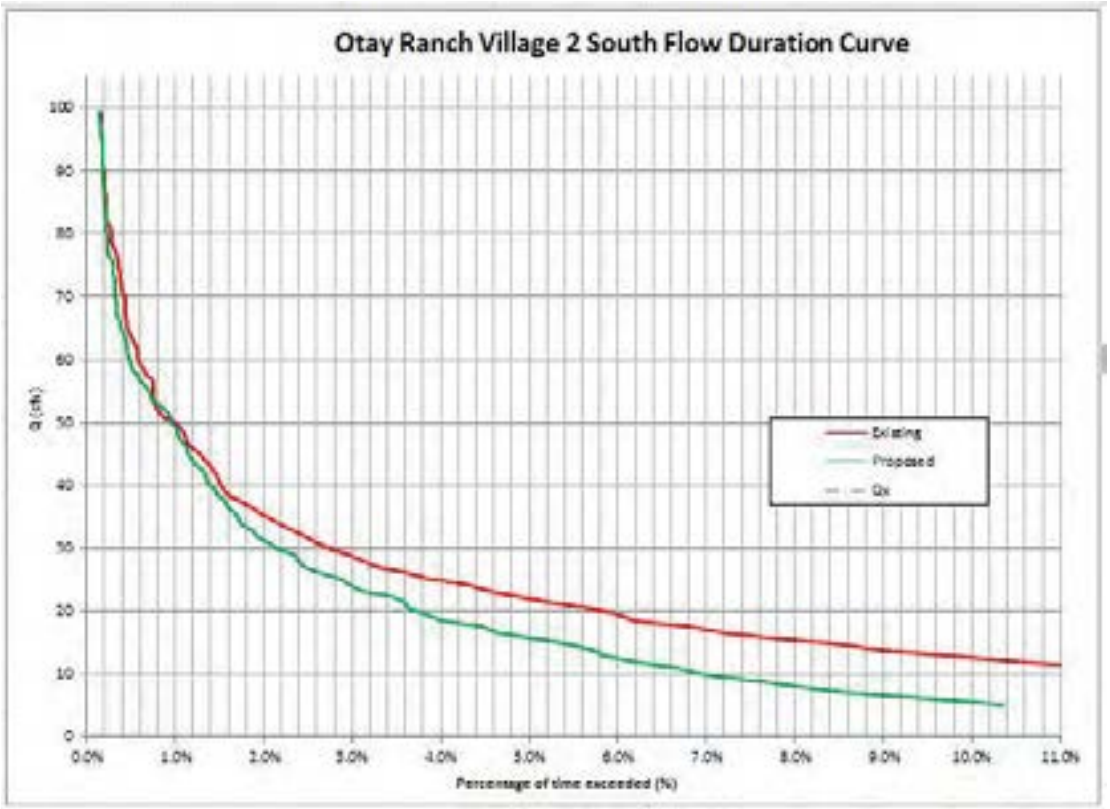
Consequently, the design passes the hydromodification test.

It is important to note that the flow duration curve can be expressed in the "x" axis as percentage of time, hours per year, total number of hours, or any other similar time variable. As those variables only differ by a multiplying constant, their plot in logarithmic scale is going to look exactly the same and compliance can be observed regardless of the variable selected. The selection of a logarithmic scale in lieu of the normal scale is preferred, as differences between the pre-development and post-development curves can be seen more clearly in the entire range of analysis. Both graphics are presented for reference.

In terms of the "y" axis, the peak flow value is the variable of choice. As an additional analysis performed by H&A, not only the range of analysis is clearly depicted (10% of Q 2 to Q 10) but also all intermediate flows are shown (30% of Q 2 , 50% of Q 2 , Q 2 , Q 3 , Q 4 , Q 5 , Q 6 , Q 7 , Q 8 and Q 9) in order to demonstrate compliance at any range Q x – Q x+1 . It must be pointed out that one of the limitations of both the SWMM and SDHM models is that the intermediate analysis is not performed (to obtain Q i from i = 2 to 10). H&A performed the analysis using the Cunnane Plotting position Method (the preferred method in the HMP permit) from the "n" largest independent peak flows obtained from the continuous time series.

The largest "n" peak flows are attached in this appendix, as well as the values of Q_i with a return period "i", from i=2 to 10. The Q i values are also added into the flow-duration plot.


Otay Ranch Village 2 South Flow Duration Curve
Chart Area
Q (cfs)
Percentage of time exceeded (%)
Existing
Proposed
Qx


Otay Ranch Village 2 South Flow Duration Curve
Q (cfs)
Percentage of time exceeded (%)
Existing
Proposed
Qx

Flow Duration Curve Data for Otay Ranch Village 2 West in Chula Vista, CA

Q2 =	51.30	cfs	Fraction Q2=	10 %
Q10 =	99.42	cfs		
Step =	0.9524	cfs		
Count =	499678	hours		
	57.00	years		

Interval	Existing Condition			Detention Basin Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
1	5.130	1002	2.01E-01	517	1.03E-01	52%	Pass
2	6.082	908	1.82E-01	467	9.35E-02	51%	Pass
3	7.035	830	1.66E-01	427	8.55E-02	51%	Pass
4	7.987	763	1.53E-01	403	8.07E-02	53%	Pass
5	8.940	693	1.39E-01	376	7.52E-02	54%	Pass
6	9.892	632	1.26E-01	350	7.00E-02	55%	Pass
7	10.844	583	1.17E-01	333	6.66E-02	57%	Pass
8	11.797	533	1.07E-01	313	6.26E-02	59%	Pass
9	12.749	489	9.79E-02	292	5.84E-02	60%	Pass
10	13.701	449	8.99E-02	286	5.72E-02	64%	Pass
11	14.654	422	8.45E-02	270	5.40E-02	64%	Pass
12	15.606	386	7.72E-02	251	5.02E-02	65%	Pass
13	16.559	360	7.20E-02	232	4.64E-02	64%	Pass
14	17.511	340	6.80E-02	223	4.46E-02	66%	Pass
15	18.463	310	6.20E-02	202	4.04E-02	65%	Pass
16	19.416	299	5.98E-02	191	3.82E-02	64%	Pass
17	20.368	286	5.72E-02	182	3.64E-02	64%	Pass
18	21.320	260	5.20E-02	179	3.58E-02	69%	Pass
19	22.273	243	4.86E-02	172	3.44E-02	71%	Pass
20	23.225	227	4.54E-02	156	3.12E-02	69%	Pass
21	24.178	213	4.26E-02	148	2.96E-02	69%	Pass
22	25.130	194	3.88E-02	144	2.88E-02	74%	Pass
23	26.082	180	3.60E-02	131	2.62E-02	73%	Pass
24	27.035	164	3.28E-02	123	2.46E-02	75%	Pass
25	27.987	155	3.10E-02	119	2.38E-02	77%	Pass
26	28.940	148	2.96E-02	117	2.34E-02	79%	Pass
27	29.892	139	2.78E-02	108	2.16E-02	78%	Pass
28	30.844	129	2.58E-02	102	2.04E-02	79%	Pass
29	31.797	124	2.48E-02	97	1.94E-02	78%	Pass
30	32.749	116	2.32E-02	94	1.88E-02	81%	Pass
31	33.701	110	2.20E-02	88	1.76E-02	80%	Pass
32	34.654	103	2.06E-02	86	1.72E-02	83%	Pass
33	35.606	98	1.96E-02	84	1.68E-02	86%	Pass
34	36.559	94	1.88E-02	80	1.60E-02	85%	Pass
35	37.511	86	1.72E-02	78	1.56E-02	91%	Pass
36	38.463	80	1.60E-02	74	1.48E-02	93%	Pass

Interval	Existing Condition			Detention Basin Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
37	39.416	77	1.54E-02	72	1.44E-02	94%	Pass
38	40.368	75	1.50E-02	68	1.36E-02	91%	Pass
39	41.320	74	1.48E-02	67	1.34E-02	91%	Pass
40	42.273	72	1.44E-02	66	1.32E-02	92%	Pass
41	43.225	69	1.38E-02	61	1.22E-02	88%	Pass
42	44.178	66	1.32E-02	59	1.18E-02	89%	Pass
43	45.130	64	1.28E-02	57	1.14E-02	89%	Pass
44	46.082	58	1.16E-02	56	1.12E-02	97%	Pass
45	47.035	56	1.12E-02	53	1.06E-02	95%	Pass
46	47.987	55	1.10E-02	51	1.02E-02	93%	Pass
47	48.940	53	1.06E-02	51	1.02E-02	96%	Pass
48	49.892	50	1.00E-02	47	9.41E-03	94%	Pass
49	50.844	44	8.81E-03	47	9.41E-03	107%	Pass
50	51.797	41	8.21E-03	45	9.01E-03	110%	Pass
51	52.749	39	7.81E-03	41	8.21E-03	105%	Pass
52	53.701	38	7.60E-03	37	7.40E-03	97%	Pass
53	54.654	38	7.60E-03	36	7.20E-03	95%	Pass
54	55.606	38	7.60E-03	34	6.80E-03	89%	Pass
55	56.559	38	7.60E-03	30	6.00E-03	79%	Pass
56	57.511	34	6.80E-03	29	5.80E-03	85%	Pass
57	58.463	33	6.60E-03	26	5.20E-03	79%	Pass
58	59.416	30	6.00E-03	25	5.00E-03	83%	Pass
59	60.368	29	5.80E-03	24	4.80E-03	83%	Pass
60	61.320	29	5.80E-03	23	4.60E-03	79%	Pass
61	62.273	28	5.60E-03	23	4.60E-03	82%	Pass
62	63.225	26	5.20E-03	22	4.40E-03	85%	Pass
63	64.178	24	4.80E-03	21	4.20E-03	88%	Pass
64	65.130	23	4.60E-03	19	3.80E-03	83%	Pass
65	66.082	23	4.60E-03	19	3.80E-03	83%	Pass
66	67.035	22	4.40E-03	17	3.40E-03	77%	Pass
67	67.987	22	4.40E-03	17	3.40E-03	77%	Pass
68	68.940	22	4.40E-03	17	3.40E-03	77%	Pass
69	69.892	22	4.40E-03	16	3.20E-03	73%	Pass
70	70.844	20	4.00E-03	16	3.20E-03	80%	Pass
71	71.797	20	4.00E-03	16	3.20E-03	80%	Pass
72	72.749	19	3.80E-03	16	3.20E-03	84%	Pass
73	73.701	19	3.80E-03	15	3.00E-03	79%	Pass
74	74.654	18	3.60E-03	15	3.00E-03	83%	Pass
75	75.606	18	3.60E-03	15	3.00E-03	83%	Pass
76	76.559	17	3.40E-03	12	2.40E-03	71%	Pass
77	77.511	16	3.20E-03	12	2.40E-03	75%	Pass
78	78.463	14	2.80E-03	12	2.40E-03	86%	Pass
79	79.416	14	2.80E-03	12	2.40E-03	86%	Pass
80	80.368	14	2.80E-03	11	2.20E-03	79%	Pass
81	81.320	13	2.60E-03	11	2.20E-03	85%	Pass

Interval	Existing Condition			Detention Basin Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
82	82.273	11	2.20E-03	11	2.20E-03	100%	Pass
83	83.225	11	2.20E-03	11	2.20E-03	100%	Pass
84	84.178	11	2.20E-03	10	2.00E-03	91%	Pass
85	85.130	11	2.20E-03	10	2.00E-03	91%	Pass
86	86.082	11	2.20E-03	10	2.00E-03	91%	Pass
87	87.035	10	2.00E-03	10	2.00E-03	100%	Pass
88	87.987	10	2.00E-03	9	1.80E-03	90%	Pass
89	88.940	10	2.00E-03	9	1.80E-03	90%	Pass
90	89.892	10	2.00E-03	9	1.80E-03	90%	Pass
91	90.844	9	1.80E-03	9	1.80E-03	100%	Pass
92	91.797	9	1.80E-03	9	1.80E-03	100%	Pass
93	92.749	9	1.80E-03	9	1.80E-03	100%	Pass
94	93.701	9	1.80E-03	9	1.80E-03	100%	Pass
95	94.654	9	1.80E-03	9	1.80E-03	100%	Pass
96	95.606	8	1.60E-03	8	1.60E-03	100%	Pass
97	96.559	8	1.60E-03	8	1.60E-03	100%	Pass
98	97.511	8	1.60E-03	8	1.60E-03	100%	Pass
99	98.463	8	1.60E-03	7	1.40E-03	88%	Pass
100	99.416	8	1.60E-03	7	1.40E-03	88%	Pass

Peak Flows calculated with Cunnane Plotting Position

Return Period	Pre-dev. Q	Post-Dev. Q	Reduction
10	99.416	97.686	1.730
9	92.909	95.522	-2.613
8	88.524	90.374	-1.850
7	83.588	85.185	-1.597
6	80.881	76.753	4.128
5	77.206	75.767	1.439
4	72.538	64.116	8.422
3	60.384	56.701	3.683
2	51.300	46.290	5.010

ATTACHMENT 3

List of Peak Events and Determination of Q2 & Q10 (Pre & Post-Development)

List of Peak events and Determination of P2 and P10 (Pre-Development)

T	Cunnane	Weibull				Period of Return	
10	**99.42**	**101.84**	Peaks	Date	Position	Weibull	Cunnane
9	**92.91**	**95.95**	32.09	3/5/1981	57	1.02	1.01
8	**88.52**	**89.69**	32.24	1/12/2001	56	1.04	1.03
7	**83.59**	**85.22**	32.68	2/23/2000	55	1.05	1.05
6	**80.88**	**81.01**	33.35	12/5/1966	54	1.07	1.07
5	**77.21**	**77.51**	33.47	2/3/1958	53	1.09	1.09
4	**72.54**	**72.99**	33.81	5/8/1977	52	1.12	1.11
3	**60.38**	**60.68**	34.38	3/16/1958	51	1.14	1.13
2	**51.30**	**51.30**	35.87	12/2/1961	50	1.16	1.15
			36.05	2/21/2000	49	1.18	1.18
			36.2	2/15/1986	48	1.21	1.20
			36.6	2/3/1998	47	1.23	1.23
			37.1	11/16/1965	46	1.26	1.25
			37.61	3/12/1978	45	1.29	1.28
			38.04	1/7/1957	44	1.32	1.31
			38.82	12/21/2002	43	1.35	1.34
			38.95	3/11/1995	42	1.38	1.38
			39.05	12/30/1951	41	1.41	1.41
			43.52	2/19/1993	40	1.45	1.44
			45.38	2/8/1976	39	1.49	1.48
			45.74	3/2/1983	38	1.53	1.52
			45.99	10/10/1986	37	1.57	1.56
			47.17	1/14/1978	36	1.61	1.61
			48.31	12/18/1967	35	1.66	1.65
			49.12	2/8/1998	34	1.71	1.70
			49.19	3/22/1954	33	1.76	1.75
			50.18	2/14/1995	32	1.81	1.81
			50.41	1/14/1969	31	1.87	1.87
			51.13	3/24/1983	30	1.93	1.93
			51.3	4/21/1988	29	2.00	2.00
			51.36	3/6/1975	28	2.07	2.07
			52.31	2/17/1998	27	2.15	2.15
			53.01	3/17/1982	26	2.23	2.23
			56.99	3/1/1983	25	2.32	2.33
			57.03	11/5/1987	24	2.42	2.42
			57.8	12/4/1974	23	2.52	2.53
			58.79	1/10/1978	22	2.64	2.65
			59.19	1/18/1952	21	2.76	2.78
			59.26	3/1/1981	20	2.90	2.92
			61.42	1/6/1979	19	3.05	3.08
			63.02	1/15/1993	18	3.22	3.25
			64.09	1/4/1995	17	3.41	3.45
			70.44	2/24/1998	16	3.63	3.67
			71.89	3/8/1968	15	3.87	3.92
			74.16	3/16/1986	14	4.14	4.21
			76.47	11/21/1967	13	4.46	4.54
			77.01	1/12/1960	12	4.83	4.93
			78.33	2/28/1970	11	5.27	5.40
			80.85	11/16/1972	10	5.80	5.96
			81.36	1/25/1995	9	6.44	6.65
			86.95	2/21/2005	8	7.25	7.53
			90.74	12/29/2004	7	8.29	8.67
			100.81	1/10/1955	6	9.67	10.21
			106.78	10/27/2004	5	11.60	12.43
			110.53	3/7/1952	4	14.50	15.89
			114.28	1/31/1979	3	19.33	22.00
			115.29	2/20/1980	2	29.00	35.75
			188.3	12/10/1965	1	58.00	95.33

Note:
Cunnane is the preferred method by the HMP permit.

List of Peak events and Determination of P2 and P10 (Post-Development)

T	Cunnane	Weibull
10	**97.69**	**98.38**
9	**95.52**	**96.53**
8	**90.37**	**92.71**
7	**85.19**	**86.17**
6	**76.75**	**78.64**
5	**75.77**	**75.87**
4	**64.12**	**64.69**
3	**56.70**	**56.87**
2	**46.29**	**46.29**

Note:
Cunnane is the preferred method by the HMP permit.

			Period of Return	
Peaks	Date	Position	Weibull	Cunnane
25.4	1/7/1977	57	1.02	1.01
25.6	12/16/1987	56	1.04	1.03
26.01	11/16/1972	55	1.05	1.05
26.17	2/4/1958	54	1.07	1.07
26.94	1/12/2001	53	1.09	1.09
27.12	10/10/1986	52	1.12	1.11
27.87	11/17/1972	51	1.14	1.13
28.52	2/14/2003	50	1.16	1.15
28.98	3/20/1991	49	1.18	1.18
28.99	2/15/1986	48	1.21	1.20
29.28	1/23/1967	47	1.23	1.23
30.8	1/29/1980	46	1.26	1.25
30.81	3/16/1952	45	1.29	1.28
31.15	1/12/1995	44	1.32	1.31
31.96	3/27/1991	43	1.35	1.34
32.98	3/11/1995	42	1.38	1.38
33.04	11/25/1985	41	1.41	1.41
34.2	1/16/1993	40	1.45	1.44
34.44	11/23/1965	39	1.49	1.48
38.34	12/14/1965	38	1.53	1.52
38.85	3/1/1991	37	1.57	1.56
39.64	12/4/1974	36	1.61	1.61
40.22	3/6/1975	35	1.66	1.65
41.93	11/16/1965	34	1.71	1.70
42.5	2/24/1998	33	1.76	1.75
43.21	1/12/1960	32	1.81	1.81
44.96	2/3/1998	31	1.87	1.87
45.38	12/5/1966	30	1.93	1.93
46.29	2/21/2000	29	2.00	2.00
46.94	3/1/1983	28	2.07	2.07
47.04	3/8/1968	27	2.15	2.15
49.52	3/1/1981	26	2.23	2.23
49.55	4/21/1988	25	2.32	2.33
52.07	12/30/1951	24	2.42	2.42
52.87	3/2/1983	23	2.52	2.53
53.27	2/19/1993	22	2.64	2.65
55.6	2/8/1976	21	2.76	2.78
56.04	1/6/1979	20	2.90	2.92
57.31	1/14/1978	19	3.05	3.08
58.22	3/17/1982	18	3.22	3.25
58.84	1/10/1955	17	3.41	3.45
59.65	3/22/1954	16	3.63	3.67
63.28	1/14/1969	15	3.87	3.92
66.21	1/18/1952	14	4.14	4.21
66.52	2/17/1998	13	4.46	4.54
75.7	1/4/1995	12	4.83	4.93
76.15	11/21/1967	11	5.27	5.40
76.3	1/15/1993	10	5.80	5.96
83.83	1/25/1995	9	6.44	6.65
87.23	12/29/2004	8	7.25	7.53
94.8	10/27/2004	7	8.29	8.67
98.15	2/28/1970	6	9.67	10.21
99.5	2/21/2005	5	11.60	12.43
105.72	2/20/1980	4	14.50	15.89
118.09	1/31/1979	3	19.33	22.00
135.34	3/7/1952	2	29.00	35.75
139.83	12/10/1965	1	58.00	95.33

ATTACHMENT 4

Elevation vs Area

For the portion of the flow diverted in the LID Control to the receiving detention basin, a pond is used to route the hydrographs. The elevation vs area curve in the model is calculated in Excel and imported into the model at a 0.1 ft interval range.

Elevation vs Discharge

The total discharge peak flow is imported from an Excel spreadsheet that calculated the elevation vs discharge of the multiple outlet system.

The orifices have been selected to maximize their size while still restricting flows to conform to the required 10% of the Q2 event flow as mandated in the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011. While we acknowledge that these orifices are small, to increase the size of these outlets would impact the basins' ability to restrict flows beneath the HMP thresholds, thus preventing the BMP from conformance with HMP requirements.

In order to prevent blockage of the orifice, a debris screen will be fitted to the base invert of the lower orifices located within the detention basin. Regular maintenance of the riser and orifices will be performed to ensure potential blockages are minimized. A detail of the orifice and riser structure is provided in Attachment 5 of this memorandum. The stage-storage and stage-discharge calculations have been provided on the following pages.

Basin #1 Stage Storage					
depth	area	depth	area	depth	area
0.0	2450	2.6	3588		
0.1	2490	2.7	3636		
0.2	2530	2.8	3684		
0.3	2570	2.9	3733		
0.4	2611	3.0	3782		
0.5	2652	3.1	3831		
0.6	2693	3.2	3881		
0.7	2735	3.3	3931		
0.8	2777	3.4	3981		
0.9	2819	3.5	4032		
1.0	2862	3.6	4083		
1.1	2905	3.7	4134		
1.2	2948	3.8	4186		
1.3	2992	3.9	4238		
1.4	3036	4.0	4290		
1.5	3080	4.1	4342		
1.6	3125	4.2	4395		
1.7	3169	4.3	4449		
1.8	3215	4.4	4502		
1.9	3260	4.5	4556		
2.0	3306	4.6	4610		
2.1	3352	4.7	4665		
2.2	3399	4.8	4719		
2.3	3445	4.9	4774		
2.4	3493	5.0	4830		
2.5	3540				

Basin #2 Stage Storage					
depth	area	depth	area	depth	area
0.0	27700	3.0	31838	6.0	36265
0.1	27833	3.1	31981	6.1	36417
0.2	27967	3.2	32125	6.2	36570
0.3	28101	3.3	32268	6.3	36723
0.4	28235	3.4	32412	6.4	36877
0.5	28370	3.5	32556	6.5	37031
0.6	28505	3.6	32701	6.6	37185
0.7	28640	3.7	32845	6.7	37339
0.8	28775	3.8	32991	6.8	37494
0.9	28911	3.9	33136	6.9	37649
1.0	29047	4.0	33282	7.0	37804
1.1	29184	4.1	33428	7.1	37960
1.2	29321	4.2	33574	7.2	38116
1.3	29458	4.3	33721	7.3	38272
1.4	29595	4.4	33868	7.4	38429
1.5	29733	4.5	34016	7.5	38586
1.6	29871	4.6	34163	7.6	38743
1.7	30010	4.7	34311	7.7	38901
1.8	30148	4.8	34460	7.8	39059
1.9	30288	4.9	34608	7.9	39217
2.0	30427	5.0	34757	8.0	39376
2.1	30567	5.1	34907	8.1	39535
2.2	30707	5.2	35056	8.2	39694
2.3	30847	5.3	35206	8.3	39853
2.4	30988	5.4	35356	8.4	40013
2.5	31129	5.5	35507	8.5	40173
2.6	31270	5.6	35658	8.6	40334
2.7	31412	5.7	35809	8.7	40495
2.8	31554	5.8	35961	8.8	40656
2.9	31696	5.9	36113	8.9	40817
				9.0	40979

Basin #3 Stage Storage							
depth	area	depth	area	depth	area	depth	area
0.0	21378	5.0	27626	10.0	34675	15	42523.46
0.1	21495	5.1	27760	10.1	34824	15.1	42688.59
0.2	21613	5.2	27893	10.2	34974	15.2	42854.04
0.3	21730	5.3	28027	10.3	35123	15.3	43019.81
0.4	21848	5.4	28161	10.4	35273	15.4	43185.9
0.5	21967	5.5	28295	10.5	35424	15.5	43352.31
0.6	22086	5.6	28430	10.6	35575	15.6	43519.04
0.7	22205	5.7	28565	10.7	35726	15.7	43686.09
0.8	22324	5.8	28700	10.8	35877	15.8	43853.46
0.9	22444	5.9	28836	10.9	36029	15.9	44021.15
1.0	22564	6.0	28972	11.0	36181	16	44189.16
1.1	22684	6.1	29109	11.1	36333	16.1	44357.49
1.2	22805	6.2	29245	11.2	36486	16.2	44526.14
1.3	22926	6.3	29382	11.3	36639	16.3	44695.11
1.4	23047	6.4	29519	11.4	36792	16.4	44864.4
1.5	23169	6.5	29657	11.5	36946	16.5	45034.01
1.6	23290	6.6	29795	11.6	37099	16.6	45203.94
1.7	23413	6.7	29933	11.7	37254	16.7	45374.19
1.8	23535	6.8	30072	11.8	37408	16.8	45544.76
1.9	23658	6.9	30211	11.9	37563	16.9	45715.65
2.0	23781	7.0	30350	12.0	37718	17	45886.86
2.1	23905	7.1	30489	12.1	37874	17.1	46058.39
2.2	24029	7.2	30629	12.2	38030	17.2	46230.24
2.3	24153	7.3	30769	12.3	38186	17.3	46402.4
2.4	24277	7.4	30910	12.4	38342	17.4	46574.89
2.5	24402	7.5	31051	12.5	38499	17.5	46747.7
2.6	24527	7.6	31192	12.6	38656	17.6	46920.83
2.7	24653	7.7	31333	12.7	38814	17.7	47094.28
2.8	24779	7.8	31475	12.8	38972	17.8	47268.05
2.9	24905	7.9	31617	12.9	39130	17.9	47442.14
3.0	25031	8.0	31760	13.0	39288	18	47616.55
3.1	25158	8.1	31902.3	13.1	39447	18.1	47791.28
3.2	25285	8.2	32045.4	13.2	39606	18.2	47966.33
3.3	25412	8.3	32188.7	13.3	39765	18.3	48141.7
3.4	25540	8.4	32332.4	13.4	39925	18.4	48317.39
3.5	25668	8.5	32476.4	13.5	40085	18.5	48493.4
3.6	25796	8.6	32620.8	13.6	40245	18.6	48669.73
3.7	25925	8.7	32765.4	13.7	40406	18.7	48846.38
3.8	26054	8.8	32910.4	13.8	40567	18.8	49023.35
3.9	26183	8.9	33055.7	13.9	40728	18.9	49200.64
4.0	26313	9	33201.3	14.0	40890	19	49378.25
4.1	26443	9.1	33347.2	14.1	41052	19.1	49556.18
4.2	26573	9.2	33493.5	14.2	41214	19.2	49734.43
4.3	26704	9.3	33640.0	14.3	41377	19.3	49913
4.4	26834	9.4	33786.9	14.4	41539	19.4	50091.89
4.5	26966	9.5	33934.1	14.5	41703	19.5	50271.1
4.6	27097	9.6	34081.7	14.6	41866	19.6	50450.63
4.7	27229	9.7	34229.5	14.7	42030	19.7	50630.48
4.8	27361	9.8	34377.7	14.8	42194	19.8	50810.65
4.9	27494	9.9	34526.2	14.9	42359	19.9	50991.14
						20	51171.95

Basin #1 Discharge

Discharge vs Elevation Table

Low orifice:	4 "	Top orifice:	8 "
Number:	0	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	0.00 ft
Middle orifice:	6 "	Emergency inlet:	
number of orif:	0	Rim height:	3.30 ft
Cg-middle:	0.61	Area (SF=2)	12.57 sq ft
invert elev:	0.00 ft	Circumference	12.57 ft

h (ft)	H/D-low -	H/D-mid -	H/D-top -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qtop-orif (cfs)	Qtop-weir (cfs)	Qtot-top (cfs)	Qemerg (cfs)	Qtot (cfs)
0.0	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.1	0.30	0.20	0.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.2	0.60	0.40	0.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.3	0.90	0.60	0.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.4	1.20	0.80	0.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.5	1.50	1.00	0.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.6	1.80	1.20	0.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.7	2.10	1.40	1.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.8	2.40	1.60	1.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.9	2.70	1.80	1.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.0	3.00	2.00	1.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.1	3.30	2.20	1.65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.2	3.60	2.40	1.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.3	3.90	2.60	1.95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.4	4.20	2.80	2.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.5	4.50	3.00	2.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.6	4.80	3.20	2.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.7	5.10	3.40	2.55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.8	5.40	3.60	2.70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.9	5.70	3.80	2.85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.0	6.00	4.00	3.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.1	6.30	4.20	3.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.2	6.60	4.40	3.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.3	6.90	4.60	3.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.4	7.20	4.80	3.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.5	7.50	5.00	3.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.6	7.80	5.20	3.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.7	8.10	5.40	4.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.8	8.40	5.60	4.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.9	8.70	5.80	4.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.0	9.00	6.00	4.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.1	9.30	6.20	4.65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.2	9.60	6.40	4.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.3	9.90	6.60	4.95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.4	10.20	6.80	5.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.232	1.232
3.5	10.50	7.00	5.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.484	3.484
3.6	10.80	7.20	5.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.401	6.401
3.7	11.10	7.40	5.55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.855	9.855
3.8	11.40	7.60	5.70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13.773	13.773
3.9	11.70	7.80	5.85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18.105	18.105
4.0	12.00	8.00	6.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	22.815	22.815
4.1	12.30	8.20	6.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	27.875	27.875
4.2	12.60	8.40	6.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	33.261	33.261
4.3	12.90	8.60	6.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	38.956	38.956
4.4	13.20	8.80	6.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	44.943	44.943
4.5	13.50	9.00	6.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	51.209	51.209
4.6	13.80	9.20	6.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	57.741	57.741
4.7	14.10	9.40	7.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	64.530	64.530
4.8	14.40	9.60	7.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	71.566	71.566
4.9	14.70	9.80	7.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	77.834	77.834
5.0	15.00	10.00	7.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	80.229	80.229
5.1	15.30	10.20	7.65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	82.555	82.555
5.2	15.60	10.40	7.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	84.817	84.817
5.3	15.90	10.60	7.95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	87.021	87.021
5.4	16.20	10.80	8.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	89.170	89.170
5.5	16.50	11.00	8.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	91.268	91.268
5.6	16.80	11.20	8.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	93.319	93.319
5.7	17.10	11.40	8.55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	95.327	95.327
5.8	17.40	11.60	8.70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	97.292	97.292
5.9	17.70	11.80	8.85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	99.219	99.219
6.0	18.00	12.00	9.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	101.109	101.109
6.1	18.30	12.20	9.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	102.964	102.964
6.2	18.60	12.40	9.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	104.787	104.787

6.3	18.90	12.60	9.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	106.578	106.578
6.4	19.20	12.80	9.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	108.340	108.340
6.5	19.50	13.00	9.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	110.074	110.074
6.6	19.80	13.20	9.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	111.780	111.780
6.7	20.10	13.40	10.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	113.461	113.461
6.8	20.40	13.60	10.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	115.118	115.118
6.9	20.70	13.80	10.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	116.751	116.751
7.0	21.00	14.00	10.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	118.361	118.361
7.1	21.30	14.20	10.65	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	119.950	119.950
7.2	21.60	14.40	10.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	121.518	121.518
7.3	21.90	14.60	10.95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	123.066	123.066
7.4	22.20	14.80	11.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	124.595	124.595
7.5	22.50	15.00	11.25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	126.105	126.105
7.6	22.80	15.20	11.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	127.598	127.598
7.7	23.10	15.40	11.55	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	129.073	129.073
7.8	23.40	15.60	11.70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	130.531	130.531
7.9	23.70	15.80	11.85	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	131.974	131.974
8.0	24.00	16.00	12.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	133.400	133.400
8.1	24.30	16.20	12.15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	134.812	134.812
8.2	24.60	16.40	12.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	136.209	136.209
8.3	24.90	16.60	12.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	137.592	137.592
8.4	25.20	16.80	12.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	138.961	138.961
8.5	25.50	17.00	12.75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	140.317	140.317
8.6	25.80	17.20	12.90	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	141.660	141.660
8.7	26.10	17.40	13.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	142.990	142.990
8.8	26.40	17.60	13.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	144.308	144.308
8.9	26.70	17.80	13.35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	145.614	145.614
9.0	27.00	18.00	13.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	146.908	146.908

Basin #2 Discharge

Discharge vs Elevation Table

Low orifice:	2 "	Top orifice:	6 "
Number:	0	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	6.00 ft
Middle orifice:	3 "	Emergency inlet:	
number of orif:	0	Rim Height:	7.00 ft
Cg-middle:	0.61	Area (sf)=	324.00 sf
invert elev:	4.30 ft	Circumference	72 ft

h (ft)	H/D-low -	H/D-mid -	H/D-top -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qtop-orif (cfs)	Qtop-weir (cfs)	Qtot-top (cfs)	Qemerg (cfs)	Qtot (cfs)
0.0	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.1	0.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.2	1.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.3	1.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.4	2.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.5	3.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.6	3.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.7	4.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.8	4.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.9	5.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.0	6.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.1	6.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.2	7.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.3	7.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.4	8.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.5	9.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.6	9.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.7	10.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.8	10.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.9	11.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.0	12.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.1	12.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.2	13.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.3	13.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.4	14.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.5	15.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.6	15.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.7	16.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.8	16.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.9	17.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.0	18.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.1	18.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.2	19.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.3	19.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.4	20.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.5	21.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.6	21.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.7	22.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.8	22.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.9	23.40	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.0	24.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.1	24.60	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.2	25.20	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.3	25.80	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.4	26.40	0.40	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.5	27.00	0.80	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.6	27.60	1.20	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.7	28.20	1.60	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.8	28.80	2.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.9	29.40	2.40	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.0	30.00	2.80	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.1	30.60	3.20	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.2	31.20	3.60	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.3	31.80	4.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.4	32.40	4.40	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.5	33.00	4.80	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.6	33.60	5.20	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.7	34.20	5.60	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.8	34.80	6.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.9	35.40	6.40	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.0	36.00	6.80	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.1	36.60	7.20	0.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.2	37.20	7.60	0.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

6.3	37.80	8.00	0.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.4	38.40	8.40	0.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.5	39.00	8.80	1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.6	39.60	9.20	1.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.7	40.20	9.60	1.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.8	40.80	10.00	1.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.9	41.40	10.40	1.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7.0	42.00	10.80	2.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7.1	42.60	11.20	2.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.058	7.058
7.2	43.20	11.60	2.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	19.964	19.964
7.3	43.80	12.00	2.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	36.676	36.676
7.4	44.40	12.40	2.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	56.466	56.466
7.5	45.00	12.80	3.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	78.913	78.913
7.6	45.60	13.20	3.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	103.734	103.734
7.7	46.20	13.60	3.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	130.720	130.720
7.8	46.80	14.00	3.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	159.709	159.709
7.9	47.40	14.40	3.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	190.572	190.572
8.0	48.00	14.80	4.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	223.200	223.200
8.1	48.60	15.20	4.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	257.504	257.504
8.2	49.20	15.60	4.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	293.404	293.404
8.3	49.80	16.00	4.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	330.833	330.833
8.4	50.40	16.40	4.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	369.731	369.731
8.5	51.00	16.80	5.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	410.045	410.045
8.6	51.60	17.20	5.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	451.725	451.725
8.7	52.20	17.60	5.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	494.729	494.729
8.8	52.80	18.00	5.60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	539.018	539.018
8.9	53.40	18.40	5.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	584.554	584.554
9.0	54.00	18.80	6.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	631.305	631.305

Basin #3 Discharge

Discharge vs Elevation Table

Low orifice:	3 "	Top orifice:	3 "
Number:	3	Number:	0
Cg-low:	0.61	Cg-low:	0.61
invert elev:	0.00 ft	invert elev:	6.00 ft
Middle orifice:	3 "	Emergency inlet:	
number of orif:	3	Rim depth:	11.00 ft
Cg-middle:	0.61	Area (SF=2)	36.00 sq ft
invert elev:	3.00 ft	Circumference	24 ft

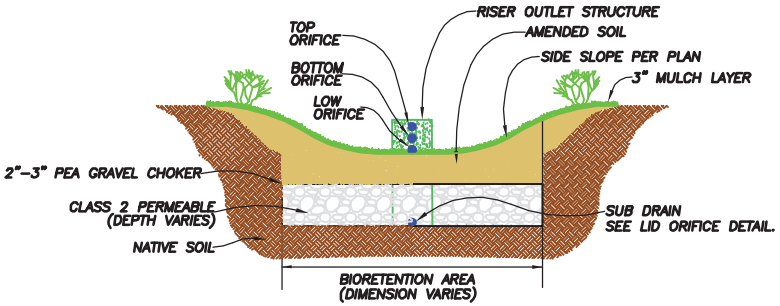
h (ft)	H/D-low -	H/D-mid -	H/D-top -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qtop-orif (cfs)	Qtop-weir (cfs)	Qtot-top (cfs)	Qemerg (cfs)	Qtot (cfs)
0.0	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.1	0.40	0.00	0.00	0.000	0.047	0.047	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.047
0.2	0.80	0.00	0.00	0.197	0.168	0.168	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.168
0.3	1.20	0.00	0.00	0.302	0.323	0.302	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.302
0.4	1.60	0.00	0.00	0.378	0.474	0.378	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.378
0.5	2.00	0.00	0.00	0.441	0.586	0.441	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.441
0.6	2.40	0.00	0.00	0.497	0.645	0.497	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.497
0.7	2.80	0.00	0.00	0.547	0.659	0.547	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.547
0.8	3.20	0.00	0.00	0.592	0.673	0.592	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.592
0.9	3.60	0.00	0.00	0.635	0.775	0.635	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.635
1.0	4.00	0.00	0.00	0.674	1.107	0.674	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.674
1.1	4.40	0.00	0.00	0.712	1.873	0.712	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.712
1.2	4.80	0.00	0.00	0.747	3.350	0.747	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.747
1.3	5.20	0.00	0.00	0.781	5.894	0.781	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.781
1.4	5.60	0.00	0.00	0.814	9.954	0.814	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.814
1.5	6.00	0.00	0.00	0.845	16.076	0.845	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.845
1.6	6.40	0.00	0.00	0.876	24.916	0.876	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.876
1.7	6.80	0.00	0.00	0.905	37.247	0.905	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.905
1.8	7.20	0.00	0.00	0.933	53.971	0.933	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.933
1.9	7.60	0.00	0.00	0.960	76.124	0.960	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.960
2.0	8.00	0.00	0.00	0.987	104.889	0.987	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.987
2.1	8.40	0.00	0.00	1.013	141.603	1.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.013
2.2	8.80	0.00	0.00	1.038	187.769	1.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.038
2.3	9.20	0.00	0.00	1.063	245.061	1.063	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.063
2.4	9.60	0.00	0.00	1.087	315.337	1.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.087
2.5	10.00	0.00	0.00	1.111	400.645	1.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.111
2.6	10.40	0.00	0.00	1.134	503.236	1.134	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.134
2.7	10.80	0.00	0.00	1.157	625.569	1.157	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.157
2.8	11.20	0.00	0.00	1.179	770.325	1.179	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.179
2.9	11.60	0.00	0.00	1.201	940.411	1.201	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.201
3.0	12.00	0.00	0.00	1.222	1138.974	1.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.222
3.1	12.40	0.40	0.00	1.243	1369.407	1.243	0.000	0.047	0.047	0.000	0.000	0.000	0.000	1.291
3.2	12.80	0.80	0.00	1.264	1635.358	1.264	0.197	0.168	0.168	0.000	0.000	0.000	0.000	1.432
3.3	13.20	1.20	0.00	1.285	1940.744	1.285	0.302	0.323	0.302	0.000	0.000	0.000	0.000	1.586
3.4	13.60	1.60	0.00	1.305	2289.753	1.305	0.378	0.474	0.378	0.000	0.000	0.000	0.000	1.683
3.5	14.00	2.00	0.00	1.324	2686.859	1.324	0.441	0.586	0.441	0.000	0.000	0.000	0.000	1.766
3.6	14.40	2.40	0.00	1.344	3136.829	1.344	0.497	0.645	0.497	0.000	0.000	0.000	0.000	1.841
3.7	14.80	2.80	0.00	1.363	3644.732	1.363	0.547	0.659	0.547	0.000	0.000	0.000	0.000	1.910
3.8	15.20	3.20	0.00	1.382	4215.948	1.382	0.592	0.673	0.592	0.000	0.000	0.000	0.000	1.974
3.9	15.60	3.60	0.00	1.401	4856.180	1.401	0.635	0.775	0.635	0.000	0.000	0.000	0.000	2.035
4.0	16.00	4.00	0.00	1.419	5571.459	1.419	0.674	1.107	0.674	0.000	0.000	0.000	0.000	2.093
4.1	16.40	4.40	0.00	1.437	6368.157	1.437	0.712	1.873	0.712	0.000	0.000	0.000	0.000	2.149
4.2	16.80	4.80	0.00	1.455	7252.991	1.455	0.747	3.350	0.747	0.000	0.000	0.000	0.000	2.203
4.3	17.20	5.20	0.00	1.473	8233.041	1.473	0.781	5.894	0.781	0.000	0.000	0.000	0.000	2.254
4.4	17.60	5.60	0.00	1.491	9315.750	1.491	0.814	9.954	0.814	0.000	0.000	0.000	0.000	2.304
4.5	18.00	6.00	0.00	1.508	10508.938	1.508	0.845	16.076	0.845	0.000	0.000	0.000	0.000	2.353
4.6	18.40	6.40	0.00	1.525	11820.812	1.525	0.876	24.916	0.876	0.000	0.000	0.000	0.000	2.400
4.7	18.80	6.80	0.00	1.542	13259.971	1.542	0.905	37.247	0.905	0.000	0.000	0.000	0.000	2.447
4.8	19.20	7.20	0.00	1.559	14835.421	1.559	0.933	53.971	0.933	0.000	0.000	0.000	0.000	2.492
4.9	19.60	7.60	0.00	1.575	16556.578	1.575	0.960	76.124	0.960	0.000	0.000	0.000	0.000	2.536
5.0	20.00	8.00	0.00	1.592	18433.283	1.592	0.987	104.889	0.987	0.000	0.000	0.000	0.000	2.579
5.1	20.40	8.40	0.00	1.608	20475.806	1.608	1.013	141.603	1.013	0.000	0.000	0.000	0.000	2.621
5.2	20.80	8.80	0.00	1.624	22694.861	1.624	1.038	187.769	1.038	0.000	0.000	0.000	0.000	2.662
5.3	21.20	9.20	0.00	1.640	25101.607	1.640	1.063	245.061	1.063	0.000	0.000	0.000	0.000	2.703
5.4	21.60	9.60	0.00	1.656	27707.668	1.656	1.087	315.337	1.087	0.000	0.000	0.000	0.000	2.743
5.5	22.00	10.00	0.00	1.671	30525.133	1.671	1.111	400.645	1.111	0.000	0.000	0.000	0.000	2.782
5.6	22.40	10.40	0.00	1.687	33566.568	1.687	1.134	503.236	1.134	0.000	0.000	0.000	0.000	2.821
5.7	22.80	10.80	0.00	1.702	36845.029	1.702	1.157	625.569	1.157	0.000	0.000	0.000	0.000	2.859
5.8	23.20	11.20	0.00	1.717	40374.065	1.717	1.179	770.325	1.179	0.000	0.000	0.000	0.000	2.896
5.9	23.60	11.60	0.00	1.732	44167.732	1.732	1.201	940.411	1.201	0.000	0.000	0.000	0.000	2.933
6.0	24.00	12.00	0.00	1.747	48240.600	1.747	1.222	1138.974	1.222	0.000	0.000	0.000	0.000	2.970
6.1	24.40	12.40	0.40	1.762	52607.764	1.762	1.243	1369.407	1.243	0.000	0.000	0.000	0.000	3.005
6.2	24.80	12.80	0.80	1.777	57284.850	1.777	1.264	1635.358	1.264	0.000	0.000	0.000	0.000	3.041
6.3	25.20	13.20	1.20	1.791	62288.027	1.791	1.285	1940.744	1.285	0.000	0.000	0.000	0.000	3.076
6.4	25.60	13.60	1.60	1.806	67634.015	1.806	1.305	2289.753	1.305	0.000	0.000	0.000	0.000	3.110
6.5	26.00	14.00	2.00	1.820	73340.097	1.820	1.324	2686.859	1.324	0.000	0.000	0.000	0.000	3.144

6.6	26.40	14.40	2.40	1.834	79424.124	1.834	1.344	3136.829	1.344	0.000	0.000	0.000	0.000	3.178
6.7	26.80	14.80	2.80	1.848	85904.525	1.848	1.363	3644.732	1.363	0.000	0.000	0.000	0.000	3.211
6.8	27.20	15.20	3.20	1.862	92800.319	1.862	1.382	4215.948	1.382	0.000	0.000	0.000	0.000	3.244
6.9	27.60	15.60	3.60	1.876	100131.1	1.876	1.401	4856.180	1.401	0.000	0.000	0.000	0.000	3.277
7.0	28.00	16.00	4.00	1.890	107917.2	1.890	1.419	5571.459	1.419	0.000	0.000	0.000	0.000	3.309
7.1	28.40	16.40	4.40	1.904	116179.3	1.904	1.437	6368.157	1.437	0.000	0.000	0.000	0.000	3.341
7.2	28.80	16.80	4.80	1.917	124938.9	1.917	1.455	7252.991	1.455	0.000	0.000	0.000	0.000	3.373
7.3	29.20	17.20	5.20	1.931	134218.2	1.931	1.473	8233.041	1.473	0.000	0.000	0.000	0.000	3.404
7.4	29.60	17.60	5.60	1.944	144039.8	1.944	1.491	9315.750	1.491	0.000	0.000	0.000	0.000	3.435
7.5	30.00	18.00	6.00	1.958	154427.3	1.958	1.508	10508.938	1.508	0.000	0.000	0.000	0.000	3.466
7.6	30.40	18.40	6.40	1.971	165404.5	1.971	1.525	11820.812	1.525	0.000	0.000	0.000	0.000	3.496
7.7	30.80	18.80	6.80	1.984	176996.3	1.984	1.542	13259.971	1.542	0.000	0.000	0.000	0.000	3.526
7.8	31.20	19.20	7.20	1.997	189228.1	1.997	1.559	14835.421	1.559	0.000	0.000	0.000	0.000	3.556
7.9	31.60	19.60	7.60	2.010	202126.0	2.010	1.575	16556.578	1.575	0.000	0.000	0.000	0.000	3.585
8.0	32.00	20.00	8.00	2.023	215716.7	2.023	1.592	18433.283	1.592	0.000	0.000	0.000	0.000	3.615
8.1	32.40	20.40	8.40	2.036	230027.8	2.036	1.608	20475.806	1.608	0.000	0.000	0.000	0.000	3.644
8.2	32.80	20.80	8.80	2.048	245087.4	2.048	1.624	22694.861	1.624	0.000	0.000	0.000	0.000	3.672
8.3	33.20	21.20	9.20	2.061	260924.7	2.061	1.640	25101.607	1.640	0.000	0.000	0.000	0.000	3.701
8.4	33.60	21.60	9.60	2.074	277569.1	2.074	1.656	27707.668	1.656	0.000	0.000	0.000	0.000	3.729
8.5	34.00	22.00	10.00	2.086	295051.2	2.086	1.671	30525.133	1.671	0.000	0.000	0.000	0.000	3.757
8.6	34.40	22.40	10.40	2.099	313402.2	2.099	1.687	33566.568	1.687	0.000	0.000	0.000	0.000	3.785
8.7	34.80	22.80	10.80	2.111	332654.0	2.111	1.702	36845.029	1.702	0.000	0.000	0.000	0.000	3.813
8.8	35.20	23.20	11.20	2.123	352839.2	2.123	1.717	40374.065	1.717	0.000	0.000	0.000	0.000	3.841
8.9	35.60	23.60	11.60	2.135	373991.6	2.135	1.732	44167.732	1.732	0.000	0.000	0.000	0.000	3.868
9.0	36.00	24.00	12.00	2.148	396145.2	2.148	1.747	48240.600	1.747	0.000	0.000	0.000	0.000	3.895
9.1	36.40	24.40	12.40	2.160	419335.2	2.160	1.762	52607.764	1.762	0.000	0.000	0.000	0.000	3.922
9.2	36.80	24.80	12.80	2.172	443597.6	2.172	1.777	57284.850	1.777	0.000	0.000	0.000	0.000	3.948
9.3	37.20	25.20	13.20	2.184	468969.0	2.184	1.791	62288.027	1.791	0.000	0.000	0.000	0.000	3.975
9.4	37.60	25.60	13.60	2.195	495487.1	2.195	1.806	67634.015	1.806	0.000	0.000	0.000	0.000	4.001
9.5	38.00	26.00	14.00	2.207	523190.1	2.207	1.820	73340.097	1.820	0.000	0.000	0.000	0.000	4.027
9.6	38.40	26.40	14.40	2.219	552117.3	2.219	1.834	79424.124	1.834	0.000	0.000	0.000	0.000	4.053
9.7	38.80	26.80	14.80	2.231	582308.9	2.231	1.848	85904.525	1.848	0.000	0.000	0.000	0.000	4.079
9.8	39.20	27.20	15.20	2.242	613805.8	2.242	1.862	92800.319	1.862	0.000	0.000	0.000	0.000	4.105
9.9	39.60	27.60	15.60	2.254	646649.7	2.254	1.876	100131.123	1.876	0.000	0.000	0.000	0.000	4.130
10.0	40.00	28.00	16.00	2.265	680883.5	2.265	1.890	107917.159	1.890	0.000	0.000	0.000	0.000	4.156
10.1	40.40	28.40	16.40	2.277	716550.7	2.277	1.904	116179.266	1.904	0.000	0.000	0.000	0.000	4.181
10.2	40.80	28.80	16.80	2.288	753695.9	2.288	1.917	124938.909	1.917	0.000	0.000	0.000	0.000	4.206
10.3	41.20	29.20	17.20	2.299	792364.4	2.299	1.931	134218.186	1.931	0.000	0.000	0.000	0.000	4.230
10.4	41.60	29.60	17.60	2.311	832602.7	2.311	1.944	144039.840	1.944	0.000	0.000	0.000	0.000	4.255
10.5	42.00	30.00	18.00	2.322	874457.9	2.322	1.958	154427.266	1.958	0.000	0.000	0.000	0.000	4.280
10.6	42.40	30.40	18.40	2.333	917978.3	2.333	1.971	165404.521	1.971	0.000	0.000	0.000	0.000	4.304
10.7	42.80	30.80	18.80	2.344	963213.1	2.344	1.984	176996.334	1.984	0.000	0.000	0.000	0.000	4.328
10.8	43.20	31.20	19.20	2.355	1010212.3	2.355	1.997	189228.114	1.997	0.000	0.000	0.000	0.000	4.352
10.9	43.60	31.60	19.60	2.366	1059027.1	2.366	2.010	202125.961	2.010	0.000	0.000	0.000	0.000	4.376
11.0	44.00	32.00	20.00	2.377	1109709.5	2.377	2.023	215716.672	2.023	0.000	0.000	0.000	0.000	4.400
11.1	44.40	32.40	20.40	2.388	1162312.5	2.388	2.036	230027.754	2.036	0.000	0.000	0.000	2.353	6.777
11.2	44.80	32.80	20.80	2.399	1216890.2	2.399	2.048	245087.431	2.048	0.000	0.000	0.000	6.655	11.102
11.3	45.20	33.20	21.20	2.410	1273497.6	2.410	2.061	260924.654	2.061	0.000	0.000	0.000	12.225	16.696
11.4	45.60	33.60	21.60	2.421	1332190.8	2.421	2.074	277569.108	2.074	0.000	0.000	0.000	18.822	23.316
11.5	46.00	34.00	22.00	2.431	1393026.9	2.431	2.086	295051.226	2.086	0.000	0.000	0.000	26.304	30.822
11.6	46.40	34.40	22.40	2.442	1456063.9	2.442	2.099	313402.193	2.099	0.000	0.000	0.000	34.578	39.119
11.7	46.80	34.80	22.80	2.453	1521361.1	2.453	2.111	332653.959	2.111	0.000	0.000	0.000	43.573	48.137
11.8	47.20	35.20	23.20	2.463	1588978.5	2.463	2.123	352839.247	2.123	0.000	0.000	0.000	53.236	57.823
11.9	47.60	35.60	23.60	2.474	1658977.5	2.474	2.135	373991.560	2.135	0.000	0.000	0.000	63.524	68.133
12.0	48.00	36.00	24.00	2.484	1731420.4	2.484	2.148	396145.196	2.148	0.000	0.000	0.000	74.400	79.032
12.1	48.40	36.40	24.40	2.495	1806370.5	2.495	2.160	419335.248	2.160	0.000	0.000	0.000	85.835	90.489
12.2	48.80	36.80	24.80	2.505	1883892.4	2.505	2.172	443597.625	2.172	0.000	0.000	0.000	97.801	102.478
12.3	49.20	37.20	25.20	2.515	1964051.7	2.515	2.184	468969.050	2.184	0.000	0.000	0.000	110.278	114.977
12.4	49.60	37.60	25.60	2.526	2046915.0	2.526	2.195	495487.076	2.195	0.000	0.000	0.000	123.244	127.965
12.5	50.00	38.00	26.00	2.536	2132550.1	2.536	2.207	523190.094	2.207	0.000	0.000	0.000	136.682	141.425
12.6	50.40	38.40	26.40	2.546	2221026.0	2.546	2.219	552117.340	2.219	0.000	0.000	0.000	150.575	155.340
12.7	50.80	38.80	26.80	2.556	2312412.7	2.556	2.231	582308.909	2.231	0.000	0.000	0.000	164.910	169.697
12.8	51.20	39.20	27.20	2.566	2406781.4	2.566	2.242	613805.756	2.242	0.000	0.000	0.000	179.673	184.481
12.9	51.60	39.60	27.60	2.577	2504204.5	2.577	2.254	646649.715	2.254	0.000	0.000	0.000	194.851	199.682
13.0	52.00	40.00	28.00	2.587	2604755.4	2.587	2.265	680883.501	2.265	0.000	0.000	0.000	210.435	215.287
13.1	52.40	40.40	28.40	2.597	2708508.9	2.597	2.277	716550.722	2.277	0.000	0.000	0.000	226.413	231.287
13.2	52.80	40.80	28.80	2.607	2815540.8	2.607	2.288	753695.889	2.288	0.000	0.000	0.000	242.777	247.671
13.3	53.20	41.20	29.20	2.617	2925928.2	2.617	2.299	792364.424	2.299	0.000	0.000	0.000	259.516	264.432
13.4	53.60	41.60	29.60	2.627	3039749.3	2.627	2.311	832602.667	2.311	0.000	0.000	0.000	273.011	277.949
13.5	54.00	42.00	30.00	2.636	3157083.5	2.636	2.322	874457.890	2.322	0.000	0.000	0.000	278.641	283.600
13.6	54.40	42.40	30.40	2.646	3278011.5	2.646	2.333	917978.305	2.333	0.000	0.000	0.000	284.159	289.139
13.7	54.80	42.80	30.80	2.656	3402615.2	2.656	2.344	963213.068	2.344	0.000	0.000	0.000	289.572	294.573
13.8	55.20	43.20	31.20	2.666	3530977.8	2.666	2.355	1010212.296	2.355	0.000	0.000	0.000	294.886	299.907
13.9	55.60	43.60	31.60	2.676	3663183.5	2.676	2.366	1059027.071	2.366	0.000	0.000	0.000	300.106	305.148
14.0	56.00	44.00	32.00	2.685	3799318.0	2.685	2.377	1109709.451	2.377	0.000	0.000	0.000	305.236	310.299
14.1	56.40	44.40	32.40	2.695	3939468.3	2.695	2.388	1162312.479	2.388	0.000	0.000	0.000	310.282	315.365
14.2	56.80	44.80	32.80	2.705	4083722.3	2.705	2.399	1216890.191	2.399	0.000	0.000	0.000	315.246	320.350
14.3	57.20	45.20	33.20	2.714	4232169.7	2.714	2.410	1273497.629	2.410	0.000	0.000	0.000	320.134	325.258
14.4	57.60	45.60	33.60	2.724	4384901.0	2.724	2.421	1332190.845	2.421	0.000	0.000	0.000	324.949	330.093
14.5	58.00	46.00	34.00	2.733	4542008.4	2.733	2.431	1393026.914	2.431	0.000	0.000	0.000	329.693	334.857
14.6	58.40	46.40	34.40	2.743	4703585.1	2.743	2.442	1456063.942	2.442	0.000	0.000	0.000	334.369	339.554

14.7	58.80	46.80	34.80	2.752	4869725.8	2.752	2.453	1521361.076	2.453	0.000	0.000	0.000	338.982	344.186
14.8	59.20	47.20	35.20	2.762	5040526.4	2.762	2.463	1588978.512	2.463	0.000	0.000	0.000	343.532	348.757
14.9	59.60	47.60	35.60	2.771	5216084.3	2.771	2.474	1658977.504	2.474	0.000	0.000	0.000	348.023	353.267
15.0	60.00	48.00	36.00	2.780	5396498.1	2.780	2.484	1731420.374	2.484	0.000	0.000	0.000	352.456	357.721
15.1	60.40	48.40	36.40	2.790	5581867.9	2.790	2.495	1806370.523	2.495	0.000	0.000	0.000	356.835	362.119
15.2	60.80	48.80	36.80	2.799	5772294.9	2.799	2.505	1883892.436	2.505	0.000	0.000	0.000	361.160	366.464
15.3	61.20	49.20	37.20	2.808	5967881.9	2.808	2.515	1964051.696	2.515	0.000	0.000	0.000	365.434	370.758
15.4	61.60	49.60	37.60	2.817	6168733.1	2.817	2.526	2046914.989	2.526	0.000	0.000	0.000	369.659	375.002
15.5	62.00	50.00	38.00	2.827	6374954.0	2.827	2.536	2132550.116	2.536	0.000	0.000	0.000	373.836	379.199
15.6	62.40	50.40	38.40	2.836	6586651.4	2.836	2.546	2221026.002	2.546	0.000	0.000	0.000	377.967	383.349
15.7	62.80	50.80	38.80	2.845	6803933.7	2.845	2.556	2312412.702	2.556	0.000	0.000	0.000	382.054	387.455
15.8	63.20	51.20	39.20	2.854	7026910.7	2.854	2.566	2406781.415	2.566	0.000	0.000	0.000	386.097	391.517
15.9	63.60	51.60	39.60	2.863	7255693.5	2.863	2.577	2504204.491	2.577	0.000	0.000	0.000	390.098	395.537
16.0	64.00	52.00	40.00	2.872	7490394.7	2.872	2.587	2604755.439	2.587	0.000	0.000	0.000	394.058	399.517
16.1	64.40	52.40	40.40	2.881	7731128.3	2.881	2.597	2708508.939	2.597	0.000	0.000	0.000	397.979	403.457
16.2	64.80	52.80	40.80	2.890	7978009.9	2.890	2.607	2815540.847	2.607	0.000	0.000	0.000	401.862	407.359
16.3	65.20	53.20	41.20	2.899	8231156.4	2.899	2.617	2925928.211	2.617	0.000	0.000	0.000	405.708	411.224
16.4	65.60	53.60	41.60	2.908	8490686.4	2.908	2.627	3039749.271	2.627	0.000	0.000	0.000	409.517	415.052
16.5	66.00	54.00	42.00	2.917	8756719.6	2.917	2.636	3157083.478	2.636	0.000	0.000	0.000	413.292	418.845
16.6	66.40	54.40	42.40	2.926	9029377.6	2.926	2.646	3278011.496	2.646	0.000	0.000	0.000	417.032	422.604
16.7	66.80	54.80	42.80	2.935	9308783.2	2.935	2.656	3402615.215	2.656	0.000	0.000	0.000	420.739	426.330
16.8	67.20	55.20	43.20	2.944	9595060.9	2.944	2.666	3530977.757	2.666	0.000	0.000	0.000	424.414	430.023
16.9	67.60	55.60	43.60	2.953	9888336.6	2.953	2.676	3663183.489	2.676	0.000	0.000	0.000	428.057	433.685
17.0	68.00	56.00	44.00	2.961	10188738	2.961	2.685	3799318.031	2.685	0.000	0.000	0.000	431.669	437.316
17.1	68.40	56.40	44.40	2.970	10496394	2.970	2.695	3939468.263	2.695	0.000	0.000	0.000	435.251	440.916
17.2	68.80	56.80	44.80	2.979	10811435	2.979	2.705	4083722.337	2.705	0.000	0.000	0.000	438.805	444.488
17.3	69.20	57.20	45.20	2.988	11133993	2.988	2.714	4232169.684	2.714	0.000	0.000	0.000	442.329	448.031
17.4	69.60	57.60	45.60	2.996	11464202	2.996	2.724	4384901.026	2.724	0.000	0.000	0.000	445.826	451.546
17.5	70.00	58.00	46.00	3.005	11802197	3.005	2.733	4542008.382	2.733	0.000	0.000	0.000	449.295	455.033
17.6	70.40	58.40	46.40	3.014	12148115	3.014	2.743	4703585.079	2.743	0.000	0.000	0.000	452.738	458.494
17.7	70.80	58.80	46.80	3.022	12502095	3.022	2.752	4869725.763	2.752	0.000	0.000	0.000	456.155	461.929
17.8	71.20	59.20	47.20	3.031	12864276	3.031	2.762	5040526.403	2.762	0.000	0.000	0.000	459.547	465.339
17.9	71.60	59.60	47.60	3.039	13234801	3.039	2.771	5216084.307	2.771	0.000	0.000	0.000	462.913	468.724
18.0	72.00	60.00	48.00	3.048	13613812	3.048	2.780	5396498.124	2.780	0.000	0.000	0.000	466.256	472.084
18.1	72.40	60.40	48.40	3.056	14001454	3.056	2.790	5581867.860	2.790	0.000	0.000	0.000	469.574	475.420
18.2	72.80	60.80	48.80	3.065	14397874	3.065	2.799	5772294.882	2.799	0.000	0.000	0.000	472.870	478.733
18.3	73.20	61.20	49.20	3.073	14803221	3.073	2.808	5967881.931	2.808	0.000	0.000	0.000	476.142	482.024
18.4	73.60	61.60	49.60	3.082	15217643	3.082	2.817	6168733.129	2.817	0.000	0.000	0.000	479.392	485.292
18.5	74.00	62.00	50.00	3.090	15641293	3.090	2.827	6374953.987	2.827	0.000	0.000	0.000	482.621	488.537
18.6	74.40	62.40	50.40	3.099	16074324	3.099	2.836	6586651.420	2.836	0.000	0.000	0.000	485.827	491.762
18.7	74.80	62.80	50.80	3.107	16516890	3.107	2.845	6803933.748	2.845	0.000	0.000	0.000	489.013	494.965
18.8	75.20	63.20	51.20	3.115	16969148	3.115	2.854	7026910.712	2.854	0.000	0.000	0.000	492.178	498.148
18.9	75.60	63.60	51.60	3.124	17431257	3.124	2.863	7255693.481	2.863	0.000	0.000	0.000	495.323	501.310
19.0	76.00	64.00	52.00	3.132	17903377	3.132	2.872	7490394.659	2.872	0.000	0.000	0.000	498.448	504.453
19.1	76.40	64.40	52.40	3.140	18385668	3.140	2.881	7731128.297	2.881	0.000	0.000	0.000	501.554	507.576
19.2	76.80	64.80	52.80	3.148	18878295	3.148	2.890	7978009.902	2.890	0.000	0.000	0.000	504.641	510.679
19.3	77.20	65.20	53.20	3.157	19381424	3.157	2.899	8231156.445	2.899	0.000	0.000	0.000	507.708	513.764
19.4	77.60	65.60	53.60	3.165	19895219	3.165	2.908	8490686.371	2.908	0.000	0.000	0.000	510.758	516.831
19.5	78.00	66.00	54.00	3.173	20419852	3.173	2.917	8756719.608	2.917	0.000	0.000	0.000	513.789	519.879
19.6	78.40	66.40	54.40	3.181	20955491	3.181	2.926	9029377.577	2.926	0.000	0.000	0.000	516.802	522.910
19.7	78.80	66.80	54.80	3.189	21502310	3.189	2.935	9308783.198	2.935	0.000	0.000	0.000	519.798	525.923
19.8	79.20	67.20	55.20	3.198	22060482	3.198	2.944	9595060.905	2.944	0.000	0.000	0.000	522.777	528.918
19.9	79.60	67.60	55.60	3.206	22630183	3.206	2.953	9888336.650	2.953	0.000	0.000	0.000	525.739	531.897
20.0	80.00	68.00	56.00	3.214	23211591	3.214	2.961	10188737.91	2.961	0.000	0.000	0.000	528.684	534.860

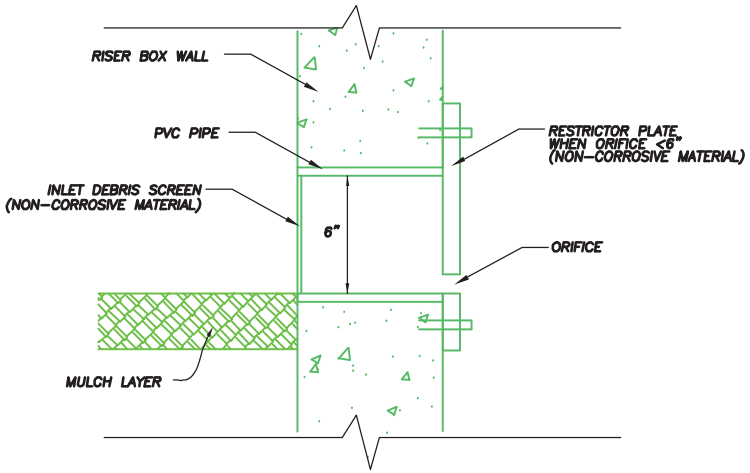
ATTACHMENT 5

Bio Retention Details



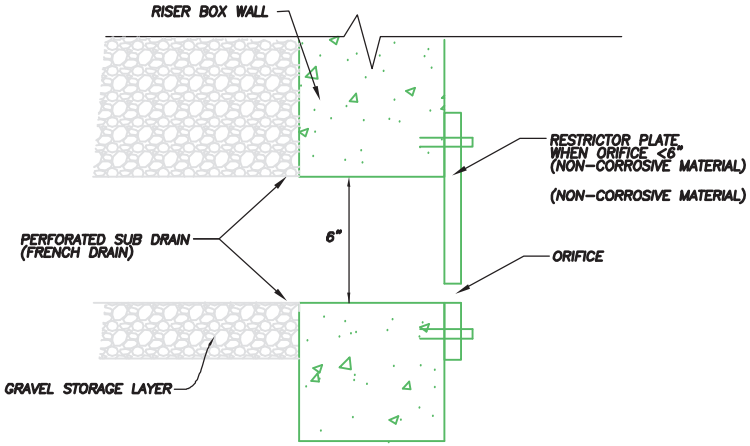
TYPICAL BIORETENTION BASIN CROSS SECTION

NOT TO SCALE



RISER (LOW) ORIFICE DETAIL

NOT TO SCALE



LID ORIFICE DETAIL

NOT TO SCALE

ATTACHMENT 6

SWMM Input Data (Existing and Proposed Models)

Otay Ranch Village 2 South DMA Calculations

Pre-Developed Condition

Neighborhood	% Imperviousness	Total Area	Pervious Area	Impervious Area
Slope - Nat - Steep	0%	223.7	223.7	0.0
Slope - Dev - 2:1	0%	7.3	7.3	0.0
ROW - Dev	75%	8.0	2.0	6.0
Pad - Dev - Per	0%	9.8	9.8	0.0
Pad - Dev - Imp	50%	1.6	0.8	0.8
Total		250.4	243.6	6.8

Otay Ranch Village 2 South DMA Calculations

Post-Developed Condition

Neighborhood	% Imperviousness	Total Area	Pervious Area	Impervious Area
Slope - Natural	0%	17.8	17.8	0.0
Slope - Developed	0%	6.4	6.4	0.0
Slope- Dev.- B#1	0%	1.1	1.1	0.0
Basin #1	0%	0.1	0.1	0.0
Basin #2	0%	0.9	0.9	0.0
Roadway - Heritage	85%	7.7	1.2	6.6
Roadway - TM - B#1	85%	2.4	0.4	2.0
Roadway - TM - B#2	85%	33.9	5.1	28.8
Roadway - NAP	0%	11.7	11.7	0.0
Lot - NAP	0%	31.1	31.1	0.0
MU-4	80%	2.6	0.5	2.1
Ind-2	80%	8.0	1.6	6.4
Ind-3	80%	17.4	3.5	13.9
CPF-2	80%	0.9	0.2	0.7
CPF-5	80%	0.6	0.1	0.5
CPF-9	80%	5.8	1.2	4.6
P-2	10%	7.1	6.4	0.7
P-5	10%	5.1	4.6	0.5
S-1	70%	10.3	3.1	7.2
S-2	70%	9.5	2.8	6.6
R-11	60%	8.7	3.5	5.2
R-16b	60%	0.5	0.2	0.3
R-17b (a)	60%	2.8	1.1	1.7
R-17b (b)	60%	4.7	1.9	2.8
R-19b	60%	3.3	1.3	2.0
R-20 55x92	40%	11.2	6.7	4.5
R-21B 60x100	50%	9.5	4.7	4.7
R-23 50x85	40%	3.8	2.3	1.5
R-23 50x85	40%	7.6	4.5	3.0
R-24	60%	2.5	1.0	1.5
R-25a	60%	13.8	5.5	8.3
R-27	60%	8.7	3.5	5.2
R-28	60%	5.2	2.1	3.1
Total		262.5	138.0	124.5
Basin #1	52%	9.9	4.8	5.0
Basin #2	47%	252.60	133.1	119.5
Slope-Dev/Basin	0%	6.6	6.6	0.0
Slope-Natural	0%	17.4	17.4	0.0
To POC 1		24.0	24.0	0.0

Watershed Parameters	
Watershed #1	
L=	1075
A=	9.8
W=	396
US Elev=	438
DS Elev=	418
S=	1.9%
Basin #1	
L=	250
A=	0.1
W=	14
US Elev=	385
DS Elev=	385
S=	0.1%
Watershed #2	
L=	6818
A=	251.7
W=	1608
US Elev=	488
DS Elev=	387
S=	1.5%
Basin #2	
L=	470
A=	0.9
W=	87
US Elev=	375
DS Elev=	375
S=	0.1%

Required Bio Retention Basin Area (Flow Based)		
Basin #1 (4%/0.4% WQ Area)=	0.22	ac
Basin #2 (4%/0.4% WQ Area)=	5.31	ac
Required Bio Retention Basin Volume (Volume Based)		
Basin #1 (85th WQ Volume)=	0.25	ac-ft
Basin #2 (85th WQ Volume)=	6.09	ac-ft
Basin 1 Adjusted Required Volume Below 1st Orifice/Riser		
Basin bottom area provided =	2450	sf
Basin #1 Infiltration Capacity=	1021	cf/hr
Basin #1 WQ Flow=	4001	cf/hr
Deficiency=	2980	cf/hr
Volume (0.55"/0.2"/hr=2.75 hours)=	0.19	ac-ft
Deficiency depth	3.345	ft
Basin 2 Adjusted Required Volume Below 1st Orifice/Riser		
Basin bottom area provided =	32500	sf
Basin #2 Infiltration Capacity=	13542	cf/hr
Basin #2 WQ Flow=	96408	cf/hr
Deficiency=	82866	cf/hr
Volume (0.55"/0.2"/hr=2.75 hours)=	5.23	ac-ft
Deficiency depth	7.012	ft

```
[TITLE]

[OPTIONS]
FLOW_UNITS            CFS
INFILTRATION          GREEN_AMPT
FLOW_ROUTING          XINWAVE
START_DATE            08/28/1951
START_TIME            05:00:00
REPORT_START_DATE     08/28/1951
REPORT_START_TIME     05:00:00
END_DATE              05/23/2008
END_TIME              23:00:00
SWEEP_START           01/01
SWEEP_END             12/31
DRY_DAYS              0
REPORT_STEP           01:00:00
WET_STEP              00:15:00
DRY_STEP              04:00:00
ROUTING_STEP          0:01:00
ALLOW_PONDING         NO
INERTIAL_DAMPING      PARTIAL
VARIABLE_STEP         0.75
LENGTHENING_STEP      0
MIN_SURFAREA          0
NORMAL_FLOW_LIMITED   BOTH
SKIP_STEADY_STATE     NO
FORCE_MAIN_EQUATION   H-W
LINK_OFFSETS          DEPTH
MIN_SLOPE             0

[EVAPORATION]
;;Type        Parameters
;;----------- ----------
MONTHLY       .041   .076   .118   .192   .237   .318   .308   .286   .217   .14    .067   .041
DRY_ONLY      NO

[RAINGAGES]
;;                Rain      Time   Snow   Data
;;Name            Type      Intrvl Catch  Source
;;--------------- --------- ------ ------ ----------
Lindberg          INTENSITY 1:00   1.0    TIMESERIES Lindberg

[SUBCATCHMENTS]
;;                                                  Total    Pcnt.              Pcnt.    Curb     Snow
;;Name            Raingage        Outlet            Area     Imperv   Width     Slope    Length   Pack
;;--------------- --------------- ----------------- -------- -------- -------- -------- -------- --------
;Existing Area
Basin1            Lindberg        Out-Prop          250.4    3.4      1840     5.3      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;--------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
Basin1            .012       0.05       .02        .1         25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;--------------- ---------- ---------- ----------
Basin1            9          .025       0.3

[OUTFALLS]
;;                Invert     Outfall    Stage/Table      Tide
;;Name            Elev.      Type       Time Series      Gate
;;--------------- ---------- ---------- ---------------- ----
Out-Prop          0          FREE                        NO

[TIMESERIES]
;;Name            Date       Time       Value
;;--------------- ---------- ---------- ----------
;From County
Lindberg          FILE "H:\EPA SWMM\PRN FILES\LINDBERG.prn"

[REPORT]
```

```
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Out-Prop         1740.113           3977.401

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Basin1           890.923            5558.444

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Lindberg         2384.000           5666.000
```

PR

Otay Ranch Village 2 South Developed Condition

```
[TITLE]

[OPTIONS]
FLOW_UNITS            CFS
INFILTRATION          GREEN_AMPT
FLOW_ROUTING          KINWAVE
START_DATE            08/28/1951
START_TIME            05:00:00
REPORT_START_DATE     08/28/1951
REPORT_START_TIME     05:00:00
END_DATE              05/23/2008
END_TIME              23:00:00
SWEEP_START           01/01
SWEEP_END             12/31
DRY_DAYS              0
REPORT_STEP           01:00:00
WET_STEP              00:15:00
DRY_STEP              04:00:00
ROUTING_STEP          0:01:00
ALLOW_PONDING         NO
INERTIAL_DAMPING      PARTIAL
VARIABLE_STEP         0.75
LENGTHENING_STEP      0
MIN_SURFAREA          0
NORMAL_FLOW_LIMITED   BOTH
SKIP_STEADY_STATE     NO
FORCE_MAIN_EQUATION   H-W
LINK_OFFSETS          DEPTH
MIN_SLOPE             0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
MONTHLY      .041   .076   .118   .192   .237   .318   .308   .286   .217   .14    .067   .041
DRY_ONLY     NO

[RAINGAGES]
;;                Rain      Time   Snow   Data
;;Name            Type      Intrvl Catch  Source
;;--------------- --------- ------ ------ ----------
Lindberg          INTENSITY 1:00   1.0    TIMESERIES Lindberg

[SUBCATCHMENTS]
;;                                                   Total    Pcnt.              Pcnt.    Curb     Snow
;;Name            Raingage         Outlet            Area     Imperv   Width     Slope    Length   Pack
;;--------------- ---------------- ----------------- -------- -------- -------- -------- -------- --------
;Area Tributary to Basin #1
Basin1            Lindberg         BR-1              9.8      51       396      1.9      0
;Area Tributary to Basin #2
Basin2            Lindberg         BR-2              251.7    47.00    1608     1.5      0
;Additional downstream area
Basin3            Lindberg         Stor-3            24.0     0.0      500      50       0
BR-1              Lindberg         Div-1             .1       0        14       0.1      0
;Bioretention 2
BR-2              Lindberg         Div-2             0.94     0        87       0.1      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;--------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
Basin1            .012       0.05       .02        .1         25         OUTLET
Basin2            0.012      0.05       0.02       0.1        25         OUTLET
Basin3            0.012      .035       .02        .1         25         OUTLET
BR-1              0.012      0.1        .02        .1         25         OUTLET
BR-2              .012       .05        0.02       0.1        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;--------------- ---------- ---------- ----------
Basin1            9          0.025      0.3
Basin2            9          .025       0.3
Basin3            9          .025       0.3
BR-1              1.5        0.3        0.33
```

```
BR-2            1.5        0.3        0.33

[LID_CONTROLS]
;;              Type/Layer Parameters
;;--------------- ---------- ----------
BR-1            BC
BR-1            SURFACE    39.6       0.1        0.1        0          5
BR-1            SOIL       18         0.4        0.25       0.05       5          5          1.5
BR-1            STORAGE    18         0.40       0.025      0
BR-1            DRAIN      1.2231     0.5        0          6

BR-2            BC
BR-2            SURFACE    85.2       .1         0.1        1.0        5
BR-2            SOIL       18         .4         0.25       0.05       5          5          1.5
BR-2            STORAGE    48         0.40       0.025      0
BR-2            DRAIN      .1639      0.5        0          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSatur  FromImprv  ToPerv     Report File
;;--------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- ------------
BR-1            BR-1             1       2450       0          1          100        0
BR-2            BR-2             1       32500      0          1          100        0

[OUTFALLS]
;;              Invert     Outfall    Stage/Table      Tide
;;Name          Elev.      Type       Time Series      Gate
;;--------------- ---------- ---------- ---------------- ----
POC-1           0          FREE                        NO

[DIVIDERS]
;;              Invert     Diverted         Divider
;;Name          Elev.      Link             Type       Parameters
;;--------------- ---------- ---------------- ---------- ----------
Div-1           0          Bypass-1         CUTOFF     .27134     0.167      0          0          0
Div-2           0          Bypass-2         CUTOFF     0.82618    .167       0          0          0

[STORAGE]
;;              Invert   Max.     Init.    Storage    Curve                          Ponded   Evap.
;;Name          Elev.    Depth    Depth    Curve      Params                         Area     Frac.    Infiltrati
;;--------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- ----------
;Basin #1
Stor-1          382.5    4.0      0        TABULAR    Basin#1                        4290     1
Stor-2          372.5    9.0      0        TABULAR    Basin#2                        40979    0
Stor-3          0        20       0        TABULAR    Basin#3                        51172    0

[CONDUITS]
;;              Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name          Node             Node             Length     N          Offset     Offset     Flow       Flow
;;--------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----
Conduit-1       Div-1            Stor-3           1          0.01       0          0          0          0
Bypass-1        Div-1            Stor-1           1          0.01       0          0          0          0
Bypass-2        Div-2            Stor-2           400        0.01       0          0          0          0
Condui-4        Div-2            Stor-3           1          0.01       0          0          0          0

[OUTLETS]
;;              Inlet            Outlet           Outflow    Outlet           Qcoeff/                    Flap
;;Name          Node             Node             Height     Type             QTable             Qexpon  Gate
;;--------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- ----
Outlet1         Stor-1           Stor-3           0          TABULAR/DEPTH    OutletBasin#1               NO
Outlet-2        Stor-2           Stor-3           0          TABULAR/DEPTH    OutleBasint#2               NO
Outlet-3        Stor-3           POC-1            0          TABULAR/DEPTH    OutletBasin#3               NO

[XSECTIONS]
;;Link          Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;--------------- ------------ ---------------- ---------- ---------- ---------- ----------
Conduit-1       DUMMY        0                0          0          0          1
Bypass-1        DUMMY        0                0          0          0          1
Bypass-2        DUMMY        0                0          0          0          1
Condui-4        DUMMY        0                0          0          0          1

[LOSSES]
;;Link          Inlet      Outlet     Average    Flap Gate
```

```
;;--------------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
;;--------------- ---------- ---------- ----------
OutletBasin#1     Rating     0.0        0.000
OutletBasin#1                0.1        0.000
OutletBasin#1                0.2        0.000
OutletBasin#1                0.3        0.000
OutletBasin#1                0.4        0.000
OutletBasin#1                0.5        0.000
OutletBasin#1                0.6        0.000
OutletBasin#1                0.7        0.000
OutletBasin#1                0.8        0.000
OutletBasin#1                0.9        0.000
OutletBasin#1                1.0        0.000
OutletBasin#1                1.1        0.000
OutletBasin#1                1.2        0.000
OutletBasin#1                1.3        0.000
OutletBasin#1                1.4        0.000
OutletBasin#1                1.5        0.000
OutletBasin#1                1.6        0.000
OutletBasin#1                1.7        0.000
OutletBasin#1                1.8        0.000
OutletBasin#1                1.9        0.000
OutletBasin#1                2.0        0.000
OutletBasin#1                2.1        0.000
OutletBasin#1                2.2        0.000
OutletBasin#1                2.3        0.000
OutletBasin#1                2.4        0.000
OutletBasin#1                2.5        0.000
OutletBasin#1                2.6        0.000
OutletBasin#1                2.7        0.000
OutletBasin#1                2.8        0.000
OutletBasin#1                2.9        0.000
OutletBasin#1                3.0        0.000
OutletBasin#1                3.1        0.000
OutletBasin#1                3.2        0.000
OutletBasin#1                3.3        0.000
OutletBasin#1                3.4        1.232
OutletBasin#1                3.5        3.484
OutletBasin#1                3.6        6.401
OutletBasin#1                3.7        9.855
OutletBasin#1                3.8        13.773
OutletBasin#1                3.9        18.105
OutletBasin#1                4.0        22.815
OutletBasin#1                4.1        27.875

OutleBasint#2     Rating     0.0        0.000
OutleBasint#2                0.1        0.000
OutleBasint#2                0.2        0.000
OutleBasint#2                0.3        0.000
OutleBasint#2                0.4        0.000
OutleBasint#2                0.5        0.000
OutleBasint#2                0.6        0.000
OutleBasint#2                0.7        0.000
OutleBasint#2                0.8        0.000
OutleBasint#2                0.9        0.000
OutleBasint#2                1.0        0.000
OutleBasint#2                1.1        0.000
OutleBasint#2                1.2        0.000
OutleBasint#2                1.3        0.000
OutleBasint#2                1.4        0.000
OutleBasint#2                1.5        0.000
OutleBasint#2                1.6        0.000
OutleBasint#2                1.7        0.000
OutleBasint#2                1.8        0.000
OutleBasint#2                1.9        0.000
OutleBasint#2                2.0        0.000
OutleBasint#2                2.1        0.000
OutleBasint#2                2.2        0.000
OutleBasint#2                2.3        0.000
```

OutleBasint#2		2.4	0.000
OutleBasint#2		2.5	0.000
OutleBasint#2		2.6	0.000
OutleBasint#2		2.7	0.000
OutleBasint#2		2.8	0.000
OutleBasint#2		2.9	0.000
OutleBasint#2		3.0	0.000
OutleBasint#2		3.1	0.000
OutleBasint#2		3.2	0.000
OutleBasint#2		3.3	0.000
OutleBasint#2		3.4	0.000
OutleBasint#2		3.5	0.000
OutleBasint#2		3.6	0.000
OutleBasint#2		3.7	0.000
OutleBasint#2		3.8	0.000
OutleBasint#2		3.9	0.000
OutleBasint#2		4.0	0.000
OutleBasint#2		4.1	0.000
OutleBasint#2		4.2	0.000
OutleBasint#2		4.3	0.000
OutleBasint#2		4.4	0.000
OutleBasint#2		4.5	0.000
OutleBasint#2		4.6	0.000
OutleBasint#2		4.7	0.000
OutleBasint#2		4.8	0.000
OutleBasint#2		4.9	0.000
OutleBasint#2		5.0	0.000
OutleBasint#2		5.1	0.000
OutleBasint#2		5.2	0.000
OutleBasint#2		5.3	0.000
OutleBasint#2		5.4	0.000
OutleBasint#2		5.5	0.000
OutleBasint#2		5.6	0.000
OutleBasint#2		5.7	0.000
OutleBasint#2		5.8	0.000
OutleBasint#2		5.9	0.000
OutleBasint#2		6.0	0.000
OutleBasint#2		6.1	0.000
OutleBasint#2		6.2	0.000
OutleBasint#2		6.3	0.000
OutleBasint#2		6.4	0.000
OutleBasint#2		6.5	0.000
OutleBasint#2		6.6	0.000
OutleBasint#2		6.7	0.000
OutleBasint#2		6.8	0.000
OutleBasint#2		6.9	0.000
OutleBasint#2		7.0	0.000
OutleBasint#2		7.1	7.058
OutleBasint#2		7.2	19.964
OutleBasint#2		7.3	36.676
OutleBasint#2		7.4	56.466
OutleBasint#2		7.5	78.913
OutleBasint#2		7.6	103.734
OutleBasint#2		7.7	130.720
OutleBasint#2		7.8	159.709
OutleBasint#2		7.9	190.572
OutleBasint#2		8.0	223.200
OutleBasint#2		8.1	257.504
OutleBasint#2		8.2	293.404
OutleBasint#2		8.3	330.833
OutleBasint#2		8.4	369.731
OutleBasint#2		8.5	410.045
OutleBasint#2		8.6	451.725
OutleBasint#2		8.7	494.729
OutleBasint#2		8.8	539.018
OutleBasint#2		8.9	584.554
OutleBasint#2		9.0	631.305
OutletBasin#3	Rating	0.0	0.000
OutletBasin#3		0.1	0.047
OutletBasin#3		0.2	0.168
OutletBasin#3		0.3	0.302

OutleBasint#2		2.4	0.000
OutleBasint#2		2.5	0.000
OutleBasint#2		2.6	0.000
OutleBasint#2		2.7	0.000
OutleBasint#2		2.8	0.000
OutleBasint#2		2.9	0.000
OutleBasint#2		3.0	0.000
OutleBasint#2		3.1	0.000
OutleBasint#2		3.2	0.000
OutleBasint#2		3.3	0.000
OutleBasint#2		3.4	0.000
OutleBasint#2		3.5	0.000
OutleBasint#2		3.6	0.000
OutleBasint#2		3.7	0.000
OutleBasint#2		3.8	0.000
OutleBasint#2		3.9	0.000
OutleBasint#2		4.0	0.000
OutleBasint#2		4.1	0.000
OutleBasint#2		4.2	0.000
OutleBasint#2		4.3	0.000
OutleBasint#2		4.4	0.000
OutleBasint#2		4.5	0.000
OutleBasint#2		4.6	0.000
OutleBasint#2		4.7	0.000
OutleBasint#2		4.8	0.000
OutleBasint#2		4.9	0.000
OutleBasint#2		5.0	0.000
OutleBasint#2		5.1	0.000
OutleBasint#2		5.2	0.000
OutleBasint#2		5.3	0.000
OutleBasint#2		5.4	0.000
OutleBasint#2		5.5	0.000
OutleBasint#2		5.6	0.000
OutleBasint#2		5.7	0.000
OutleBasint#2		5.8	0.000
OutleBasint#2		5.9	0.000
OutleBasint#2		6.0	0.000
OutleBasint#2		6.1	0.000
OutleBasint#2		6.2	0.000
OutleBasint#2		6.3	0.000
OutleBasint#2		6.4	0.000
OutleBasint#2		6.5	0.000
OutleBasint#2		6.6	0.000
OutleBasint#2		6.7	0.000
OutleBasint#2		6.8	0.000
OutleBasint#2		6.9	0.000
OutleBasint#2		7.0	0.000
OutleBasint#2		7.1	7.058
OutleBasint#2		7.2	19.964
OutleBasint#2		7.3	36.676
OutleBasint#2		7.4	56.466
OutleBasint#2		7.5	78.913
OutleBasint#2		7.6	103.734
OutleBasint#2		7.7	130.720
OutleBasint#2		7.8	159.709
OutleBasint#2		7.9	190.572
OutleBasint#2		8.0	223.200
OutleBasint#2		8.1	257.504
OutleBasint#2		8.2	293.404
OutleBasint#2		8.3	330.833
OutleBasint#2		8.4	369.731
OutleBasint#2		8.5	410.045
OutleBasint#2		8.6	451.725
OutleBasint#2		8.7	494.729
OutleBasint#2		8.8	539.018
OutleBasint#2		8.9	584.554
OutleBasint#2		9.0	631.305
OutletBasin#3	Rating	0.0	0.000
OutletBasin#3		0.1	0.047
OutletBasin#3		0.2	0.168
OutletBasin#3		0.3	0.302

OutletBasin#3	0.4	0.378
OutletBasin#3	0.5	0.441
OutletBasin#3	0.6	0.497
OutletBasin#3	0.7	0.547
OutletBasin#3	0.8	0.592
OutletBasin#3	0.9	0.635
OutletBasin#3	1.0	0.674
OutletBasin#3	1.1	0.712
OutletBasin#3	1.2	0.747
OutletBasin#3	1.3	0.781
OutletBasin#3	1.4	0.814
OutletBasin#3	1.5	0.845
OutletBasin#3	1.6	0.876
OutletBasin#3	1.7	0.905
OutletBasin#3	1.8	0.933
OutletBasin#3	1.9	0.960
OutletBasin#3	2.0	0.987
OutletBasin#3	2.1	1.013
OutletBasin#3	2.2	1.038
OutletBasin#3	2.3	1.063
OutletBasin#3	2.4	1.087
OutletBasin#3	2.5	1.111
OutletBasin#3	2.6	1.134
OutletBasin#3	2.7	1.157
OutletBasin#3	2.8	1.179
OutletBasin#3	2.9	1.201
OutletBasin#3	3.0	1.222
OutletBasin#3	3.1	1.291
OutletBasin#3	3.2	1.432
OutletBasin#3	3.3	1.586
OutletBasin#3	3.4	1.683
OutletBasin#3	3.5	1.766
OutletBasin#3	3.6	1.841
OutletBasin#3	3.7	1.910
OutletBasin#3	3.8	1.974
OutletBasin#3	3.9	2.035
OutletBasin#3	4.0	2.093
OutletBasin#3	4.1	2.149
OutletBasin#3	4.2	2.203
OutletBasin#3	4.3	2.254
OutletBasin#3	4.4	2.304
OutletBasin#3	4.5	2.353
OutletBasin#3	4.6	2.400
OutletBasin#3	4.7	2.447
OutletBasin#3	4.8	2.492
OutletBasin#3	4.9	2.536
OutletBasin#3	5.0	2.579
OutletBasin#3	5.1	2.621
OutletBasin#3	5.2	2.662
OutletBasin#3	5.3	2.703
OutletBasin#3	5.4	2.743
OutletBasin#3	5.5	2.782
OutletBasin#3	5.6	2.821
OutletBasin#3	5.7	2.859
OutletBasin#3	5.8	2.896
OutletBasin#3	5.9	2.933
OutletBasin#3	6.0	2.970
OutletBasin#3	6.1	3.005
OutletBasin#3	6.2	3.041
OutletBasin#3	6.3	3.076
OutletBasin#3	6.4	3.110
OutletBasin#3	6.5	3.144
OutletBasin#3	6.6	3.178
OutletBasin#3	6.7	3.211
OutletBasin#3	6.8	3.244
OutletBasin#3	6.9	3.277
OutletBasin#3	7.0	3.309
OutletBasin#3	7.1	3.341
OutletBasin#3	7.2	3.373
OutletBasin#3	7.3	3.404
OutletBasin#3	7.4	3.435
OutletBasin#3	7.5	3.466

OutletBasin#3	7.6	3.496
OutletBasin#3	7.7	3.526
OutletBasin#3	7.8	3.556
OutletBasin#3	7.9	3.585
OutletBasin#3	8.0	3.615
OutletBasin#3	8.1	3.644
OutletBasin#3	8.2	3.672
OutletBasin#3	8.3	3.701
OutletBasin#3	8.4	3.729
OutletBasin#3	8.5	3.757
OutletBasin#3	8.6	3.785
OutletBasin#3	8.7	3.813
OutletBasin#3	8.8	3.841
OutletBasin#3	8.9	3.868
OutletBasin#3	9.0	3.895
OutletBasin#3	9.1	3.922
OutletBasin#3	9.2	3.948
OutletBasin#3	9.3	3.975
OutletBasin#3	9.4	4.001
OutletBasin#3	9.5	4.027
OutletBasin#3	9.6	4.053
OutletBasin#3	9.7	4.079
OutletBasin#3	9.8	4.105
OutletBasin#3	9.9	4.130
OutletBasin#3	10.0	4.156
OutletBasin#3	10.1	4.181
OutletBasin#3	10.2	4.206
OutletBasin#3	10.3	4.230
OutletBasin#3	10.4	4.255
OutletBasin#3	10.5	4.280
OutletBasin#3	10.6	4.304
OutletBasin#3	10.7	4.328
OutletBasin#3	10.8	4.352
OutletBasin#3	10.9	4.376
OutletBasin#3	11.0	4.400
OutletBasin#3	11.1	6.777
OutletBasin#3	11.2	11.102
OutletBasin#3	11.3	16.696
OutletBasin#3	11.4	23.316
OutletBasin#3	11.5	30.822
OutletBasin#3	11.6	39.119
OutletBasin#3	11.7	48.137
OutletBasin#3	11.8	57.823
OutletBasin#3	11.9	68.133
OutletBasin#3	12.0	79.032
OutletBasin#3	12.1	90.489
OutletBasin#3	12.2	102.478
OutletBasin#3	12.3	114.977
OutletBasin#3	12.4	127.965
OutletBasin#3	12.5	141.425
OutletBasin#3	12.6	155.340
OutletBasin#3	12.7	169.697
OutletBasin#3	12.8	184.481
OutletBasin#3	12.9	199.682
OutletBasin#3	13.0	215.287
OutletBasin#3	13.1	231.287
OutletBasin#3	13.2	247.671
OutletBasin#3	13.3	264.432
OutletBasin#3	13.4	277.949
OutletBasin#3	13.5	283.600
OutletBasin#3	13.6	289.139
OutletBasin#3	13.7	294.573
OutletBasin#3	13.8	299.907
OutletBasin#3	13.9	305.148
OutletBasin#3	14.0	310.299
OutletBasin#3	14.1	315.365
OutletBasin#3	14.2	320.350
OutletBasin#3	14.3	325.258
OutletBasin#3	14.4	330.093
OutletBasin#3	14.5	334.857
OutletBasin#3	14.6	339.554
OutletBasin#3	14.7	344.186

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OutletBasin#3                14.8        348.757
OutletBasin#3                14.9        353.267
OutletBasin#3                15.0        357.721
OutletBasin#3                15.1        362.119
OutletBasin#3                15.2        366.464
OutletBasin#3                15.3        370.758
OutletBasin#3                15.4        375.002
OutletBasin#3                15.5        379.199
OutletBasin#3                15.6        383.349
OutletBasin#3                15.7        387.455
OutletBasin#3                15.8        391.517
OutletBasin#3                15.9        395.537
OutletBasin#3                16.0        399.517
OutletBasin#3                16.1        403.457
OutletBasin#3                16.2        407.359
OutletBasin#3                16.3        411.224
OutletBasin#3                16.4        415.052
OutletBasin#3                16.5        418.845
OutletBasin#3                16.6        422.604
OutletBasin#3                16.7        426.330
OutletBasin#3                16.8        430.023
OutletBasin#3                16.9        433.685
OutletBasin#3                17.0        437.316
OutletBasin#3                17.1        440.916
OutletBasin#3                17.2        444.488
OutletBasin#3                17.3        448.031
OutletBasin#3                17.4        451.546
OutletBasin#3                17.5        455.033
OutletBasin#3                17.6        458.494
OutletBasin#3                17.7        461.929
OutletBasin#3                17.8        465.339
OutletBasin#3                17.9        468.724
OutletBasin#3                18.0        472.084
OutletBasin#3                18.1        475.420
OutletBasin#3                18.2        478.733
OutletBasin#3                18.3        482.024
OutletBasin#3                18.4        485.292
OutletBasin#3                18.5        488.537
OutletBasin#3                18.6        491.762
OutletBasin#3                18.7        494.965
OutletBasin#3                18.8        498.148
OutletBasin#3                18.9        501.310
OutletBasin#3                19.0        504.453
OutletBasin#3                19.1        507.576
OutletBasin#3                19.2        510.679
OutletBasin#3                19.3        513.764
OutletBasin#3                19.4        516.831
OutletBasin#3                19.5        519.879
OutletBasin#3                19.6        522.910
OutletBasin#3                19.7        525.923
OutletBasin#3                19.8        528.918
OutletBasin#3                19.9        531.897
OutletBasin#3                20.0        534.860

;Basin #1
Basin#1          Storage     0.0         2450
Basin#1                      0.1         2490
Basin#1                      0.2         2530
Basin#1                      0.3         2570
Basin#1                      0.4         2611
Basin#1                      0.5         2652
Basin#1                      0.6         2693
Basin#1                      0.7         2735
Basin#1                      0.8         2777
Basin#1                      0.9         2819
Basin#1                      1.0         2862
Basin#1                      1.1         2905
Basin#1                      1.2         2948
Basin#1                      1.3         2992
Basin#1                      1.4         3036
Basin#1                      1.5         3080
Basin#1                      1.6         3125
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Basin#1		1.7	3169
Basin#1		1.8	3215
Basin#1		1.9	3260
Basin#1		2.0	3306
Basin#1		2.1	3352
Basin#1		2.2	3399
Basin#1		2.3	3445
Basin#1		2.4	3493
Basin#1		2.5	3540
Basin#1		2.6	3588
Basin#1		2.7	3636
Basin#1		2.8	3684
Basin#1		2.9	3733
Basin#1		3.0	3782
Basin#1		3.1	3831
Basin#1		3.2	3881
Basin#1		3.3	3931
Basin#1		3.4	3981
Basin#1		3.5	4032
Basin#1		3.6	4083
Basin#1		3.7	4134
Basin#1		3.8	4186
Basin#1		3.9	4238
Basin#1		4.0	4290
Basin#2	Storage	0.0	27700
Basin#2		0.1	27833
Basin#2		0.2	27967
Basin#2		0.3	28101
Basin#2		0.4	28235
Basin#2		0.5	28370
Basin#2		0.6	28505
Basin#2		0.7	28640
Basin#2		0.8	28775
Basin#2		0.9	28911
Basin#2		1.0	29047
Basin#2		1.1	29184
Basin#2		1.2	29321
Basin#2		1.3	29458
Basin#2		1.4	29595
Basin#2		1.5	29733
Basin#2		1.6	29871
Basin#2		1.7	30010
Basin#2		1.8	30148
Basin#2		1.9	30288
Basin#2		2.0	30427
Basin#2		2.1	30567
Basin#2		2.2	30707
Basin#2		2.3	30847
Basin#2		2.4	30988
Basin#2		2.5	31129
Basin#2		2.6	31270
Basin#2		2.7	31412
Basin#2		2.8	31554
Basin#2		2.9	31696
Basin#2		3.0	31838
Basin#2		3.1	31981
Basin#2		3.2	32125
Basin#2		3.3	32268
Basin#2		3.4	32412
Basin#2		3.5	32556
Basin#2		3.6	32701
Basin#2		3.7	32845
Basin#2		3.8	32991
Basin#2		3.9	33136
Basin#2		4.0	33282
Basin#2		4.1	33428
Basin#2		4.2	33574
Basin#2		4.3	33721
Basin#2		4.4	33868
Basin#2		4.5	34016
Basin#2		4.6	34163

Basin#2		4.7	34311
Basin#2		4.8	34460
Basin#2		4.9	34608
Basin#2		5.0	34757
Basin#2		5.1	34907
Basin#2		5.2	35056
Basin#2		5.3	35206
Basin#2		5.4	35356
Basin#2		5.5	35507
Basin#2		5.6	35658
Basin#2		5.7	35809
Basin#2		5.8	35961
Basin#2		5.9	36113
Basin#2		6.0	36265
Basin#2		6.1	36417
Basin#2		6.2	36570
Basin#2		6.3	36723
Basin#2		6.4	36877
Basin#2		6.5	37031
Basin#2		6.6	37185
Basin#2		6.7	37339
Basin#2		6.8	37494
Basin#2		6.9	37649
Basin#2		7.0	37804
Basin#2		7.1	37960
Basin#2		7.2	38116
Basin#2		7.3	38272
Basin#2		7.4	38429
Basin#2		7.5	38586
Basin#2		7.6	38743
Basin#2		7.7	38901
Basin#2		7.8	39059
Basin#2		7.9	39217
Basin#2		8.0	39376
Basin#2		8.1	39535
Basin#2		8.2	39694
Basin#2		8.3	39853
Basin#2		8.4	40013
Basin#2		8.5	40173
Basin#2		8.6	40334
Basin#2		8.7	40495
Basin#2		8.8	40656
Basin#2		8.9	40817
Basin#2		9.0	40979
;Basin #3			
Basin#3	Storage	0.0	21378
Basin#3		0.1	21495
Basin#3		0.2	21613
Basin#3		0.3	21730
Basin#3		0.4	21848
Basin#3		0.5	21967
Basin#3		0.6	22086
Basin#3		0.7	22205
Basin#3		0.8	22324
Basin#3		0.9	22444
Basin#3		1.0	22564
Basin#3		1.1	22684
Basin#3		1.2	22805
Basin#3		1.3	22926
Basin#3		1.4	23047
Basin#3		1.5	23169
Basin#3		1.6	23290
Basin#3		1.7	23413
Basin#3		1.8	23535
Basin#3		1.9	23658
Basin#3		2.0	23781
Basin#3		2.1	23905
Basin#3		2.2	24029
Basin#3		2.3	24153
Basin#3		2.4	24277
Basin#3		2.5	24402

Basin#3	2.6	24527
Basin#3	2.7	24653
Basin#3	2.8	24779
Basin#3	2.9	24905
Basin#3	3.0	25031
Basin#3	3.1	25158
Basin#3	3.2	25285
Basin#3	3.3	25412
Basin#3	3.4	25540
Basin#3	3.5	25668
Basin#3	3.6	25796
Basin#3	3.7	25925
Basin#3	3.8	26054
Basin#3	3.9	26183
Basin#3	4.0	26313
Basin#3	4.1	26443
Basin#3	4.2	26573
Basin#3	4.3	26704
Basin#3	4.4	26834
Basin#3	4.5	26966
Basin#3	4.6	27097
Basin#3	4.7	27229
Basin#3	4.8	27361
Basin#3	4.9	27494
Basin#3	5.0	27626
Basin#3	5.1	27760
Basin#3	5.2	27893
Basin#3	5.3	28027
Basin#3	5.4	28161
Basin#3	5.5	28295
Basin#3	5.6	28430
Basin#3	5.7	28565
Basin#3	5.8	28700
Basin#3	5.9	28836
Basin#3	6.0	28972
Basin#3	6.1	29109
Basin#3	6.2	29245
Basin#3	6.3	29382
Basin#3	6.4	29519
Basin#3	6.5	29657
Basin#3	6.6	29795
Basin#3	6.7	29933
Basin#3	6.8	30072
Basin#3	6.9	30211
Basin#3	7.0	30350
Basin#3	7.1	30489
Basin#3	7.2	30629
Basin#3	7.3	30769
Basin#3	7.4	30910
Basin#3	7.5	31051
Basin#3	7.6	31192
Basin#3	7.7	31333
Basin#3	7.8	31475
Basin#3	7.9	31617
Basin#3	8.0	31760
Basin#3	8.1	31902
Basin#3	8.2	32045
Basin#3	8.3	32189
Basin#3	8.4	32332
Basin#3	8.5	32476
Basin#3	8.6	32621
Basin#3	8.7	32765
Basin#3	8.8	32910
Basin#3	8.9	33056
Basin#3	9.0	33201
Basin#3	9.1	33347
Basin#3	9.2	33493
Basin#3	9.3	33640
Basin#3	9.4	33787
Basin#3	9.5	33934
Basin#3	9.6	34082
Basin#3	9.7	34230

Basin#3	9.8	34378
Basin#3	9.9	34526
Basin#3	10.0	34675
Basin#3	10.1	34824
Basin#3	10.2	34974
Basin#3	10.3	35123
Basin#3	10.4	35273
Basin#3	10.5	35424
Basin#3	10.6	35575
Basin#3	10.7	35726
Basin#3	10.8	35877
Basin#3	10.9	36029
Basin#3	11.0	36181
Basin#3	11.1	36333
Basin#3	11.2	36486
Basin#3	11.3	36639
Basin#3	11.4	36792
Basin#3	11.5	36946
Basin#3	11.6	37099
Basin#3	11.7	37254
Basin#3	11.8	37408
Basin#3	11.9	37563
Basin#3	12.0	37718
Basin#3	12.1	37874
Basin#3	12.2	38030
Basin#3	12.3	38186
Basin#3	12.4	38342
Basin#3	12.5	38499
Basin#3	12.6	38656
Basin#3	12.7	38814
Basin#3	12.8	38972
Basin#3	12.9	39130
Basin#3	13.0	39288
Basin#3	13.1	39447
Basin#3	13.2	39606
Basin#3	13.3	39765
Basin#3	13.4	39925
Basin#3	13.5	40085
Basin#3	13.6	40245
Basin#3	13.7	40406
Basin#3	13.8	40567
Basin#3	13.9	40728
Basin#3	14.0	40890
Basin#3	14.1	41052
Basin#3	14.2	41214
Basin#3	14.3	41377
Basin#3	14.4	41539
Basin#3	14.5	41703
Basin#3	14.6	41866
Basin#3	14.7	42030
Basin#3	14.8	42194
Basin#3	14.9	42359
Basin#3	15.0	42523
Basin#3	15.1	42689
Basin#3	15.2	42854
Basin#3	15.3	43020
Basin#3	15.4	43186
Basin#3	15.5	43352
Basin#3	15.6	43519
Basin#3	15.7	43686
Basin#3	15.8	43853
Basin#3	15.9	44021
Basin#3	16.0	44189
Basin#3	16.1	44357
Basin#3	16.2	44526
Basin#3	16.3	44695
Basin#3	16.4	44864
Basin#3	16.5	45034
Basin#3	16.6	45204
Basin#3	16.7	45374
Basin#3	16.8	45545
Basin#3	16.9	45716

```
Basin#3                     17.0        45887
Basin#3                     17.1        46058
Basin#3                     17.2        46230
Basin#3                     17.3        46402
Basin#3                     17.4        46575
Basin#3                     17.5        46748
Basin#3                     17.6        46921
Basin#3                     17.7        47094
Basin#3                     17.8        47268
Basin#3                     17.9        47442
Basin#3                     18.0        47617
Basin#3                     18.1        47791
Basin#3                     18.2        47966
Basin#3                     18.3        48142
Basin#3                     18.4        48317
Basin#3                     18.5        48493
Basin#3                     18.6        48670
Basin#3                     18.7        48846
Basin#3                     18.8        49023
Basin#3                     18.9        49201
Basin#3                     19.0        49378
Basin#3                     19.1        49556
Basin#3                     19.2        49734
Basin#3                     19.3        49913
Basin#3                     19.4        50092
Basin#3                     19.5        50271
Basin#3                     19.6        50451
Basin#3                     19.7        50630
Basin#3                     19.8        50811
Basin#3                     19.9        50991
Basin#3                     20.0        51172

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Lindberg Rain Gage from San Diego County
Lindberg         FILE "H:\EPA SWMM\PRN FILES\LINDBERG.prn"

[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            2720.510           3039.320
Div-1            981.151            4560.296
Div-2            1950.638           4896.495
Stor-1           947.368            4198.830
Stor-2           1677.135           4614.532
Stor-3           1955.367           3358.130

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
Basin1           890.923            5558.444
Basin2           2035.227           5649.335
Basin3           382.572            3538.789
BR-1             904.472            4959.350
```

```
BR-2            2021.129          5282.783

[SYMBOLS]
;;Gage         X-Coord           Y-Coord
;;-------------- ----------------- -----------------
Lindberg        1483.740          5365.854
```

ATTACHMENT 7

SWMM Screens and Explanation of Significant Variables

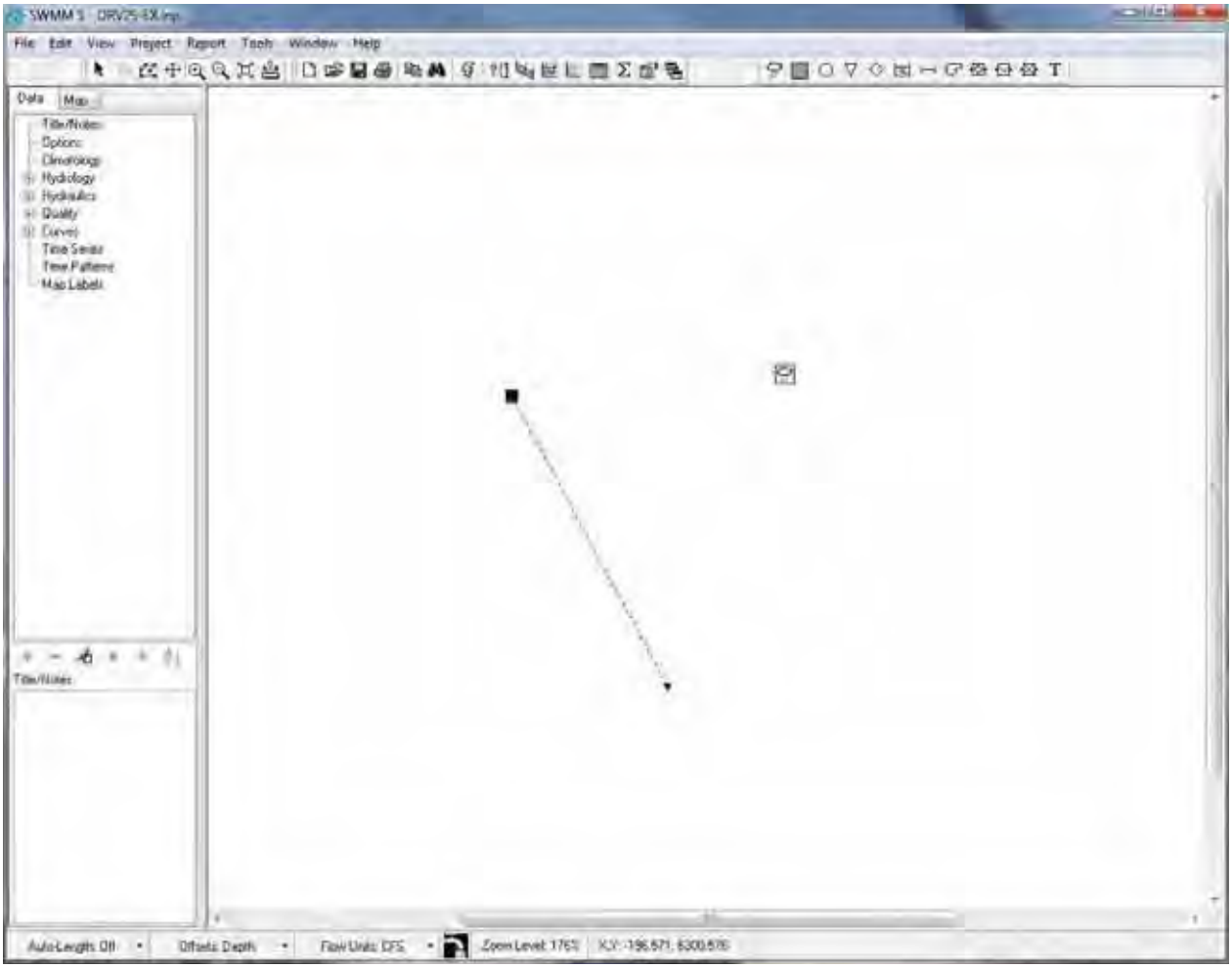
Attached, the reader can see the screens associated with the EPA-SWMM Model in both pre-development and post-development conditions. Each portion, i.e., sub-catchments, outfalls, storage units, LID controls for the bio-retention cells, ponding on top of the bio-retention (modeled as a storage unit), weir as a discharge, and outfalls (point of compliance), are also shown.

Variables for modeling are associated with typical recommended values by the EPA-SWMM model, typical values found in technical literature (such as Maidment's Handbook of Hydrology). Recommended values for the SWMM model have been attained from the interim Orange County criteria established for their SWMM calibration. Currently, no recommended values have been established by the San Diego County HMP Permit for the SWMM Model.

Soil characteristics of the existing soils were determined from the USGS sources.

Some values incorporated within the SWMM model have been determined from the professional experience of H&A using conservative assumption that have a tendency to increase the size of the needed BMP and also generate a long-term runoff as a percentage of rainfall similar to those measured in gage stations in Southern California by the USGS.

Pre-Developed Condition



Outfall Out-Prop

Property	Value
Name	Out-Prop
X-Coordinate	1748.113
Y-Coordinate	3977.401
Description	
Tag	
Inflows	NO
Treatment	NO
Invert EL	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall

Rain Gage Lindberg

Property	Value
Name	Lindberg
X-Coordinate	2384.000
Y-Coordinate	5666.000
Description	
Tag	
Rain Format	INTENSITY
Time Interval	1:00
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	Lindberg
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

User-assigned name of rain gage

Subcatchment Basin1

Property	Value
Name	Basin1
X-Coordinate	890.923
Y-Coordinate	5558.444
Description	Existing Area
Tag	
Rain Gage	Lindberg
Outlet	Out-Prop
Area	250.4
Width	1840
% Slope	5.3
% Imperv	3.4
N-Imperv	.012
N-Perv	0.05
Dstore-Imperv	.02
Dstore-Perv	.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Infiltration Editor

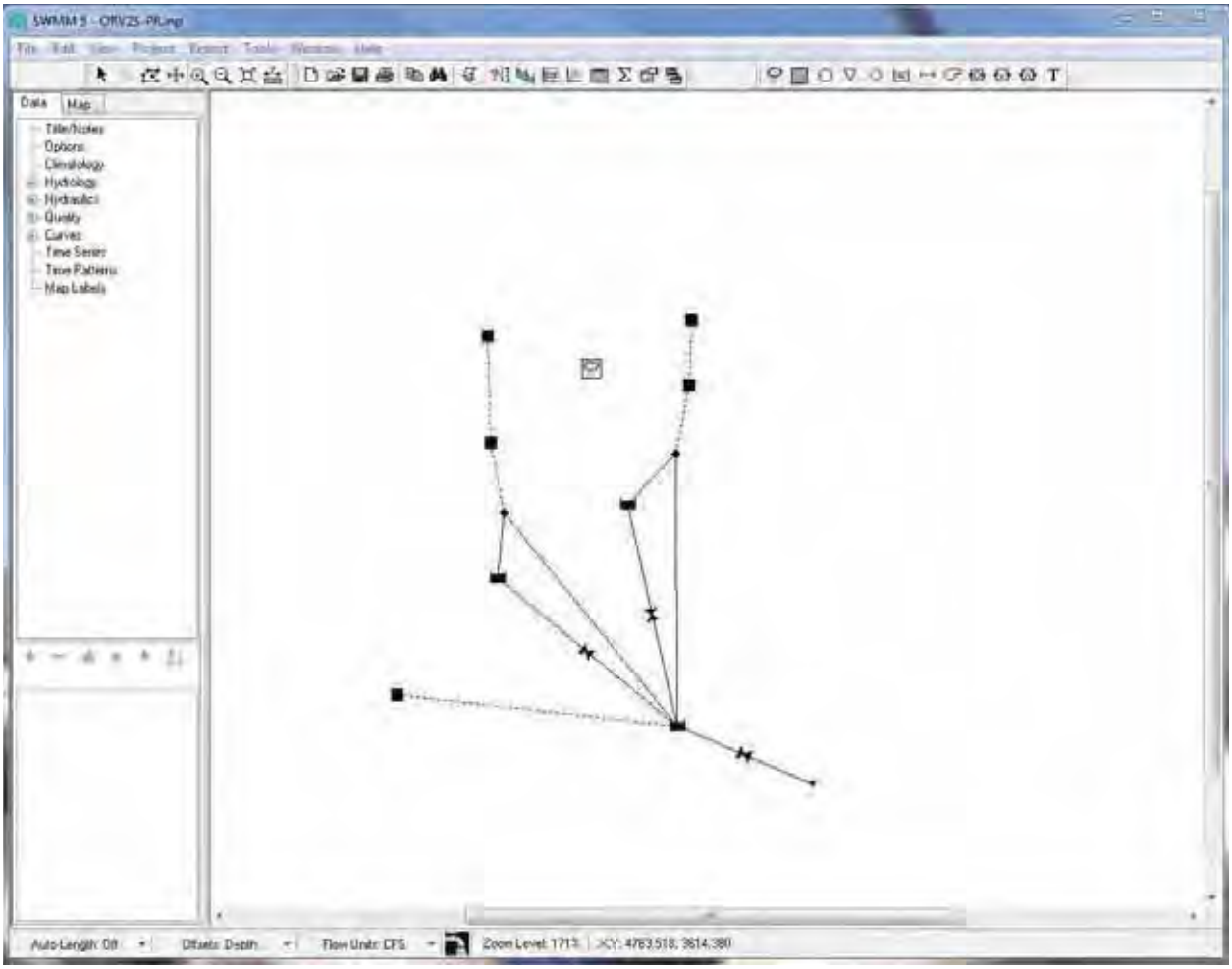
Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	.025
Initial Deficit	0.3

Soil capillary suction head (inches or mm)

OK Cancel Help

Developed Condition



Outfall POC-1

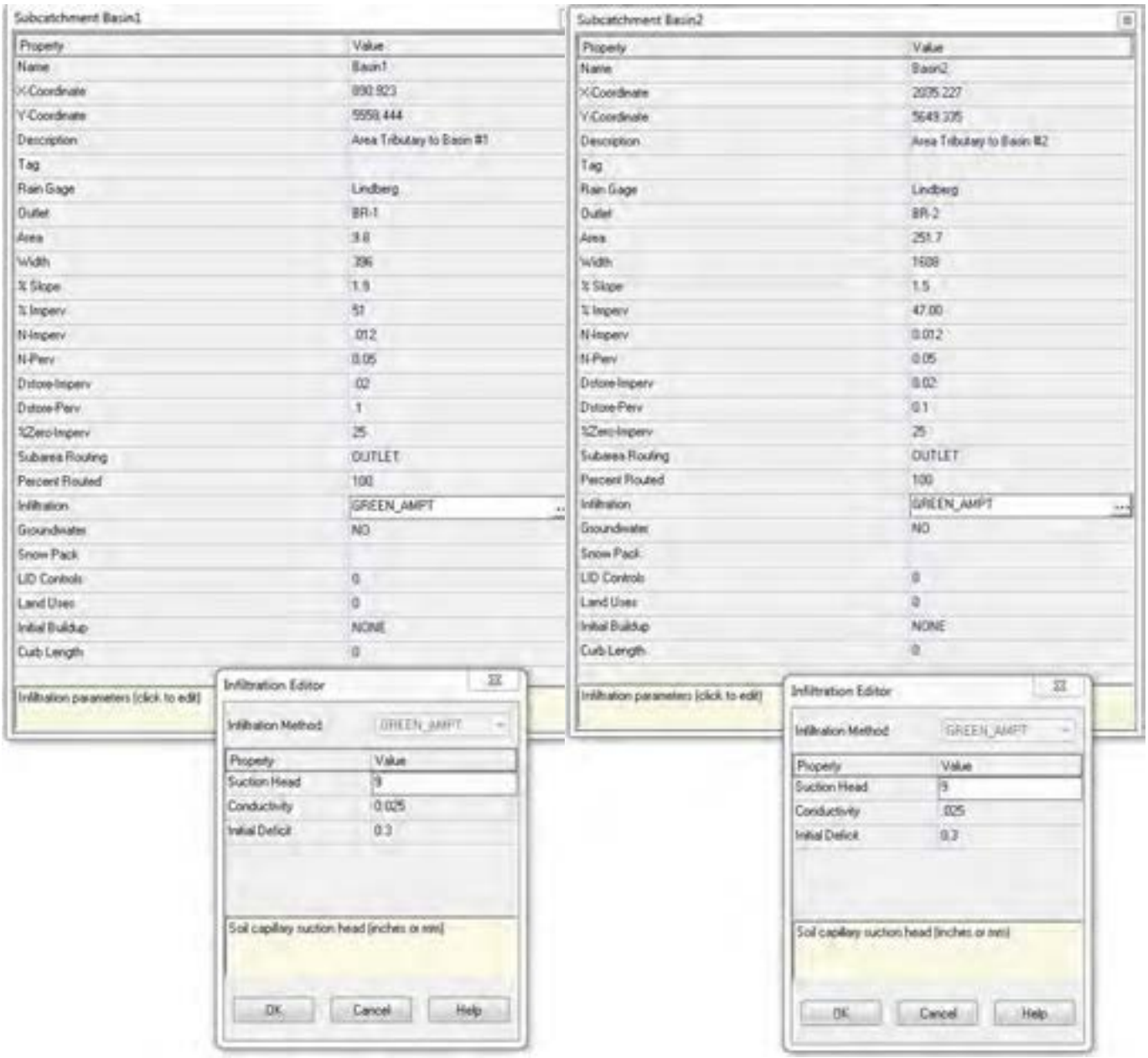
Property	Value
Name	POC-1
X-Coordinate	2726.510
Y-Coordinate	3039.320
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall

Rain Gage Lindberg

Property	Value
Name	Lindberg
X-Coordinate	1483.740
Y-Coordinate	5365.854
Description	
Tag	
Rain Format	INTENSITY
Time Interval	1:00
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	Lindberg
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

User-assigned name of rain gage


Subcatchment Basin1
Property
Value
Name
Basin1
X-Coordinate
890.923
Y-Coordinate
5559.444
Description
Area Tributary to Basin #1
Tag
Rain Gage
Lindberg
Outlet
BR-1
Area
9.8
%Width
396
% Slope
1.9
% Imperv
51
N-Imperv
.012
N-Perv
0.05
Dstore-Imperv
.02
Dstore-Perv
1
%Zero-Imperv
25
Subarea Routing
OUTLET
Percent Routed
100
Infiltration
GREEN_AMPT
Groundwater
NO
Snow Pack
LID Controls
0
Land Uses
0
Initial Buildup
NONE
Curb Length
0
Infiltration parameters (click to edit)
Infiltration Editor
Infiltration Method
GREEN_AMPT
Property
Value
Suction Head
9
Conductivity
0.025
Initial Deficit
0.3
Soil capillary suction head (inches or mm)
OK
Cancel
Help
Subcatchment Basin2
Property
Value
Name
Basin2
X-Coordinate
2035.227
Y-Coordinate
5649.105
Description
Area Tributary to Basin #2
Tag
Rain Gage
Lindberg
Outlet
BR-2
Area
251.7
%Width
1608
% Slope
1.5
% Imperv
47.00
N-Imperv
0.012
N-Perv
0.05
Dstore-Imperv
0.02
Dstore-Perv
0.1
%Zero-Imperv
25
Subarea Routing
OUTLET
Percent Routed
100
Infiltration
GREEN_AMPT
Groundwater
NO
Snow Pack
LID Controls
0
Land Uses
0
Initial Buildup
NONE
Curb Length
0
Infiltration parameters (click to edit)
Infiltration Editor
Infiltration Method
GREEN_AMPT
Property
Value
Suction Head
9
Conductivity
.025
Initial Deficit
0.3
Soil capillary suction head (inches or mm)
OK
Cancel
Help

Subcatchment BR-1

Property	Value
Name	BR-1
X-Coordinate	904.472
Y-Coordinate	4959.350
Description	
Tag	
Rain Gage	Lindberg
Outlet	Div-1
Area	.1
Width	14
% Slope	0.1
% Imperv	0
N-Imperv	0.012
N-Perv	0.1
Dstore-Imperv	.02
Dstore-Perv	.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	1.5
Conductivity	0.3
Initial Deficit	0.33

Soil capillary suction head (inches or mm)

OK Cancel Help

Subcatchment BR-2

Property	Value
Name	BR-2
X-Coordinate	2021.129
Y-Coordinate	5282.783
Description	Bioretention 2
Tag	
Rain Gage	Lindberg
Outlet	Div-2
Area	0.94
Width	87
% Slope	0.1
% Imperv	0
N-Imperv	.012
N-Perv	.05
Dstore-Imperv	0.02
Dstore-Perv	0.1
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	1.5
Conductivity	0.3
Initial Deficit	0.33

Soil capillary suction head (inches or mm)

OK Cancel Help

EXPLANATION OF SELECTED VARIABLES

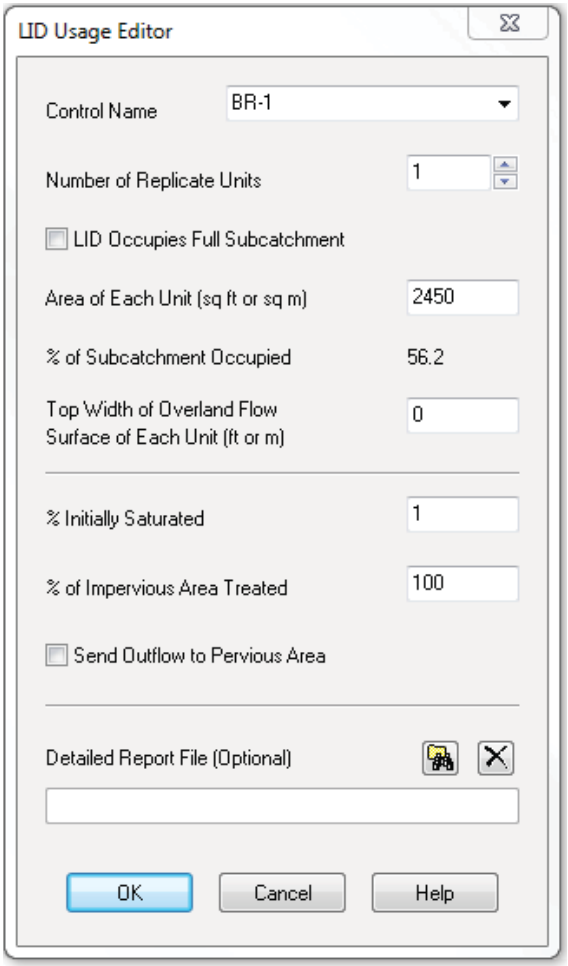
Parameters for the pre- and post-developed models include soil type D in accordance with the San Diego County Hydrology Manual and the USGS Soil Survey Map (attached at the end of this appendix). Suction head, conductivity and initial deficit corresponds to average values expected for soils type D, according to sources consulted, professional experience, and approximate values obtained by the interim Orange County modeling approach.

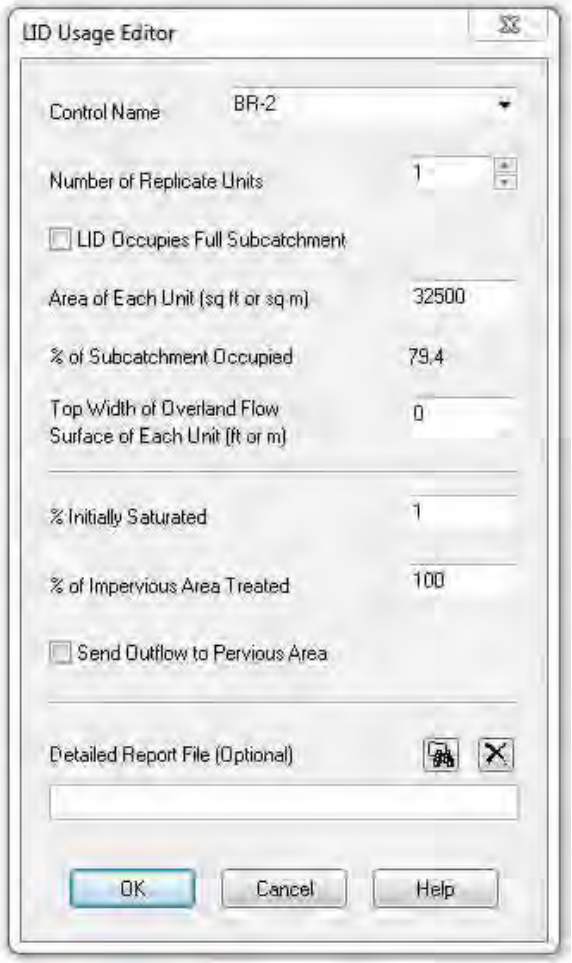
H&A selected infiltration values, such that the percentage of total precipitation that becomes runoff, is realistic for soil type D and slightly smaller than measured values for Southern California watersheds.

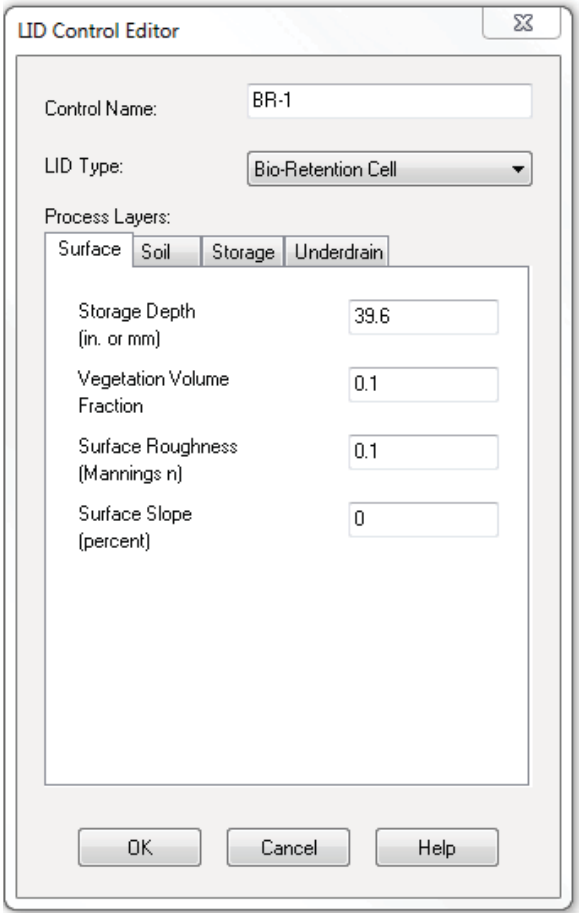
Selection of a Kinematic Approach: As the continuous model is based on hourly rainfall, and the time of concentration for the pre-development and post-development conditions is significantly smaller than 60 minutes, precise routing of the flows through the impervious surfaces, the underdrain pipe system, and the discharge pipe was considered unnecessary. The truncation error of the precipitation into hourly steps is much more significant than the precise routing in a system where the time of concentration is much smaller than 1 hour.

Sub-catchments BR-1 & BR-2:

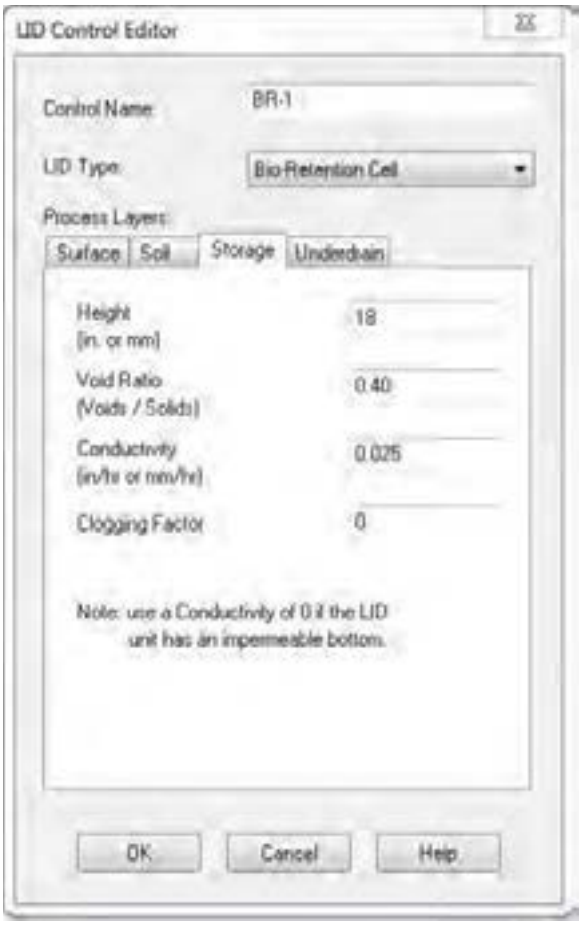
The area of Prop-X + BR-X must be equal to the area of the development tributary to that particular bio-retention facility. Five (5) decimal places were given regarding the areas of the bio-retention to insure that the area used by the program for the LID subroutine corresponds exactly with these tributaries.


LID Usage Editor
Control Name
BR-1
Number of Replicate Units
1
LID Occupies Full Subcatchment
Area of Each Unit (sq ft or sq m)
2450
% of Subcatchment Occupied
56.2
Top Width of Overland Flow Surface of Each Unit (ft or m)
0
% Initially Saturated
1
% of Impervious Area Treated
100
Send Outflow to Pervious Area
Detailed Report File (Optional)
OK
Cancel
Help

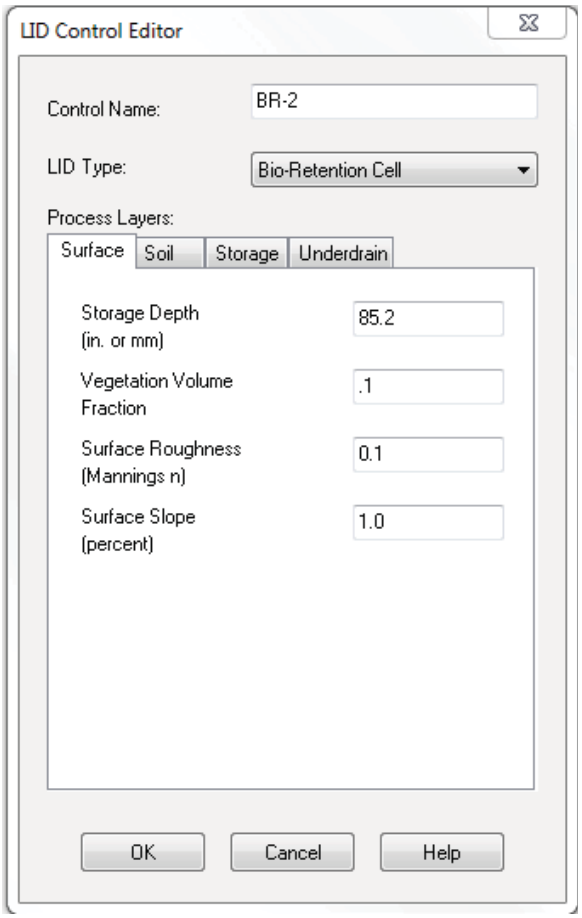

LID Usage Editor
Control Name
BR-2
Number of Replicate Units
1
LID Occupies Full Subcatchment
Area of Each Unit (sq ft or sq m)
32500
% of Subcatchment Occupied
79.4
Top Width of Overland Flow Surface of Each Unit (ft or m)
0
% Initially Saturated
1
% of Impervious Area Treated
100
Send Outflow to Pervious Area
Detailed Report File (Optional)
OK
Cancel
Help

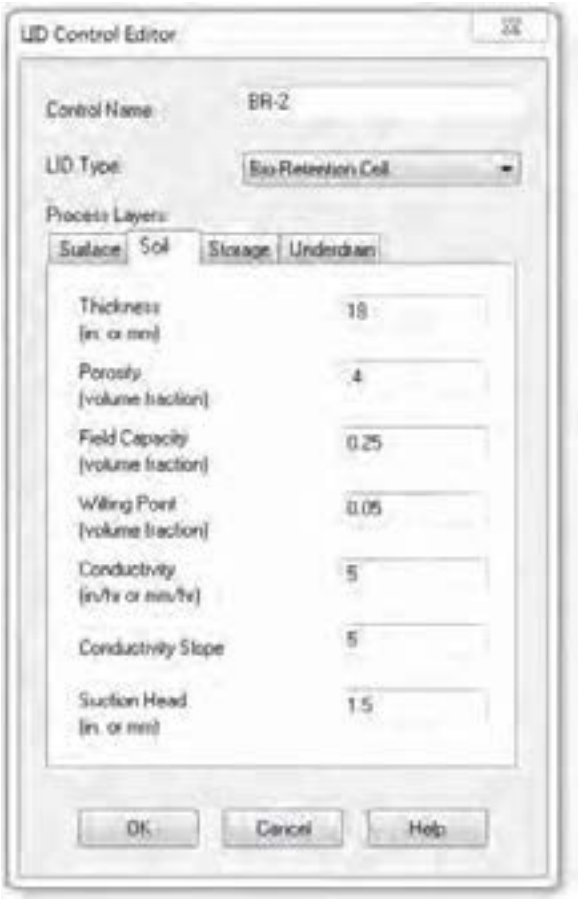

LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth
(in. or mm)
39.6
Vegetation Volume
Fraction
0.1
Surface Roughness
(Mannings n)
0.1
Surface Slope
(percent)
0
OK
Cancel
Help

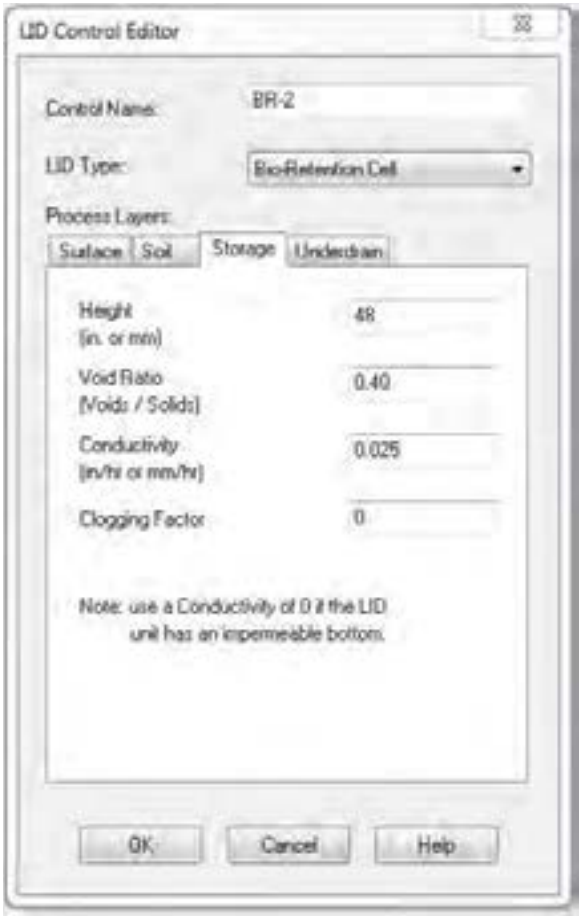
LID Control Editor
Control Name:
BR-1
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness
(in. or mm)
18
Porosity
(volume fraction)
0.4
Field Capacity
(volume fraction)
0.25
Wilting Point
(volume fraction)
0.05
Conductivity
(in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head
(in. or mm)
1.5

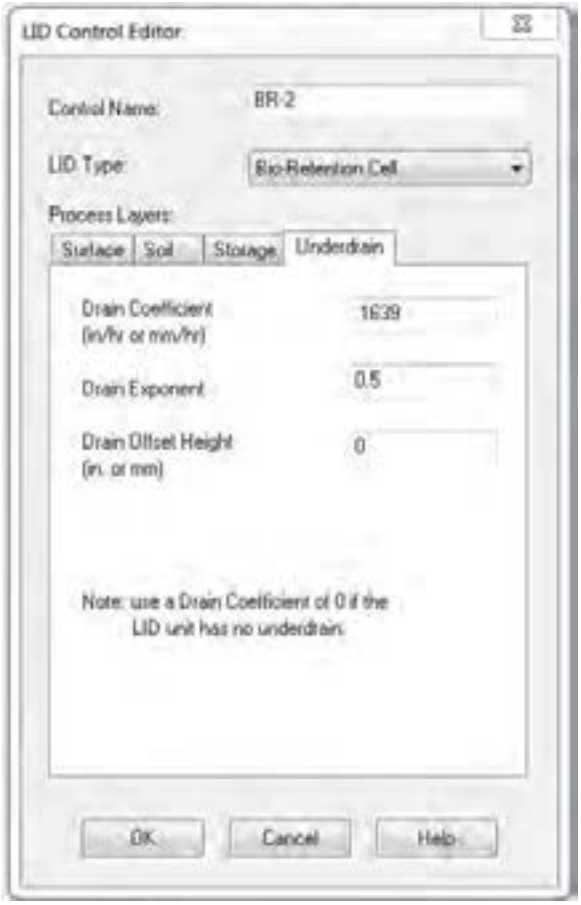

LID Control Editor
Control Name
BR-1
LID Type
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height
(in. or mm)
18
Void Ratio
(Voids / Solids)
0.40
Conductivity
(in/hr or mm/hr)
0.025
Clogging Factor
0
Note: use a Conductivity of 0 if the LID unit has an impermeable bottom.
OK
Cancel
Help

LID Control Editor
Control Name
BR-1
LID Type
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient
[in/hr or mm/hr]
1.2231
Drain Exponent
0.5
Drain Offset Height
(in. or mm)
0
Note: use a Drain Coefficient of 0 if the LID unit has no underdrain.
OK
Cancel
Help


LID Control Editor
Control Name:
BR-2
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth
(in. or mm)
85.2
Vegetation Volume
Fraction
.1
Surface Roughness
(Mannings n)
0.1
Surface Slope
(percent)
1.0
OK
Cancel
Help


LID Control Editor
Control Name
BR-2
LID Type
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness
(in. or mm)
18
Porosity
(volume fraction)
.4
Field Capacity
(volume fraction)
0.25
Wilting Point
(volume fraction)
0.05
Conductivity
(in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head
(in. or mm)
1.5
OK
Cancel
Help


LID Control Editor
Control Name:
BR-2
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height
(in. or mm)
48
Void Ratio
(Voids / Solids)
0.40
Conductivity
(in/hr or mm/hr)
0.025
Clogging Factor
0
Note: use a Conductivity of 0 if the LID
unit has an impermeable bottom.
OK
Cancel
Help


LID Control Editor
Control Name:
BR-2
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient
(in/hr or mm/hr)
1639
Drain Exponent
0.5
Drain Offset Height
(in. or mm)
0
Note: use a Drain Coefficient of 0 if the
LID unit has no underdrain.
OK
Cancel
Help

LID Control Editor: Explanation of Significant Variables

Storage Depth:
The storage depth variable within the SWMM model is representative of the storage volume provided beneath the engineered soil and mulch components of the bioretention facility. This storage volume is comprised of a gravel located bed beneath a layer of engineered soil and a 0.25 foot (3-inch) layer of landscaping mulch.

Porosity:
A porosity value of 0.4 has been selected for the model. The amended soil is to be highly sandy in content in order to have a saturated hydraulic conductivity of approximately 5 in/hr.

H&A considers such a value to be slightly high; however, in order to comply with the HMP Permit, the value recommended by the Copermittees for the porosity of amended soil is 0.4, per Appendix A of the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011.

Void Ratio:
The ratio of the void volume divided by the soil volume is directly related to porosity as n/(1-n). As the underdrain layer is composed of gravel, a porosity value of 0.4 has been selected, which results in a void ratio of 0.4/(1-0.4) = 0.67 for the gravel detention layer.

Clogging factor:
A clogging factor was not used (0 indicates that there is not clogging assumed within the model). The reason for this is related to the fairness of a comparison with the SDHM model and the HMP sizing tables: a clogging factor was not considered, and instead, a conservative value of infiltration was recommended.

Drain (Flow) coefficient:
The flow coefficient in the SWMM Model is the coefficient needed to transform the orifice equation into a general power law equation of the form:

$$q = C(H - H_D)^n \qquad (1)$$

where q is the peak flow in in/hr, n is the exponent (typically 0.5 for orifice equation), H D is the elevation of the centroid of the orifice in inches (assumed equal to the invert of the orifice for small orifices and in our design equal to 0) and H is the depth of the water in inches.

The general orifice equation can be expressed as:

$$Q = \frac{\pi}{4} c_g \frac{D^2}{144} \sqrt{2g \frac{(H - H_D)}{12}} \qquad (2)$$

where Q is the peak flow in cfs, D is the diameter in inches, c g is the typical discharge coefficient for orifices (0.61-0.63 for thin walls and around 0.75-0.8 for thick walls), g is the acceleration of gravity in ft/s^2, and H and H D are defined above and are also used in inches in Equation (2).

Cutoff Flow:

This is the only significant variable in the diversion, as the type of diversion is defined by this value. Any excess of flow over this value will be diverted into a pond subroutine (the surface stage of the bio-retention basin) and routed there. The determination of this value equates to the value obtained with equation (2) above, plus 1%, when H = depth of gravel layer and H_D=0 (orifice situated at the datum). Thus, once flows exceed the maximum discharge the LID orifice experiences a head of the storage depth, ponding occurs within the bioretention basin, routing these additional flows via the pond riser.

Divider Div-1

Property	Value
Name	Div-1
X-Coordinate	981.151
Y-Coordinate	4560.296
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	0.167
Initial Depth	0
Surcharge Depth	0
Ponded Area	0
Diverted Link	Bypass-1
Type	CUTOFF
Cutoff Divider	
Cutoff Flow	.27134
Tabular Divider	
Curve Name	*
Weir Divider	
Min. Flow	0
Max. Depth	0
Coefficient	0

Divider Div-2

Property	Value
Name	Div-2
X-Coordinate	1950.638
Y-Coordinate	4896.495
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	.167
Initial Depth	0
Surcharge Depth	0
Ponded Area	0
Diverted Link	Bypass-2
Type	CUTOFF
Cutoff Divider	
Cutoff Flow	0.82618
Tabular Divider	
Curve Name	*
Weir Divider	
Min. Flow	0
Max. Depth	0
Coefficient	0

Note:

The complete storage and rating curves and the respective explanation is shown at the end of this appendix. A variable area vs. elevation storage curve was used for the final model, and a discharge that is a function of the outlet structure in the surface was used also.

LID Outlet #1			
ABMP=	**2450**	sq-ft	(Area above engineered fill/bio-retention section)
			(It can also be area of infiltration at the bottom)
Cg=	**0.61**		(coefficient of discharge of the bottom orifice)
Dorif=	**3**	in	(diameter in inches of the bottom orifice)
Aorifice=	0.04909	sq-ft	(area of orifice in sq-ft)
C_{SWMM}=	1.2231		C coefficient to be inserted into SWMM
H-gravel=	**1.5**	ft	Depth of the gravel layer where water is ponding
	18	in	(In this case: superior bottom - mulch - ammended soil - invert of French drain)
			(726.75-3/12-18/12-722.35)
	15	in	
H-design=	1.250	ft	H-gravel minus radius of the discharge
$Q_{orif\text{-}classic}$=	0.26866	cfs	
$Q_{orif\text{-}SWMM}$=	0.26866	cfs	
$Q_{diversion}$=	0.27134	cfs	1% additional to the Qorifice.

LID Outlet #2			
ABMP=	**32500**	sq-ft	(Area above engineered fill/bio-retention section)
			(It can also be area of infiltration at the bottom)
Cg=	**0.61**		(coefficient of discharge of the bottom orifice)
Dorif=	**4**	in	(diameter in inches of the bottom orifice)
Aorifice=	0.08727	sq-ft	(area of orifice in sq-ft)
C_{SWMM}=	0.1639		C coefficient to be inserted into SWMM
H-gravel=	**4**	ft	Depth of the gravel layer where water is ponding
	48	in	(In this case: superior bottom - mulch - ammended soil - invert of French drain)
			(726.75-3/12-18/12-722.35)
	44	in	
H-design=	3.667	ft	H-gravel minus radius of the discharge
$Q_{orif\text{-}classic}$=	0.81800	cfs	
$Q_{orif\text{-}SWMM}$=	0.81800	cfs	
$Q_{diversion}$=	0.82618	cfs	1% additional to the Qorifice.

Storage Unit Stor-1

Property	Value
Name	Stor-1
X-Coordinate	947.368
Y-Coordinate	4198.830
Description	Basin #1
Tag	
Inflows	NO
Treatment	NO
Invert El.	382.5
Max. Depth	4.0
Initial Depth	0
Ponded Area	4290
Evap. Factor	1
Infiltration	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	Basin#1

Name of storage curve to use (after specifing a curve, you can double-click to edit it)

Outlet Outlet1

Property	Value
Name	Outlet1
Inlet Node	Stor-1
Outlet Node	Stor-3
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/DEPTH
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OutletBasin#1

User-assigned name of outlet

Storage Unit Stor-2

Property	Value
Name	Stor-2
X-Coordinate	1577.135
Y-Coordinate	4014.532
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	372.5
Max. Depth	3.0
Initial Depth	0
Ponded Area	40979
Evap. Factor	0
Infiltration	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	Basin#2

User-assigned name of storage unit

Outlet Outlet-2

Property	Value
Name	Outlet-2
Inlet Node	Stor-2
Outlet Node	Stor-3
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/DEPTH
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OutletBasin#2

User-assigned name of outlet

Storage Unit Stor-3

Property	Value
Name	Stor-3
X-Coordinate	1955.367
Y-Coordinate	3358.130
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	20
Initial Depth	0
Ponded Area	51172
Evap. Factor	0
Infiltration	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	Basin01

User assigned name of storage unit

Outlet Outlet-3

Property	Value
Name	Outlet-3
Inlet Node	Stor-3
Outlet Node	POC-1
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/DEPTH
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OutletBasin01

User assigned name of outlet

Outfall POC-1

Property	Value
Name	POC-1
X-Coordinate	2720.510
Y-Coordinate	3039.320
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

ATTACHMENT 8

Drying Time of the Surface Layer of Bio-retention cells

The LID subroutine of the SWMM Model does not increase the discharge of the lower LID orifice once the storage layer is full (in other words, it does not consider the influence of the pressure in the amended soil layer). The discharge of the lower LID orifice when the surface layer is full is considered constant by the model and equal to the discharge of the lower orifice when the storage layer is full (equal to the cutoff flows).

The drying time interval between an elevation yi and another elevation $yi - \Delta y$ can be obtained by:

$$\Delta t_i(hours) = \frac{(Q(yi)+Q(yi-\Delta y))}{7200\,(V(yi)-V(yi-\Delta y))} = \frac{Q_{ave}}{3600\,\Delta V}$$

$$t = \sum_{i=1}^{n} \Delta t_i \ (hours)$$

Q_{ave} represents the average discharge between elevation y_i and y_{i+1} obtained by $\frac{Q(yi)+Q(yi-\Delta y)}{2}$ where ΔV represents the fraction of the volume that must be discharged at a peak flow $Q_{ave}(V(yi) - V(yi - \Delta y))$.

The volume and the discharge change as the elevation changes; the calculation takes into account this change.

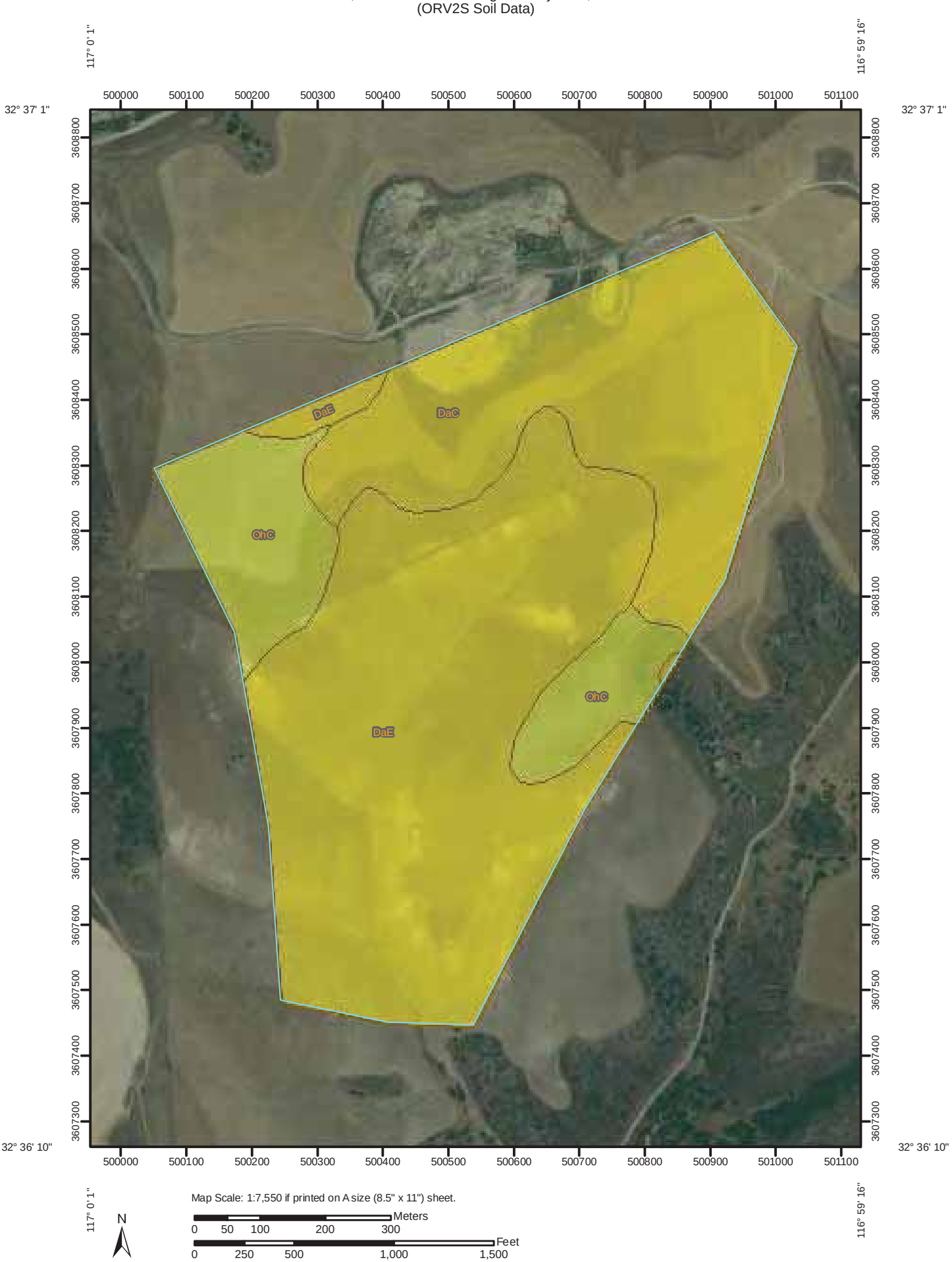
Basin #1		$Q_{Sub\ Drain}$=	0.27	cfs
Elevation	Q_{AVG} (CFS)	DV (CF)	DT (HR)	Total T
382.6	0.27	247	0.25	10.28
382.7	0.27	251	0.26	10.03
382.8	0.27	255	0.26	9.77
382.9	0.27	259	0.27	9.51
383.0	0.27	263	0.27	9.24
383.1	0.27	267	0.27	8.97
383.2	0.27	271	0.28	8.70
383.3	0.27	276	0.28	8.42
383.4	0.27	280	0.29	8.14
383.5	0.27	284	0.29	7.85
383.6	0.27	288	0.30	7.56
383.7	0.27	293	0.30	7.27
383.8	0.27	297	0.30	6.97
383.9	0.27	301	0.31	6.67
384.0	0.27	306	0.31	6.36
384.1	0.27	310	0.32	6.04
384.2	0.27	315	0.32	5.73
384.3	0.27	319	0.33	5.40
384.4	0.27	324	0.33	5.08
384.5	0.27	328	0.34	4.75
384.6	0.27	333	0.34	4.41
384.7	0.27	338	0.35	4.07
384.8	0.27	342	0.35	3.72
384.9	0.27	347	0.36	3.37
385.0	0.27	352	0.36	3.02
385.1	0.27	356	0.36	2.66
385.2	0.27	361	0.37	2.29
385.3	0.27	366	0.37	1.92
385.4	0.27	371	0.38	1.55
385.5	0.27	376	0.38	1.17
385.6	0.27	381	0.39	0.78
385.7	0.27	386	0.39	0.39
385.8	0.27	391	0.40	0.00

Basin #2		$Q_{Sub\ Drain}$=	0.83	cfs
Elevation	Q_{AVG} (CFS)	DV (CF)	DT (HR)	Total T
372.6	0.83	2777	0.93	75.51
372.7	0.83	2790	0.94	74.57
372.8	0.83	2803	0.94	73.64
372.9	0.83	2817	0.95	72.69
373.0	0.83	2830	0.95	71.75
373.1	0.83	2844	0.96	70.79
373.2	0.83	2857	0.96	69.84
373.3	0.83	2871	0.97	68.88
373.4	0.83	2884	0.97	67.91
373.5	0.83	2898	0.97	66.94
373.6	0.83	2912	0.98	65.97
373.7	0.83	2925	0.98	64.99
373.8	0.83	2939	0.99	64.01
373.9	0.83	2953	0.99	63.02
374.0	0.83	2966	1.00	62.02
374.1	0.83	2980	1.00	61.03
374.2	0.83	2994	1.01	60.03
374.3	0.83	3008	1.01	59.02
374.4	0.83	3022	1.02	58.01
374.5	0.83	3036	1.02	56.99
374.6	0.83	3050	1.03	55.97
374.7	0.83	3064	1.03	54.95
374.8	0.83	3078	1.03	53.92
374.9	0.83	3092	1.04	52.88
375.0	0.83	3106	1.04	51.84
375.1	0.83	3120	1.05	50.80
375.2	0.83	3134	1.05	49.75
375.3	0.83	3148	1.06	48.69
375.4	0.83	3162	1.06	47.64
375.5	0.83	3177	1.07	46.57
375.6	0.83	3191	1.07	45.50
375.7	0.83	3205	1.08	44.43
375.8	0.83	3220	1.08	43.35
375.9	0.83	3234	1.09	42.27
376.0	0.83	3248	1.09	41.18
376.1	0.83	3263	1.10	40.09
376.2	0.83	3277	1.10	38.99
376.3	0.83	3292	1.11	37.89
376.4	0.83	3306	1.11	36.79
376.5	0.83	3321	1.12	35.67
376.6	0.83	3335	1.12	34.56
376.7	0.83	3350	1.13	33.44
376.8	0.83	3365	1.13	32.31
376.9	0.83	3379	1.14	31.18
377.0	0.83	3394	1.14	30.04
377.1	0.83	3409	1.15	28.90
377.2	0.83	3424	1.15	27.76
377.3	0.83	3439	1.16	26.60
377.4	0.83	3453	1.16	25.45
377.5	0.83	3468	1.17	24.29
377.6	0.83	3483	1.17	23.12
377.7	0.83	3498	1.18	21.95
377.8	0.83	3513	1.18	20.77
377.9	0.83	3528	1.19	19.59
378.0	0.83	3543	1.19	18.41
378.1	0.83	3558	1.20	17.21
378.2	0.83	3573	1.20	16.02
378.3	0.83	3588	1.21	14.82
378.4	0.83	3604	1.21	13.61
378.5	0.83	3619	1.22	12.40
378.6	0.83	3634	1.22	11.18
378.7	0.83	3649	1.23	9.96
378.8	0.83	3665	1.23	8.73
378.9	0.83	3680	1.24	7.50
379.0	0.83	3695	1.24	6.26
379.1	0.83	3711	1.25	5.02
379.2	0.83	3726	1.25	3.77
379.3	0.83	3742	1.26	2.52
379.4	0.83	3757	1.26	1.26
379.5	0.83	3773	1.27	0.00

ATTACHMENT 9

USGS Soil Map of Project Site

K Factor, Whole Soil—San Diego County Area, California
(ORV2S Soil Data)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

.02

.05

.10

.15

.17

.20

.24

.28

.32

.37

.43

.49

.55

.64

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:7,550 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 6, Dec 17, 2007

Date(s) aerial images were photographed: 6/7/2005

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

K Factor, Whole Soil

K Factor, Whole Soil— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
DaC	Diablo clay, 2 to 9 percent slopes	.17	51.2	30.8%
DaE	Diablo clay, 15 to 30 percent slopes	.17	91.7	55.1%
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes	.20	23.4	14.1%
Totals for Area of Interest			**166.3**	**100.0%**

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Layer Options: Surface Layer

Hydrologic Soil Group—San Diego County Area, California
(ORV2S Soil Data)

Map Scale: 1:7,550 if printed on A size (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1,000 1,500

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:7,550 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

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Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 6, Dec 17, 2007

Date(s) aerial images were photographed: 6/7/2005

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
DaC	Diablo clay, 2 to 9 percent slopes	D	51.2	30.8%
DaE	Diablo clay, 15 to 30 percent slopes	D	91.7	55.1%
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes	D	23.4	14.1%
Totals for Area of Interest			**166.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

ATTACHMENT 10

Hydromodification Watershed Maps

OTAY RANCH
VILLAGE 2 NORTH

OTAY RANCH
VILLAGE 2 WEST

1.8 ACRES

8.0 ACRES

4.0 ACRES

8.8 ACRES

HERITAGE ROAD

2.3 ACRES

OTAY RANCH
VILLAGE 2 SOUTH

OTAY RANCH
VILLAGE 2 SOUTH
(SUNWOOD OWNERSHIP)

223.7 ACRES

POC 1

LEGEND:

10.0 ACRES	WATERSHED AREA
	SLOPE NATURAL STEEP
	SLOPE DEVELOPED 2:1
	DEVELOPED RIGHT OF WAY GRADED BENCH
	DEVELOPED LOT
	DEVELOPED MASS GRADED PAD

VICINITY MAP

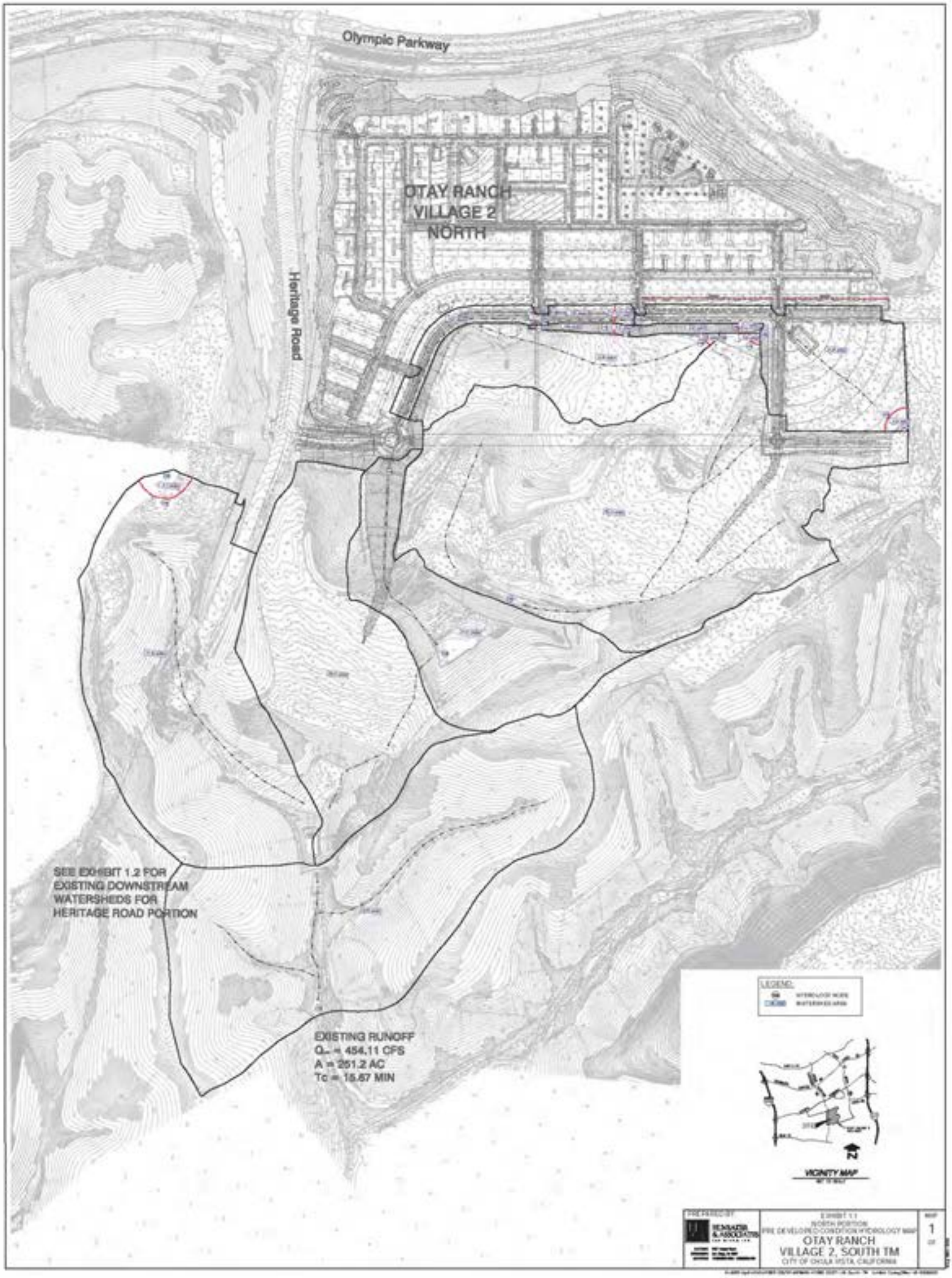
PREPARED BY:
HUNSAKER & ASSOCIATES

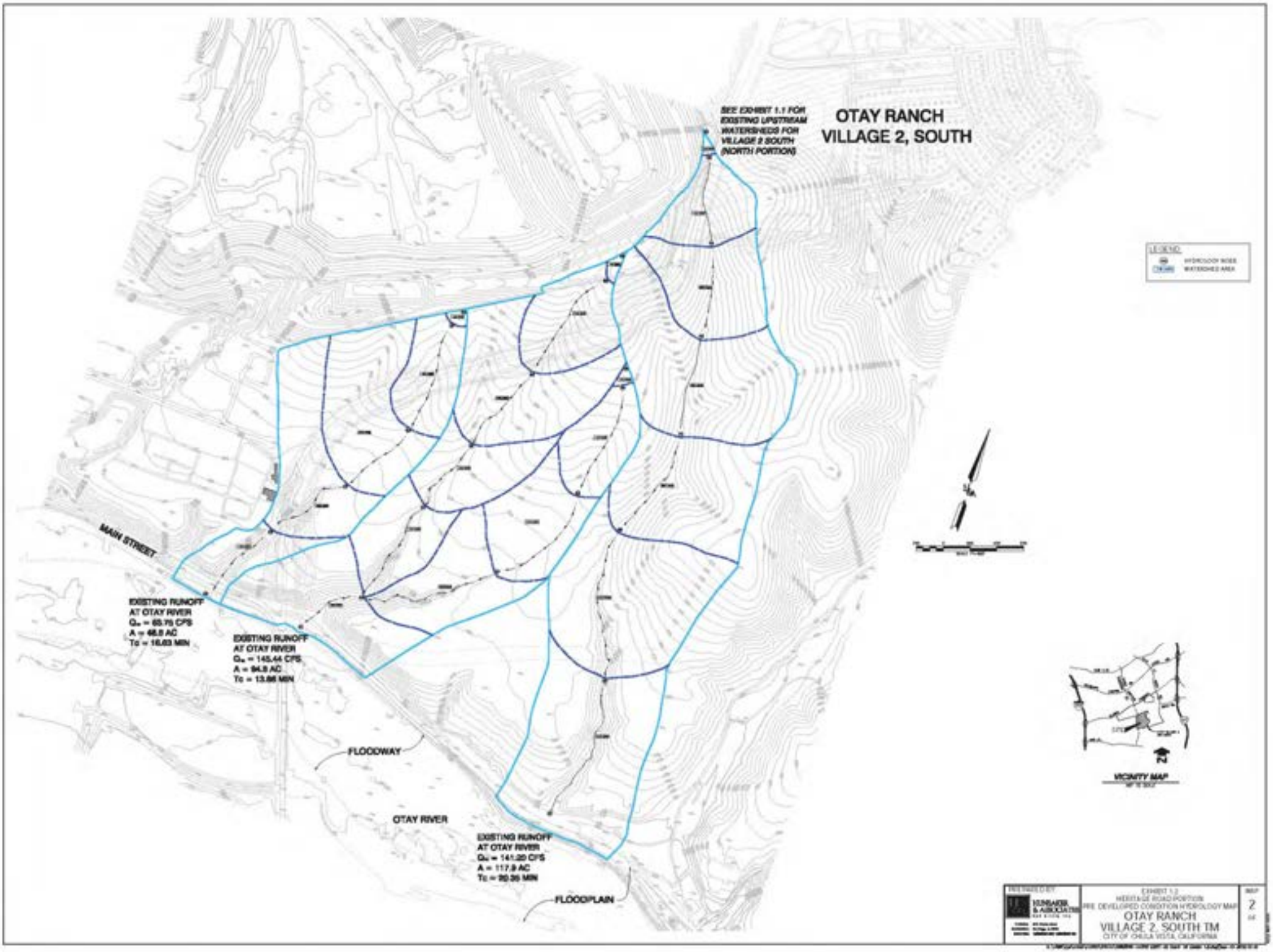
EXHIBIT 1.1
EXISTING CONDITION
HYDROMODIFICATION MAP
OTAY RANCH
VILLAGE 2, SOUTH
CITY OF CHULA VISTA, CALIFORNIA

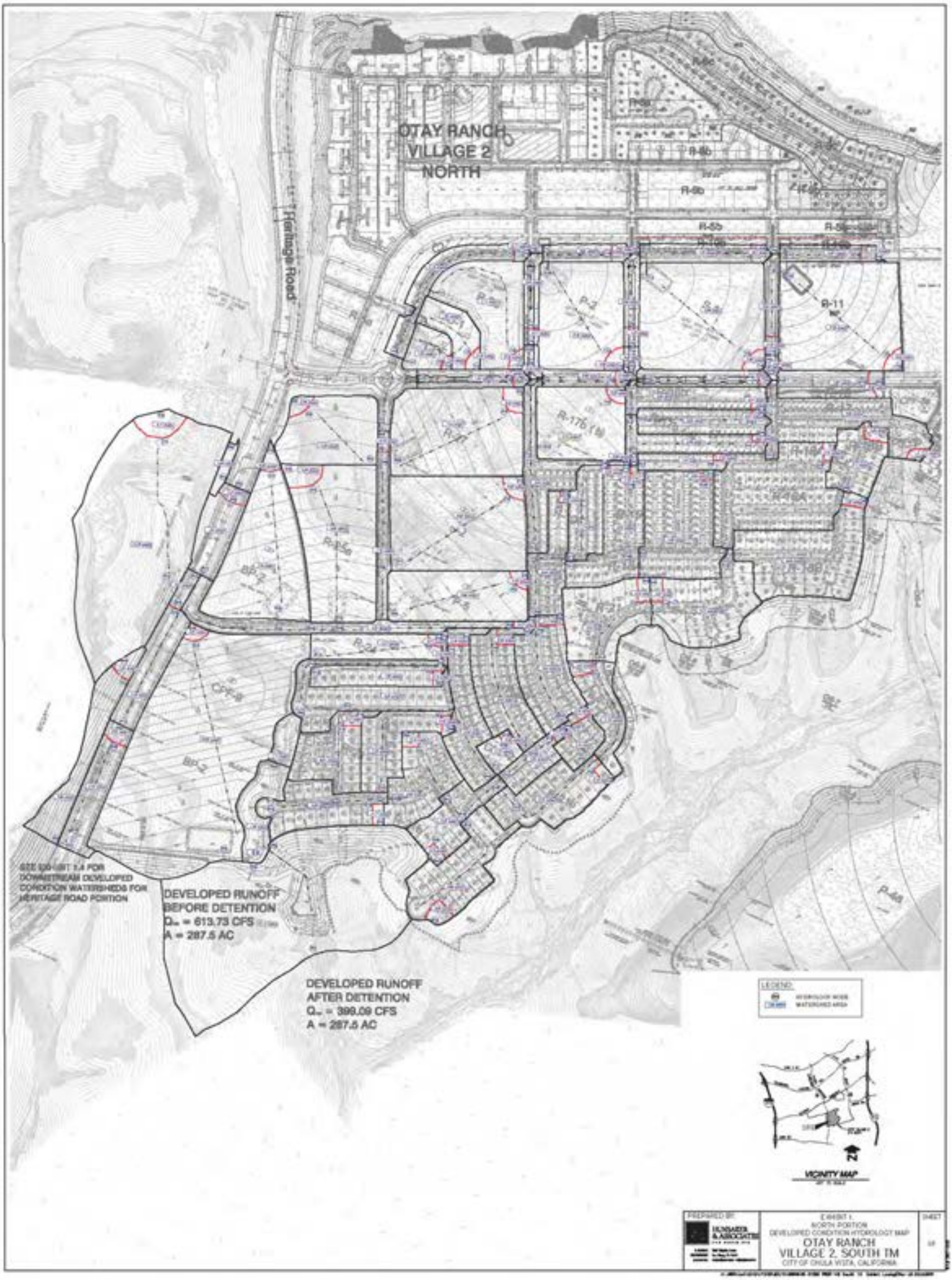
MAP 1 OF 2

OTAY RANCH
VILLAGE 2 WEST
OTAY RANCH
VILLAGE 2 NORTH
OTAY RANCH
VILLAGE 2 SOUTH
OTAY RANCH
VILLAGE 2 SOUTH
(SUNWOOD OWNERSHIP)
HERITAGE ROAD
R-5a
MU-1
CPF-5
P-2
S-1
R-17b (1)
R-17b (4)
R-19b
S-2
R-25a
BP-2
P-5
R-24
CPF-9
R-20
R-21b
R-26
CPF
BASIN 1
(WQ-ONLY)
BASIN 2
(WQ-HMP)
BASIN 3
(HMP-DETENTION)
POC 1
5.2 ACRES
2.8 ACRES
0.6 ACRES
7.1 ACRES
10.3 ACRES
8.7 ACRES
0.5 ACRES
8.7 ACRES
4.7 ACRES
2.8 ACRES
3.3 ACRES
31.1 ACRES
11.7 ACRES
17.8 ACRES
6.0 ACRES
13.8 ACRES
9.5 ACRES
5.1 ACRES
36.3 ACRES
2.5 ACRES
11.2 ACRES
3.83 ACRES
5.8 ACRES
6.4 ACRES
17.4 ACRES
1.3 ACRES
11.0 ACRES
0.9 ACRES
0.94 ACRES
6.8 ACRES
9.5 ACRES
17.4 ACRES
LEGEND:
10.0 ACRES WATERSHED AREA
SLOPE NATURAL STEEP
SLOPE DEVELOPED 2:1
WATER UALITY HYDROMOD BASIN
ROADWAY DEVELOPED TM BASIN 1
ROADWAY DEVELOPED TM BASIN 2
ROADWAY DEVELOPED HERITAGE
ROADWAY DEVELOPED NOT A PART
LOT DEVELOPED NOT A PART
LOT DEVELOPED MULTI USE
LOT DEVELOPED INDUSTRIAL
LOT DEVELOPED CPF
LOT DEVELOPED PAR
LOT DEVELOPED SCHOOL
LOT DEVELOPED MULTI FAMILY
LOT DEVELOPED SINGLE FAMILY 50 86 SF ONE
LOT DEVELOPED SINGLE FAMILY 55 2 SF ONE
LOT DEVELOPED SINGLE FAMILY 0 100 SF ONE
VICINITY MAP
PREPARED BY:
HENSLEY & ASSOCIATES
EXHIBIT 1.2
DEVELOPED CONDITION
HYDROMODIFICATION MAP
OTAY RANCH
VILLAGE 2, SOUTH
CITY OF CHULA VISTA, CALIFORNIA
SHEET
1
of
1

CHAPTER 12 – EXHIBITS/MAPS


Olympic Parkway
OTAY RANCH
VILLAGE 2
NORTH
Heritage Road
SEE EXHIBIT 1.2 FOR
EXISTING DOWNSTREAM
WATERSHEDS FOR
HERITAGE ROAD PORTION
EXISTING RUNOFF
Q100 = 454.11 CFS
A = 251.2 AC
Tc = 15.57 MIN
LEGEND:
VICINITY MAP
N
PREPARED BY
EXHIBIT 1.1
NORTH PORTION
PRE DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA
MAP
1
OF

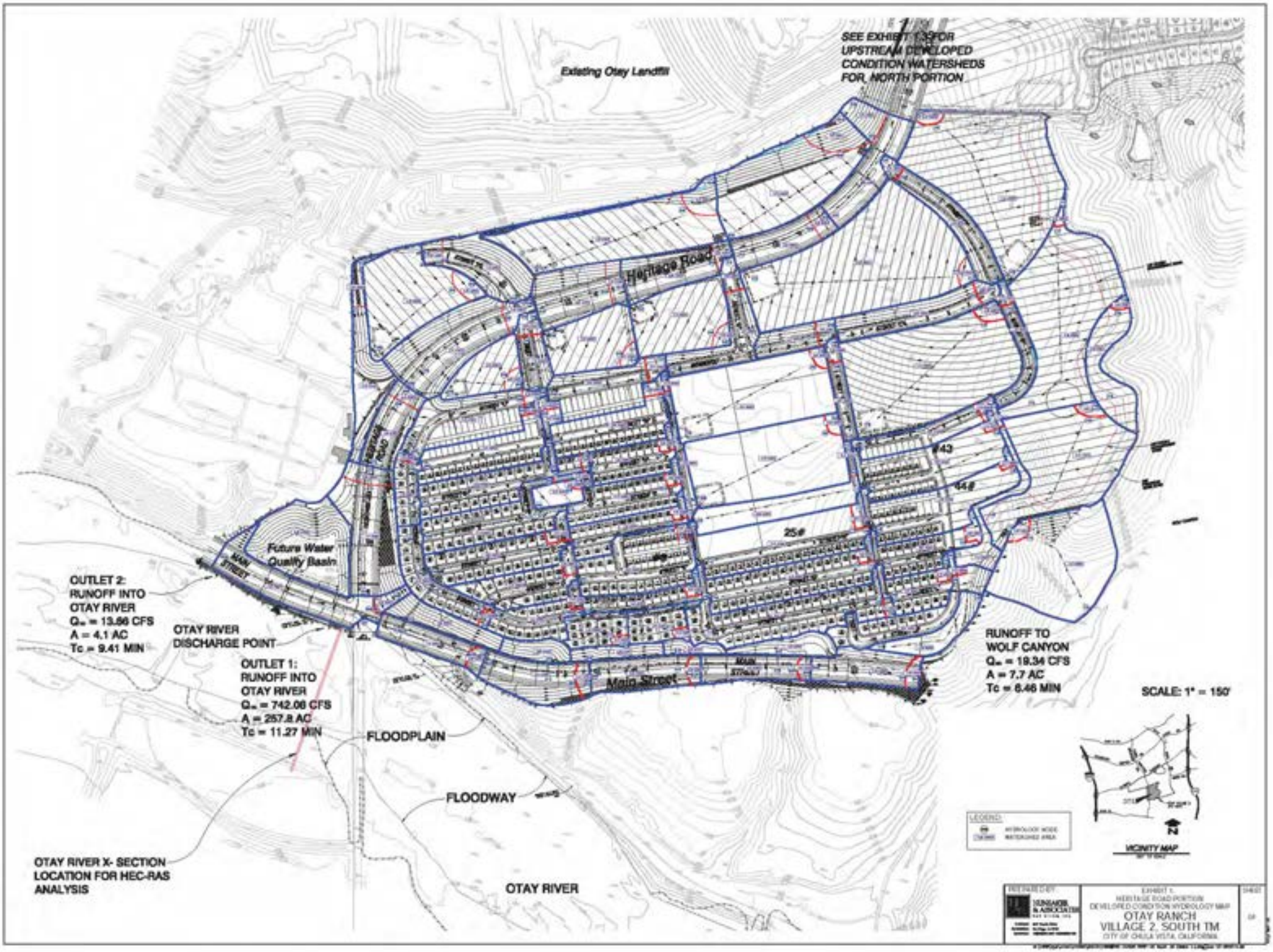

OTAY RANCH
VILLAGE 2, SOUTH
SEE EXHIBIT 1.1 FOR EXISTING UPSTREAM WATERSHEDS FOR VILLAGE 2 SOUTH (NORTH PORTION)
LEGEND
HYDROLOGY NODE
WATERSHED AREA
MAIN STREET
EXISTING RUNOFF AT OTAY RIVER
Q_{100} = 65.75 CFS
A = 46.8 AC
Tc = 16.63 MIN
EXISTING RUNOFF AT OTAY RIVER
Q_{100} = 145.44 CFS
A = 94.8 AC
Tc = 13.86 MIN
FLOODWAY
OTAY RIVER
EXISTING RUNOFF AT OTAY RIVER
Q_{100} = 141.20 CFS
A = 117.9 AC
Tc = 20.35 MIN
FLOODPLAIN
VICINITY MAP
EXHIBIT 1.2
HERITAGE ROAD PORTION
PRE DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA
MAP
2

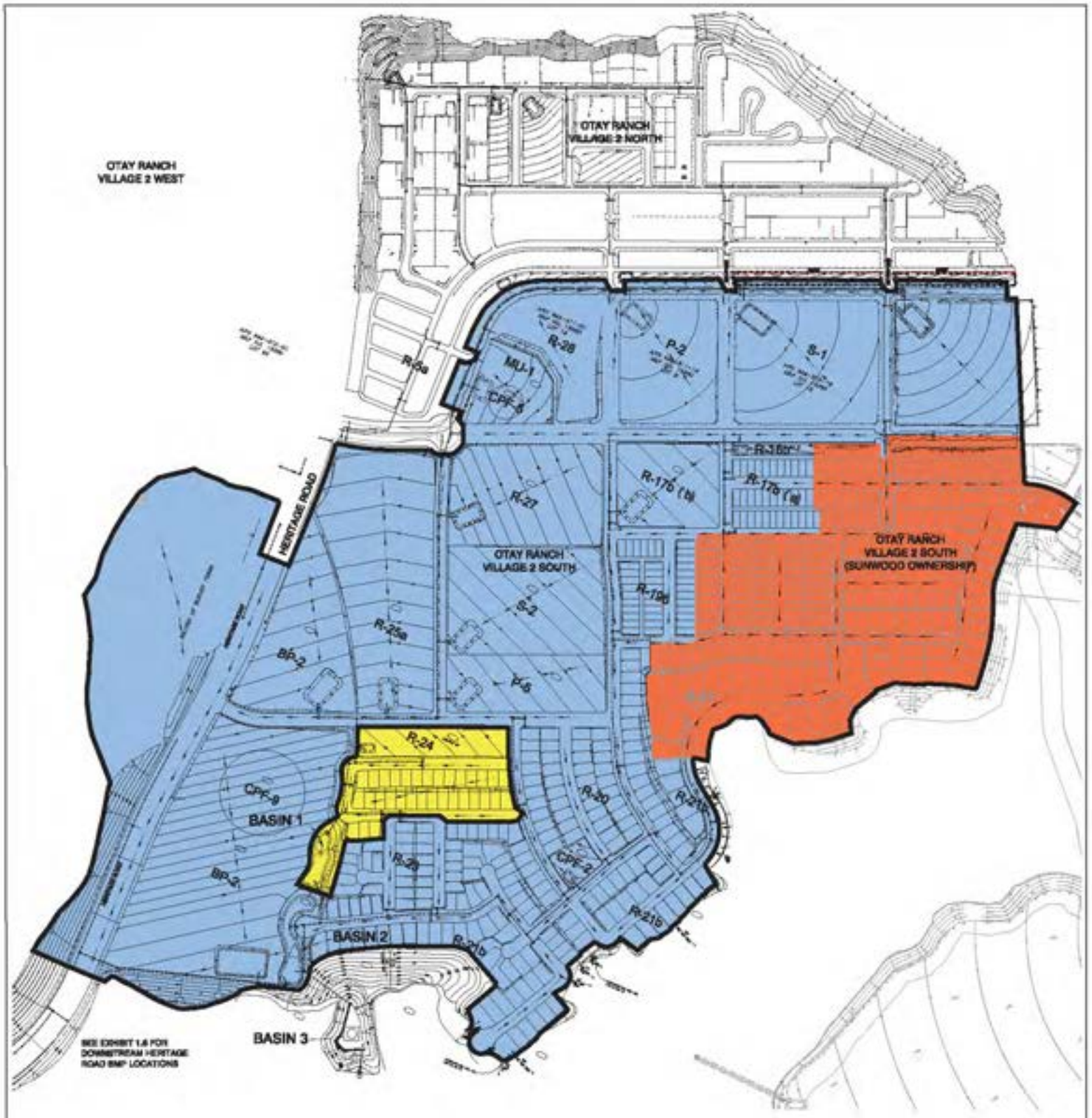


PREPARED BY:
HUNSAKER & ASSOCIATES

EXHIBIT 1
NORTH PORTION
DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA

SHEET
1


SEE EXHIBIT 1.3 FOR UPSTREAM DEVELOPED CONDITION WATERSHEDS FOR NORTH PORTION
Existing Otay Landfill
Heritage Road
Future Water Quality Basin
MAIN STREET
Main Street
OUTLET 2: RUNOFF INTO OTAY RIVER
Q100 = 13.86 CFS
A = 4.1 AC
Tc = 9.41 MIN
OTAY RIVER DISCHARGE POINT
OUTLET 1: RUNOFF INTO OTAY RIVER
Q100 = 742.06 CFS
A = 257.8 AC
Tc = 11.27 MIN
FLOODPLAIN
FLOODWAY
OTAY RIVER X- SECTION LOCATION FOR HEC-RAS ANALYSIS
OTAY RIVER
RUNOFF TO WOLF CANYON
Q100 = 19.34 CFS
A = 7.7 AC
Tc = 8.46 MIN
SCALE: 1" = 150'
LEGEND
HYDROLOGY NODE
WATERSHED AREA
N
VICINITY MAP
EXHIBIT 1.
HERITAGE ROAD PORTION
DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, SOUTH TM
CITY OF CHULA VISTA, CALIFORNIA



TREATMENT CONTROL BMP

WATER QUALITY BASIN

HYDROMODIFICATION/DETENTION BASIN

WATER QUALITY/HYDROMODIFICATION BASIN

LEGEND

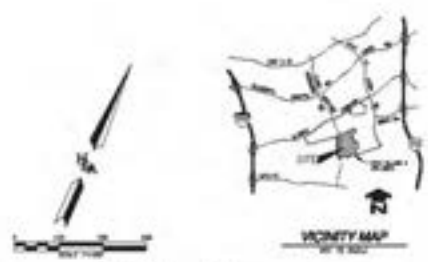
FLOW DIRECTION

BASIN TRIBUTARY AREA BOUNDARY

TREATMENT OF AREA VIA BASIN 1

FUTURE BUILDER RESPONSIBLE FOR TREATMENT OF STORM WATER FLOWS IN ACCORDANCE WITH THE GOVERNING WATER QUALITY REQUIREMENTS AT THE TIME OF CONSTRUCTION PRIOR TO THE RECEIVING STORM DRAIN SYSTEM

TREATMENT OF AREA VIA BASIN 2

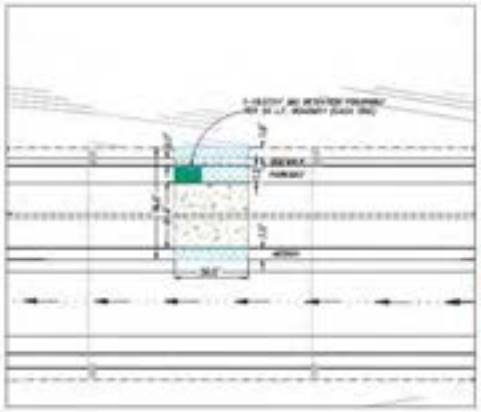


PREPARED BY:

HENSLEY & ASSOCIATES

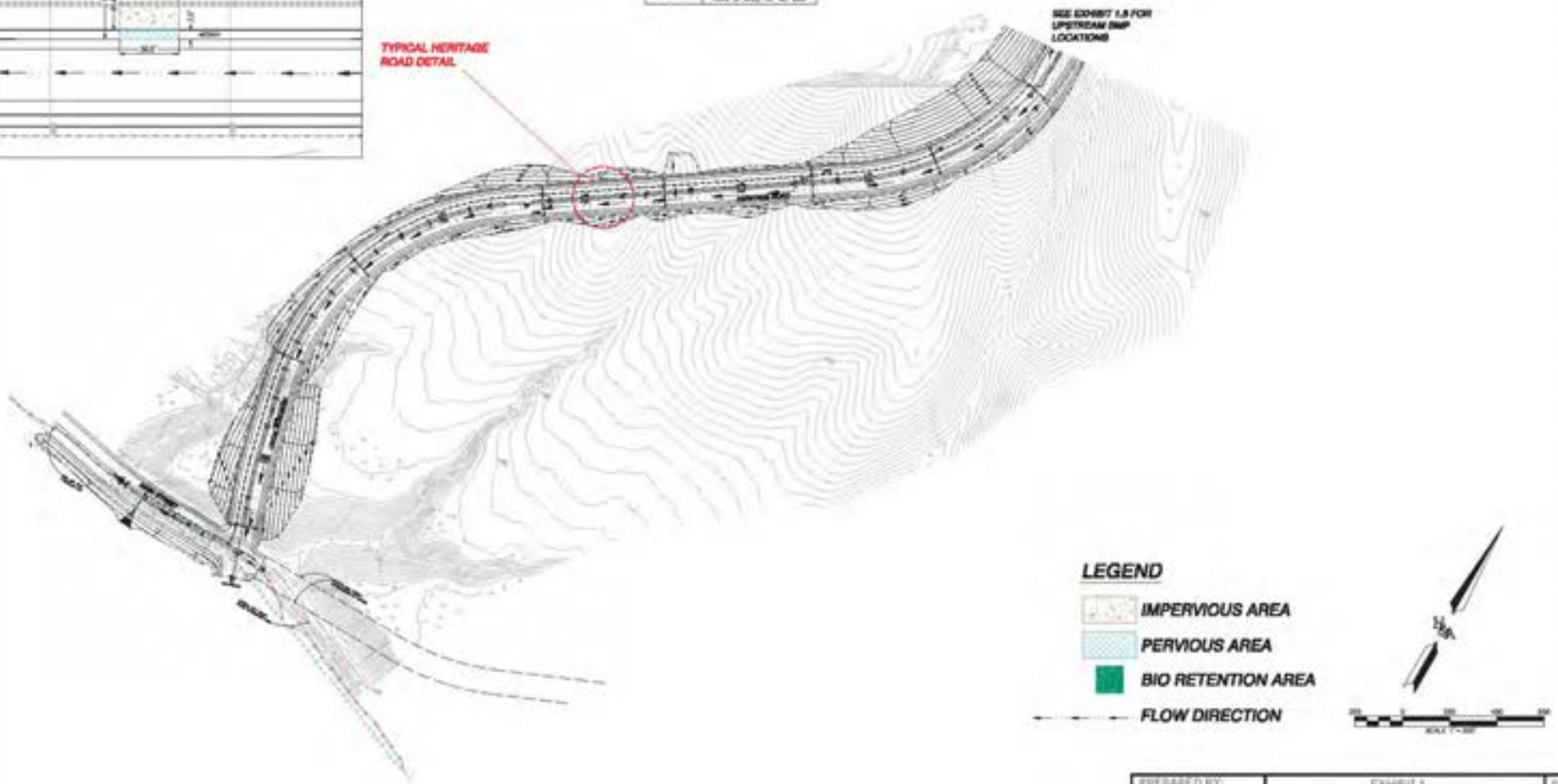
EXHIBIT 1.6
BMP LOCATION EXHIBIT FOR
OTAY RANCH
VILLAGE 2 SOUTH
CITY OF CHULA VISTA, CALIFORNIA

SHEET 1 of 2



DETAIL: TYPICAL HERITAGE ROAD

BMP BIO RETENTION TREATMENT AREA	DMA AREA (SQ FT)	RUNOFF FACTOR (UNITLESS)	BMP SIZING FACTOR (UNITLESS)	DMA AREA X RUNOFF FACTOR / BMP SIZING FACTOR (SQ FT)
IMPERVIOUS (SO PAVEMENT, CURB & GUTTER, SIDEWALK, ETC)	[illegible]	1	[illegible]	[illegible]
PERVIOUS (LANDSCAPED PARKWAY, ETC)	[illegible]	[illegible]	[illegible]	[illegible]
			BMP AREA=	[illegible]



LEGEND

- IMPERVIOUS AREA
- PERVIOUS AREA
- BIO RETENTION AREA
- FLOW DIRECTION

PREPARED BY:
HUNSAKER & ASSOCIATES

EXHIBIT 1.
BMP LOCATION EXHIBIT FOR
OTAY RANCH
VILLAGE 2 SOUTH
CITY OF CHULA VISTA, CALIFORNIA

SHEET 2 OF 2

CHAPTER 13
INTERIM CONDITION – VILLAGE 2 R-15c STAND-ALONE

Village 2 R-15c - Water Quality/Hydromodification

The following analysis pertains to the development of Village 2 R-15c and assumes that Village 2 South and its associated storm drain and water quality infrastructure has not been constructed. The residential areas within R-15c will drain its runoff towards Ortega Street where it will be collected with an inlet and then conveyed west until it outlets into an existing earthen channel that terminates at a sediment trap approximately 460 feet to the south.

This site has been graded per the approved grading plans for Otay Ranch Village 2 Phase 1 (Dwg No. 05101-20). Per the grading plans and the associated hydrology study, the site was intended to be developed as a CPF site. Per the Village 2 R-15c TM and this study, the land use has changed to residential development. The reduction in runoff coefficient from 0.75 to 0.65 translates to a reduction in imperviousness and peak flows for the same acreage. Therefore, although this project (R-15c) will need to comply with City of Chula Vista water quality requirements, it does not need to address hydromodification requirements. Based on the 2012 County of San Diego SUSMP Figure 1-1*, HMP Applicability Determination* projects can claim HMP exemption it they do not increase impervious area and do not increase unmitigated peak flows.

The following calculations determine the required size of bioretention area needed to comply with City of Chula Vista water quality requirements.

Total Area = 5.5 acres
Pervious Area = 4.48 + (1.02 x 40%) = 4.89 acres
Impervious Area = 1.02 x 60% = 0.61 acres

Summation of (DMA x Runoff Factor) = (4.89 x 0.1) + (0.61 x 1) = 1.10
Sizing Factor = 0.04
Required BMP Area = 1.10 x 0.04 = 0.04 acres = 1,917 sf

Existing sediment trap bottom area = 2,485 sf

WATER QUALITY TECHNICAL REPORT
FOR
OTAY RANCH VILLAGE 2 WEST
TENTATIVE MAP

City of Chula Vista, California

Prepared for:
Baldwin & Sons, Inc.
610 W. Ash Street
Suite 1500
San Diego, CA 92121

W.O. 2807-35

November 13, 2013

Hunsaker & Associates
San Diego, Inc.

Alisa S. Vialpando, R.C.E. 47945
Principal

REGISTERED PROFESSIONAL ENGINEER
ALISA S. VIALPANDO
No. 47945
Exp. 12/31/13
CIVIL
STATE OF CALIFORNIA

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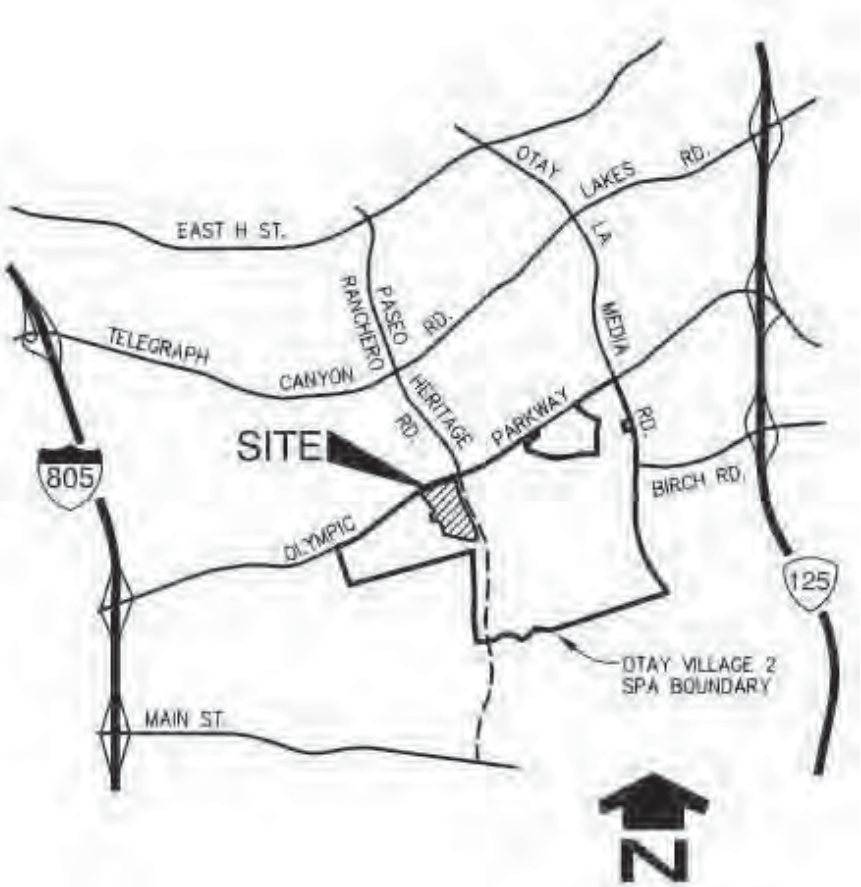
CHAPTER 1 – EXECUTIVE SUMMARY

This Master Water Quality Technical Report (WQTR) addresses the treatment of 85th percentile runoff from the proposed development of Otay Ranch Village 2 West for Baldwin & Sons, Inc. The design will utilize on site Low Impact Development (LID), Best Management Practices (BMPs) and Bioretention Integrated Management Practices (IMP's) Treatment Controls to treat the 85th percentile flow requirements from the development.

1.1 – Introduction

The Otay Ranch Village 2 West project site is located south of Olympic Parkway, west of the future extension of Heritage Road, and north of the future extension of Santa Victoria Road in the City of Chula Vista (see Vicinity Map below). The gross subdivision area is 48.2 acres although approximately 28.3 acres will be graded and developed with single family, multi-family, and park area per this Tentative Map study. The remainder of the boundary area will consist of undisturbed areas, slopes, and brow ditches for erosion control.



VICINITY MAP

NOT TO SCALE

Per the City of Chula Vista's *"Development Storm Water Manual"* dated January 2011 and FORM 5500 (Permanent Storm Water BMPs Applicability Checklist), the Otay Ranch Village 2 West project is classified as a priority project. As such, it is subject to the Standard Urban Storm Water Mitigation Plans (SUSMP) requirements set forth in Section 3 of the *"City of Chula Vista Storm Water Manual"*.

This WQTR for Otay Ranch Village 2 West Tentative Map has been prepared pursuant to requirements set forth in the City of Chula Vista's "*Development Storm Water Manual*." All calculations are consistent with criteria set forth by the Regional Water Quality Control Board's Order No. R9-2007-0001, and the "*County of San Diego SUSMP"* dated January 2011.

This WQTR recommends the conceptual locations of site Best Management Practices (BMPs) which include multiple Bioretention IMPs and LID Site Design BMPs. Exact locations of BMPs will be determined during the final engineering phase at which point a specific WQTR will be prepared.

This Otay Ranch Village 2 West Tentative Map will consist of a total of 115 lots including 106 single family, 1 multi-family, 2 parks, 4 open spaces, and 2 neighborhood open spaces. Stated urban land uses are typical generators of pollutants such as sediment, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, bacteria and viruses, and pesticides. If not mitigated, these pollutants can degrade urban runoff and impair receiving waters. This project proposes to reduce potential urban pollution by implementing Best Management Practices (BMP's), including Low Impact Development site design, source control, and treatment control BMP's. Detailed site plans are not available at this time for the multi-family site, therefore, the developers/builders for that respective planning area associated with this TM will be required to submit site-specific Water Quality Technical Report for City review and approval prior to obtaining any land development permits. Individual developers/builders will also be responsible for implementation.

The majority of the Village 2 West site flows towards the northwest towards the existing Poggi Canyon Detention Basin located at the southwest quadrant of the Olympic Parkway- Santa Victoria Road intersection in both the pre and post developed conditions. Runoff from small areas along the east side of the site drain towards Heritage Road and will be conveyed within the Heritage Road storm drain system. Refer to Chapter 12 for Exhibits 1.1 and 1.2 for an overview of the existing and proposed drainage patterns for the site. To provide maximum water quality treatment for flows generated by the proposed streets and developed areas, site flows will receive treatment via Bioretention based IMPs such as bioretention basins and linear bioretention swales prior to discharging into their respective downstream storm drain facility. According to technical memorandums prepared by Tory Walker Engineering, Inc., the Village 2 West project qualifies for an infill exemption from hydromodification requirements. See Section 1.4 below for further discussion.

This report also determines anticipated project pollutants, pollutants of concern in the receiving watersheds, conditions of concern in receiving waters, recommended source control BMPs, recommended maintenance, sampling, and monitoring requirements and methodology used for the design of BMPs.

1.2 Summary of Pre-Developed Conditions

The topography for existing Village 2 West project area is characterized by rolling hills, vegetation consisting mainly of brush and incised canyons that partition the site into the watersheds shown on Exhibit 1.1 in Chapter 12. The southern watershed boundary was defined by the grading which has occurred for the Otay Landfill. The project site per this study will only include the area immediately west of Heritage Road and the future Santa Victoria Road as shown on Exhibit 1.1. The additional watersheds shown on the exhibits were included for informational and comparison purposes between the existing and ultimate development of Village 2 West. The natural drainage channels located throughout Village 2 West drain to the northwest and the existing Poggi Canyon Detention Basin. This detention basin was sized to accommodate runoff from this project as well as the other portions of the Village 2 Master Development which drain towards Poggi Canyon. Please refer to Appendix A for an excerpt from the *Master Drainage Study for Otay Ranch Village 2, 3, & 4* (2005) which shows the anticipated drainage areas towards the detention basin and attenuated flows for buildout. Runoff from the detention basin confluences with the Otay River downstream. The Otay River ultimately empties into San Diego Bay.

Table 1 below summarizes the 100-year pre-development peak flows to each of the delineated watersheds. Runoff coefficients for this site in its existing condition varied between 0.35- 0.60 depending on the terrains average slope and type per the City of Chula Vista Subdivision Manual. These coefficients correspond to vegetated slopes (steep to flat).

TABLE 1 - Summary of Pre-Developed Flows to the Otay River

Watershed Name	Drainage Area (ac)	100-Year Peak Flow (cfs)
West	31.46	66.07
West-Central	2.63	7.69
East-Central	1.04	3.22
East	109.19	187.67
TOTAL	**144.32**	**264.65**

Supporting calculations for the data presented in Table 1 are located in Chapter 3 of the *TM Drainage Study for Otay Ranch Village 2 West* dated November 2013. The corresponding hydrology map is Exhibit 1.1 in Chapter 12 of this study.

1.3 – Summary of Proposed Development

The Otay Ranch Village 2 West Tentative Map will consist of residential dwelling units, park sites, open space areas, and paved roads. The project boundary encompasses 48.2 acres with approximately 28.3 acres being graded for the residential units, parks, and roads. The project boundary per this Tentative Map is delineated in the 'Developed Condition Hydrology Map' located in the Chapter 12. The TM project area is located on the eastern portion of the overall Village 2 West development immediately west of Heritage Road and south of Olympic Parkway.

Two streets (Barranca Avenue, Natoma Court) will intersect with the proposed extension of Santa Victoria Road which will connect between Heritage Road and Olympic Parkway. The developed residential areas will slope towards the south with average slopes between 1 - 2%. Santa Victoria Road will drain towards the northwest with varying slopes between 1 - 8%. Onsite inlets will collect runoff from the study area and convey it south then west along Santa Victoria Road. Approximately 930 feet south of the intersection with Olympic Parkway, the storm drain along Santa Victoria Road will be directed towards the proposed bioretention basin to be located immediately south of the existing Poggi Canyon Detention Basin. After water quality treatment, runoff from the basin will be sent to the Poggi Canyon Detention Basin for peak flow attenuation. The Poggi Canyon Detention Basin was sized to attenuate peak flows related to the areas of Otay Ranch Village 2 which drain to Poggi Canyon. Appendix A includes an excerpt from the *Master Drainage Study for Otay Ranch Villages 2, 3, & 4* dated July, 2005. It outlines the detention basin watershed and attenuated flows.

This TM proposes storm drain from the developed residential areas to the detention basin via Santa Victoria Road. Additionally, subsequent developments along the storm drain route will need to tie-in to it in the future. For instance, the industrial and offsite areas south of Santa Victoria Road will drain towards Santa Victoria Road when developed. For this reason, the 'Developed Condition Hydrology Map' (Exhibit 1.2) located in Chapter 12 includes the ultimate build out scenario to account for expected runoff and to correctly design the proposed storm drain infrastructure along the Santa Victoria Road system.

Table 2 below summarizes the 100-year developed condition peak flows to each of the discharge locations towards the Otay River. Runoff coefficients assumed for the proposed roads, commercial development, multi-family development, single family development and park sites are per the City of Chula Vista Subdivision Manual.

TABLE 2 - Summary of Developed Flows to Otay River

Watershed Name	Drainage Area (ac)	100-Year Peak Flow (cfs)
West	3.73	12.92
Village 2	143.55	594.82
Ephemeral Stream	9.80*	8.28
East	3.12	14.52
TOTAL	**160.2**	**630.54**

*-This is a low flow channel. It includes area already accounted for in the Village 2 Watershed.

Supporting calculations for the data presented in Table 2 is located in Chapter 3 of the *TM Drainage Study for Otay Ranch Village 2 West* dated June, 2012. The corresponding hydrology map is Exhibit 1.2 in Chapter 12.

The storm drain outlet from the site will connect to an existing outlet structure into the Poggi Detention Basin. This structure was built per C.V. Dwg. No. 99-427.

1.4 – Results and Recommendations

Multiple LID-based BMP's are proposed to treat the 85th percentile runoff from the site prior to discharge to the proposed storm drain within Village 2 West. To determine the Design Treatment Flow, the 85th percentile design runoff has been calculated using the Rational Method per Sections 4 and 5 of the *City of Chula Vista Development Storm Water Manual* and Equation 4.8 of the "*County of San Diego SUSMP"*. Equation 4-7 was used for sizing minimum bioretention IMP areas.

Per Table 4-2 of the "*County of San Diego SUSMP"*, a runoff factor of 1.0 was used for paved and impervious areas while pervious areas were given a runoff factor of 0.1.

Portions of street areas at the eastern and western ends of Santa Victoria Road are not part of the drainage watershed tributary to the proposed bioretention basin. These areas will receive water quality treatment via linear bioretention swales. The 85th percentile flows will be captured along the gutter with intermittent curb cuts that will direct flows to bioretention areas within the available parkway area directly behind the curb.

The proposed bioretention basin located at the southwest corner of the Olympic Parkway-Santa Victoria Road intersection will treat runoff from the street and residential areas that are tributary to them relative to the TM for Village 2 West only. Future developments such as the industrial sites to the south or the other residential areas north of Santa Victoria Road will be required to treat their own respective stormwater runoff in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system.

Per the *Technical Memorandum: Susceptibility Analysis of Poggi Creek* (January 2013) and the *Technical Memorandum: Urban Infill Hydromodification Exemption, Otay Ranch Village 2 West* (January 2013) prepared by Tory Walker Engineering, Inc., 'the Otay Ranch Village 2 West project satisfies the conditions for an infill exemption' and 'is exempt from hydromodification compliance'. The two studies in conjunction with each other state that 'the recommended BMPs must only satisfy water quality constraints per the City of Chula Vista SUSMP requirements'.

Per Section 3 of the *City of Chula Vista Development Storm Water Manual*, a sizing factor of 0.04 was used for sizing the bioretention facilities located at either end of Santa Victoria Road which are collecting street flow and which are not tributary to the basin mentioned above. The proposed bioretention swales will aid in filtering out sediments, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances and oil/hydrocarbons.

For mass graded pads, the only potential pollutant of concern generated will be sediment. Desilt basins will target this sole pollutant prior to discharging flows to the receiving storm drain system. Applicable erosion control measures for permanent stabilization will comply with CASQA Handbook measures and as indicated by each area's Storm Water Pollution Prevention Plan. Future development of each mass graded pad will be the responsibility of the future builder, ensuring that all future developed runoff from these aforementioned pads are treated in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system.

Locations of the BMP's described above are shown on the BMP Location Exhibit 1.3 in Chapter 12. The exhibit also includes typical sizes and spacing intervals for the proposed bioretention linear swales located at each end of Santa Victoria Road.

Low Impact Design (LID) BMP's have been implemented on the project site to the maximum extent practicable to ensure water quality treatment is maximized throughout the development.

Many alternate treatment BMPs, including media filters, drainage inserts, hydrodynamic separators, tree wells, and wet ponds were explored and evaluated. See Chapter 5 for a full comparison of all treatment BMPs considered. Bioretention IMPs and LID Site Design BMPs were deemed to be the most effective and feasible BMP treatment for the Otay Ranch Village 2 West development.

1.5 – Conclusion

The combination of proposed construction and permanent BMP's will reduce, to the maximum extent practicable, the expected project pollutants and will not adversely impact the beneficial uses of the receiving waters. If new technology that increases treatment capacity at the time of construction is developed, it will be considered during the Final Engineering design phase.

1.6 – References

"County of San Diego SUSMP", County of San Diego, January, 2010.

"Development Storm Water Manual", City of Chula Vista, January 2011.

"Final Hydromodification Management Plan" prepared for County of San Diego, California, March 2011

"*Low Impact Development Handbook, Stormwater Management Strategies*", County of San Diego, California July 20, 2007.

"Order No. R9-2007-0001,NPDES No.CAS0108758–Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, San Diego Unified Port District and the San Diego County Regional Airport Authority", California Regional Water Quality Control Board–San Diego Region; January 24, 2007.

"San Diego County Hydrology Manual", County of San Diego Department of Public Works – Flood Control Section; June 2003.

"Master Drainage Study for Otay Ranch Villages 2, 3,& 4", Hunsaker & Associates, July 14, 2005.

"TM Drainage Study for Otay Ranch Village West", Hunsaker & Associates, November 2013.

"*Technical Memorandum: Susceptibility Analysis of Poggi Creek*", Tory Walker Engineering, Inc., January 2013

"*Technical Memorandum: Urban Infill Hydromodification Exemption, Otay Ranch Village 2 West*", Tory Walker Engineering, Inc., January 2013

CHAPTER 2 – STORM WATER TREATMENT CRITERIA

2.1 – Regional Water Quality Control Board Criteria

All runoff conveyed in the proposed storm drain systems will be treated in compliance with Regional Water Quality Control Board (RWQCB) regulations and National Pollutant Discharge Elimination System (NPDES) criteria prior to discharging to natural watercourses. California Regional Water Quality Control Board Order No. R9-2007-0001 dated January 24, 2007, sets the waste discharge requirements for discharges of urban runoff from municipal storm separate drainage systems draining the watersheds of San Diego County.

Per the RWQCB Order, post-development runoff from a site shall not contain pollutant loads which cause or contribute to an exceedance of receiving water quality objectives or which have not been reduced to the maximum extent practicable. Post-construction Best Management Practices (BMPs), which refer to specific storm water management techniques that are applied to manage construction and post-construction site runoff and minimize erosion, include source control – aimed at reducing the amount of sediment and other pollutants – and treatment controls that keep soil and other pollutants onsite once they have been loosened by storm water erosion.

Post construction pollutants are a result of the urban development of the property and the effects of automobile use. Runoff from paved surfaces can contain both sediment (in the form of silt and sand) as well as a variety of pollutants transported by the sediment. Landscape activities by homeowners are an additional source of sediment.

All BMPs shall be located to infiltrate, filter, or treat the required runoff volume or flow (based on the 85th percentile rainfall) prior to its discharge to any receiving watercourse supporting beneficial uses.

2.2 – City of Chula Vista SUSMP Criteria

Per the City of Chula Vista SUSMP, the Otay Ranch Village 3 project is classified as a Priority Project and subject to the City's Permanent Storm Water BMP Requirements.

The Standard Urban Storm Water Mitigation Plans Permanent Storm Water BMPs Applicability Checklist (FORM 5500), which must be included along with Grading Plan applications, is included in the following page.

Otay Ranch
Village 2 West TM

CITY OF CHULA VISTA	**DEVELOPMENT SERVICES DEPARTMENT** 276 Fourth Avenue, Chula Vista, CA 91910 Phone: (619) 691-5021 Fax: (619) 691-5171	**PERMANENT STORM WATER BMPs APPLICABILITY CHECKLIST**
	FORM 5500	

Complete the following checklist to determine the project's permanent Best Management Practices requirements. This form must be completed and submitted with the permit application.

If one or more questions in the checklist are answered "Yes", the project is a Priority Development Project subject to the Standard Urban Storm Water Mitigation Plan (SUSMP) requirements in Section 3 of this Manual. If all answers are "No", please complete Form 5501 to select applicable Standard Permanent BMPs for your proposed project.

Project category descriptions in the following checklist are abbreviated for clarity. Please refer to the definitions in the NPDES Municipal Permit, Order No. R9-2007-0001, or Sections 3.1 and 9 of the Manual for expanded definitions of "Priority Development Projects" and "Redevelopment."

Does the project meet the definition of one or more of the Priority Development Project Categories below?

	Priority Development Project Categories	Yes	No
1	Housing subdivisions of 10 or more dwelling units.	X	
2	Commercial developments greater than one acre		X
3	Developments of heavy industry greater than one acre		X
4	Automotive repair shops		X
5	Restaurants		X
6	All Hillside development greater than 5,000 square feet	X	
7	Development within or adjacent to Environmentally Sensitive Areas		X
8	Parking lots 5,000 square feet or more or with 15 or more parking spaces and potentially exposed to urban runoff	X	
9	Streets, roads, highways, and freeways	X	
10	Retail Gasoline Outlets		X
11	Development Projects that result in the disturbance of one acre or more of land	X	
12	Redevelopment projects that create, add, or replace at least 5,000 square feet of impervious surfaces on an already developed site that falls under the project categories or locations listed above		X

Limited Exclusion: Trenching and resurfacing work associated with utility projects are not considered Priority Development Projects unless the project results in new impervious surfaces. Parking lots, buildings, and other structures associated with utility projects are Priority Development Projects if one or more of the criteria is met.

CHAPTER 3 – IDENTIFICATION OF TYPICAL POLLUTANTS

3.1 – Anticipated Pollutants from Project Site

The following table details typical anticipated and potential pollutants generated by various land use types. This WQTR covers the proposed development of Otay Ranch Village 2 West consisting of paved servicing roads, sidewalks, single- and multi- family residential, parks, community purpose facilities and public utilities. The applicable categories have been highlighted below to clearly illustrate which general pollutant categories are anticipated from the project area.

	General Pollutant Categories								
Priority Project Categories	**Sediments**	**Nutrients**	**Heavy Metals**	**Organic Compounds**	**Trash & Debris**	**Oxygen Demanding Substances**	**Oil & Grease**	**Bacteria & Viruses**	**Pesticides**
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development >100,000 ft^2	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft^2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

3.2 – Sediment

Soils or other surface materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, smother bottom dwelling organisms, and suppress aquatic vegetative growth.

3.3 – Nutrients

Inorganic substances, such as nitrogen and phosphorous, that commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.

3.4 – Trash & Debris

Examples include paper, plastic, leaves, grass cuttings, and food waste, which may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. In areas where stagnant water is present, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.

3.5 – Oxygen-Demanding Substances

Biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.

3.6 – Oil & Grease

Characterized as high high-molecular weight organic compounds. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, oils, waxes, and high-molecular weight fatty acids. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

3.7 – Pesticides

Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive application of a pesticide may result in runoff containing toxic levels of its active component.

3.8 – Organic Compounds

Organic compounds are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease and grime retained in the cleaning fluid or rinse water may also adsorb level of organic compounds that are harmful or hazardous to aquatic life.

3.9 – Bacteria and Viruses

Bacteria and viruses are ubiquitous micro-organisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animals or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

3.10 – Metals

Metals are raw material components in non-metal products such as fuels, adhesives, paints and other coatings. Primary sources of metal pollution in storm water are typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooler tower systems. At low concentrations naturally occurring in soil, metals are not toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.

CHAPTER 4 – CONDITIONS OF CONCERN

4.1 – Receiving Watershed Description

The Regional Water Quality Control Board has identified the Otay River as part of the Otay Hydrologic Unit and Otay Valley Hydrologic Area (basin number 910.20).

The beneficial use for this hydrologic subunit is found in Chapter 2 of the California Regional Water Quality Control Plan for the San Diego Basin, dated April 25, 2007 (Amended).

4.2 – Surface Water Quality Objectives and Beneficial Uses

Per the "Water Quality Plan for the San Diego Basin", the beneficial uses for the Otay River include agricultural supply, potential industrial process supply, potential contact water recreation, non-contact water recreation, warm freshwater habitat, wildlife habitat and rare, threatened or endangered species.

4.3 – 303(d) Status

Section 303(d) of the Federal Clean Water Act (CWA) requires the State to identify surface waters that do not meet applicable water quality standards with certain technology-based controls. The State Water Resources Control Board has approved the 2008 *303(d) List of Water Quality Limited Segment*. The revised list approved January 26, 2010 indicates that there are no impaired waterbodies associated with the proposed project.

The project location and watersheds have been compared to the current published 303(d) List of Water Quality Limited Segment. Poggi Canyon Creek lists DDT and Toxicity as Primary Pollutants of Concern.

4.4 – Identification of Primary & Secondary Pollutants of Concern

As stated above in Section 4.3, the primary pollutants of concern generated by the proposed project site are Pesticides and Nutrients.

Secondary pollutants generated by the project site include Sediment, Trash and Debris, Oxygen Demanding Substances, Organic Compounds, Oil & Grease, Bacteria and Viruses, and Heavy Metals.

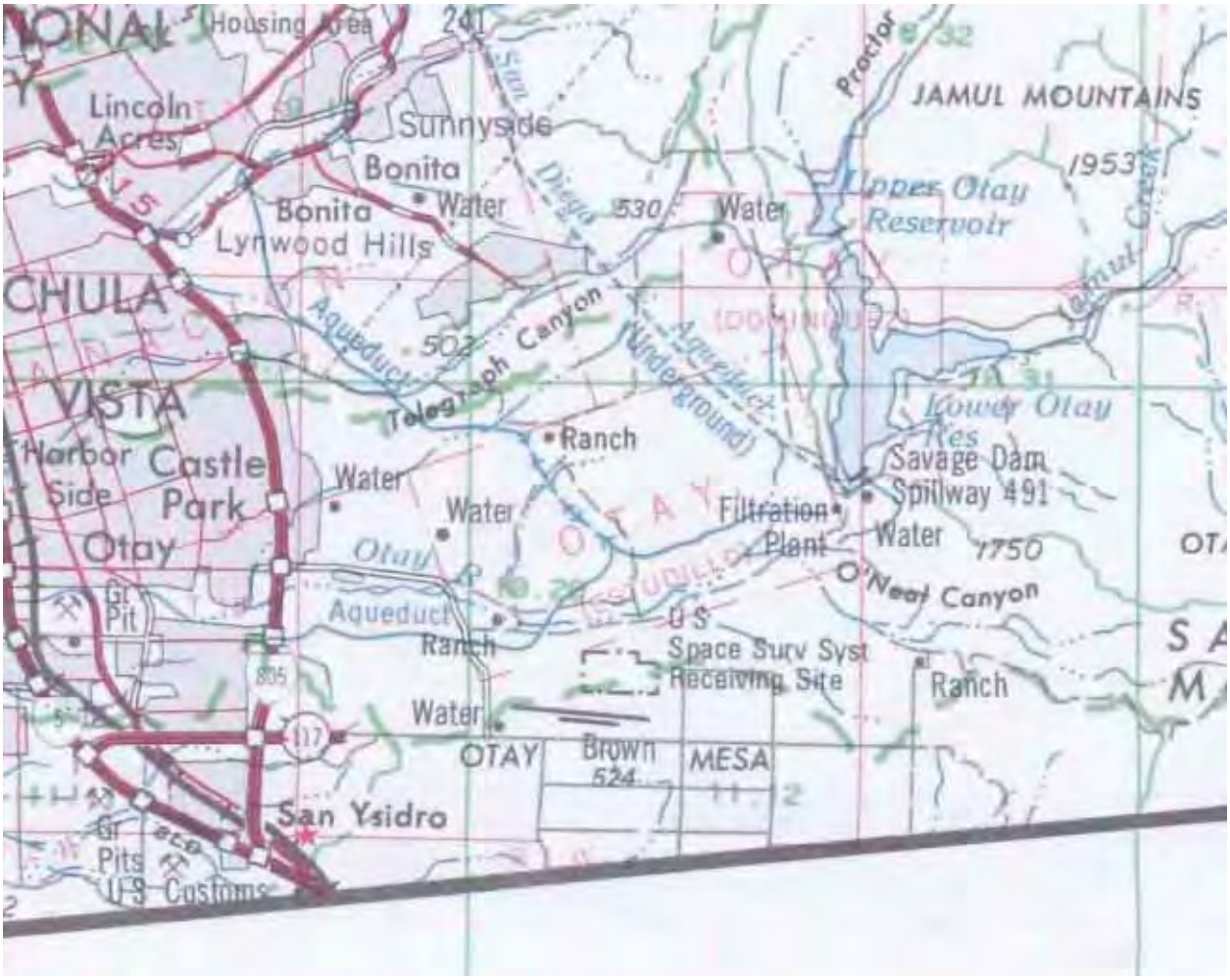

Housing Area
241
Lincoln Acres
Sunnyside
Bonita
Bonita
Water
Lynwood Hills
530
Water
Proctor
JAMUL MOUNTAINS
1953
Upper Otay Reservoir
CHULA
VISTA
Aqueduct
502
Telegraph Canyon
Aqueduct (Underground)
Lower Otay Res
Ranch
Harbor Side
Castle Park
Otay
Water
Water
Savage Dam
Spillway 491
Filtration Plant
Water
1750
O'Neal Canyon
Otay
Aqueduct
Ranch
U S Space Surv Syst Receiving Site
Ranch
Water
OTAY
Brown 524
MESA
San Ysidro
Gr Pits
U S Customs

Table 2-2. BENEFICIAL USES OF INLAND SURFACE WATERS

Inland Surface Waters [1, 2]	Hydrologic Unit Basin Number	BENEFICIAL USE														
		MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Otay River Watershed – continued																
Otay River	10.20	+	●	○					○	●		●		●	●	
O'Neal Canyon	10.20	+	●	○					○	●		●		●		
Salt Creek	10.20	+	●	○					○	●		●		●		
Johnson Canyon	10.20	+	●	○					○	●		●		●		
Wolf Canyon	10.20	+	●	○					○	●		●		●		
Dennery Canyon	10.20	+	●	○					○	●		●		●		
Poggi Canyon	10.20	+	●	○					○	●		●		●		
Tijuana River Watershed																
Tijuana River	11.11	+		○					○	●	●	●		●	●	
Moody Canyon	11.11	+		○					○	●		●		●		
Smugglers Gulch	11.11	+		○					○	●		●		●		
Goat Canyon	11.11	+		○					○	●		●		●		
Tijuana River Estuary	11.11	See Coastal Waters – Table 2-3														
Spring Canyon	11.12	+	●	○					○	●		●		●		
Dillon Canyon	11.12	+	●	○					○	●		●		●		
Finger Canyon	11.12	+	●	○					○	●		●		●		
Wruck Canyon	11.12	+	●	○					○	●		●		●		

4.5 – Conditions of Concern in Receiving Waters

4.5.1 – Summary of Hydrologic/Hydraulic Analysis

The "*TM Drainage Study for Otay Ranch Village 2 West*" by Hunsaker & Associates, dated November 2013 has been prepared to assess the pre-developed and developed condition peak runoff rates.

Development at buildout of Otay Ranch Village 2 West including the industrial site and future residential areas north of Santa Victoria Road will result in the net increase of runoff of about 366 cfs. However, the existing Poggi Canyon Detention Basin was designed to attenuate the peak flow increases as discussed in the *Master Drainage Study for Otay Ranch Village 2, 3, & 4* (2005). See Appendix A for an excerpt this study with pertinent information.

4.6 – Hydromodification Analysis

4.6.1 – Introduction

According to the *City of Chula Vista Development Storm Water Manual*, Priority Development Projects must be designed so that runoff rates and durations are controlled to maintain or reduce downstream erosion conditions and protect stream habitat. However, exemptions to the HMP are included in the San Diego County SUSMP and the Final Hydromodification Plan which include discharges to hardened conveyance systems that extend to exempt systems, as well as discharges to highly urbanized watersheds (greater than 70 % imperviousness). Per the *Technical Memorandum: Susceptibility Analysis of Poggi Creek* (January 2013) and the *Technical Memorandum: Urban Infill Hydromodification Exemption, Otay Ranch Village 2 West* (January 2013) prepared by Tory Walker Engineering, Inc., 'the Otay Ranch Village 2 West project satisfies the conditions for an infill exemption' and 'is exempt from hydromodification compliance'.

Chapter 5 – TREATMENT CONTROL BMP DESIGN

5.1 – BMP Location

To address water quality, two types of IMPs are proposed for the Village 2 West development. For the areas within Santa Victoria Road that are not tributary to the proposed bioretention basin, stormwater treatment will be via linear bioretention swales located behind the curb. Refer to Exhibit 1.3 for swale location and spacing interval. For the remaining Village 2 West area per this TM, water quality treatment will be via the proposed bioretention basin located within the open space immediately south of the existing Poggi Canyon Detention Basin.

According to page 3-29 of the City of Chula Vista Development Stormwater Manual, "Treatment Control BMPs with a high or medium pollutant removal efficiency for the project's most significant Pollutant of Concern shall be selected." The BMPs selected will both consist of engineered fill aimed to treat the sites primary pollutants of concern and attain a "High" or "Medium" pollutant efficiency.

The above IMP's will be implemented per the specifications provided by the City of Chula Vista SUSMP. See a reduced scale BMP location exhibit at the end of this chapter and a full scaled exhibit in Chapter 12.

5.2 – Determination of Treatment Flow

Multiple LID-based BMP's are proposed to treat the 85th percentile runoff from the site prior to discharge to the proposed downstream storm drain. To determine the Design Treatment Flow, the 85th percentile design runoff has been calculated using the Rational Method and Equation 4.8 of the "*County of San Diego SUSMP"*. For sizing minimum bioretention IMP areas, Equation 4-7 was used. See end of Chapter 5 for 85th Percentile Rainfall Isopluvial Map.

Per Table 4-2 of the "*County of San Diego SUSMP"*, a runoff factor of 1.0 was used for paved areas and 0.1 for all pervious areas. The bioretention basin was sized to accommodate the 85th percentile water quality volume flowing through the basin's engineered fill. See calculations on the BMP Location Exhibit 1.3 in Chapter 12.

5.3 – Bioretention IMPs

The bioretention IMPs function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area.

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and

volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fallout of suspension.

Examples of Bioretention IMPs can be configured as swales, free-form areas, extended detention basins or planters to be integrated with landscape design. Refer to Chapter 4 of the County SUSMP for further discussion of Bioretention facilities.

5.4 – BMP Unit Sizing

The bioretention linear swales which are proposed to treat the Santa Victoria Road runoff have been sized based on runoff factors per the City of Chula Vista Storm Water Manual and a sizing factor of 4%. This sizing factor is per Section 3 of the *City of Chula Vista Development Storm Water Manual*. The BMP Exhibit 1.3 located in Chapter 12 details the swale areas and spacing interval along Santa Victoria Road. A plan and profile of bioretention area along 8% street slope is included at the end of this chapter to verify capacity with 4” of ponding over engineered section.

The basin was sized based on the required water quality volume needed for treatment as well as the basin physical characteristics such as basin bottom area, the allowable ponding depth, the engineered soils rate of infiltration, and the allowable drawdown time. Using Darcy’s equation, these characteristics were used in determining the final BMP area.

5.5 – Pollutant Removal Efficiency Table

The table below shows the generalized pollutant removal efficiencies for bioretention facilities. The proposed **Bioretention Based IMPs** target trash and debris, sediments, organic compounds oxygen demanding substances, pesticides, oil/hydrocarbons, nutrients and bacterial pollutants.

Table 4. Structural Treatment Control BMP Selection Matrix

Pollutants of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	High-rate biofilters	High-rate media filters	Trash Racks & Hydro -dynamic Devices
Coarse Sediment and Trash	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Pollutants that tend to associate with fine particles during treatment	HIGH	HIGH	HIGH	HIGH	HIGH	MEDIUM	MEDIUM	LOW
Pollutants that tend to be dissolved following treatment	MEDIUM	LOW	MEDIUM	HIGH	LOW	LOW	LOW	LOW

Pollutant	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	X	X	
Nutrients		X	X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
Oxygen Demanding		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

5.6 – BMP Unit Selection Discussion

5.6.1 Bioretention Basins

Bioretention facilities are designed to capture runoff or infiltrate slowly through a soil media, which also supports vegetation. Bio retention facilities effectively promote infiltration into native soils. In low-permeability soils such as clay soils, facilities may capture excess treated runoff in an underdrain piped to the municipal storm drain system.

Advantages

- Due to the simplicity of design, bioretention basins are relatively easy and inexpensive to construct and operate.
- Bioretention basins can provide substantial capture of sediment and the toxics fraction associated with particulates.

- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in the watershed.
- If designed as a bioretention facility per the criteria noted in the County SUSMP, they can serve as an aesthetic, potentially inexpensive urban development feature with significant water quality benefits.
- Low maintenance.
- Easily access for maintenance.
- They can convey high flows while percolating and treating lower flows

Limitations

- Limitation of the diameter of the orifice may not allow use of bioretention basins in watersheds of less than 5 acres (would require an orifice with a diameter of less than 0.5 inches that would be prone to clogging).
- Basins can detract from the value of a home due to possible adverse aesthetics of dry or bare areas and inlet and outlet structures, if not maintained properly..

Conclusion:

The proposed bioretention basin located at the site will be sized to treat the water quality volume.

5.6.2 Vegetated (Linear) Swales

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and stormwater systems, however, if curb is required intermittent curb cuts can be provided to allow the flows to get to the vegetated swale.

Advantages

- If designed as a bioretention facility per the criteria noted in the County SUSMP, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant water quality benefits.
- Low maintenance.
- Easily access for maintenance.
- They can convey high flows while percolating and treating lower flows.

Limitations

- Can be difficult to avoid channelization.

- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.

Conclusion:

Per the County of San Diego SUSMP, one of the best uses for bioretention (linear) swales is along roadways. These are, therefore, proposed along portions of Santa Victoria Road which are not tributary to the bioretention basin.

5.6.3 Infiltration Basins

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principle benefit of infiltration basins is the approximation of pre-development hydrology during which a significant portion of the average rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.
- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- Infiltration rates exceeding 2.4 inches/hour, the runoff should be treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Conclusion:

Due to the type D clay soils typically located in the region, onsite infiltration basins are not a feasible option for the Otay Ranch Village 2 West project site.

5.6.4 Wet Ponds

Wet ponds are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetland habitat.
- Ponds are often viewed as a public amenity when integrated with a park setting.
- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvements across a relatively broad spectrum of constituents including dissolved nutrients.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.
- Mosquito and midge breeding is likely to occur in ponds.
- Cannot be placed on steep unstable slopes.
- Need for base flow or supplemental water if water level is to be maintained.
- Require a relatively large footprint.
- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams.

Conclusion:

Due to the large acreage requirements of a wet pond, proximity to residences (vector issues) and the fact that other BMP’s are able to treat pollutants of concern with equal efficiency, wet ponds are not a feasible option for the project site.

5.6.5 Media Filters

Stormwater media filters are usually two-chambered including a pre-treatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber.

Advantages

- Relatively high pollutant removal, especially for sediment and associated pollutants.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- More expensive to construct than many other BMP's.
- May require more maintenance than some other BMP's depending upon the sizing of the filter bed.
- Generally require more hydraulic head to operate properly (min 4 feet).
- High solids loads will cause the filter to clog.
- Work best for relatively small, impervious watersheds.
- Filters in residential areas can present aesthetic and safety problems if constructed with vertical concrete walls.
- Certain designs maintain permanent sources of standing water where mosquito's and midge breeding is likely to occur.

Conclusion:

Due to the fact that other BMPs provided equal or higher levels of treatment efficiency for target pollutants of concern, media filters were not implemented within the project site.

5.6.6 Drainage Inserts

Drainage inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling to one of three different groups: socks, boxes and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays and mesh grates. The trays may hold different types of media.
Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose and activated carbon.

Advantages

- Does not require additional space as inserts as the drain inserts are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

- Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults.
- Usually not suited for large areas or areas with trash or leaves that can plug the insert.

Conclusion:

Due to lower levels of treatment efficiency for target pollutants of concern, and the size of the project, curb inlet filters were deemed infeasible for this development.

5.6.7 Hydrodynamic Separator Systems

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants that are widely used in storm water treatment. No outside power source is required, because the energy of the flowing water allows the sediments to efficiently separate. Depending on the type of unit, this separation may be by means of swirl action or indirect filtration. Variations of this unit have been designed to meet specific needs. Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables -which can be captured, rather than solids with poor settleability or dissolved pollutants. In addition to the standard units, some vendors offer supplemental features to reduce the velocity of the flow entering the system. This increases the efficiency of the unit by allowing more sediment to settle out.

Advantages

- May provide the desired performance in less space and therefore less cost.
- May be more cost-effective pre-treatment devices than traditional wet or dry basins.
- Mosquito control may be less of an issue than with traditional wet basins.

Limitations

- As some of the systems have standing water that remains between storms, there is concern about mosquito breeding.
- It is likely that vortex separators are not as effective as wet vaults at removing fine sediments, on the order 50 to 100 microns in diameter and less.
- The area served is limited by the capacity of the largest models.

- As the products come in standard sizes, the facilities will be oversized in many cases relative to the design treatment storm, increasing cost.
- The non-steady flows of stormwater decreases the efficiency of vortex separators from what may be estimated or determined from testing under constant flow.
- Do not remove dissolved pollutants.
- A loss of dissolved pollutants may occur as accumulated organic matter (e.g., leaves) decomposes in the units.

Conclusion

Due to the fact that other BMPs provided equal or higher levels of treatment efficiency for target pollutants of concern, hydrodynamic separators were not implemented within the project site.

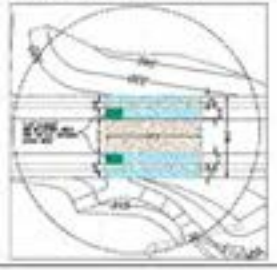
LEGEND

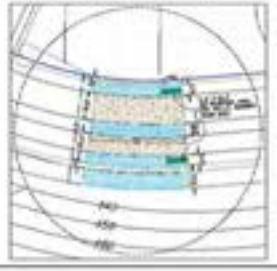
TREATMENT CONTROL BMP

DETAIL: TYPICAL SANTA VICTORIA ROAD, WEST

DETAIL: HOPE RANCH ROAD

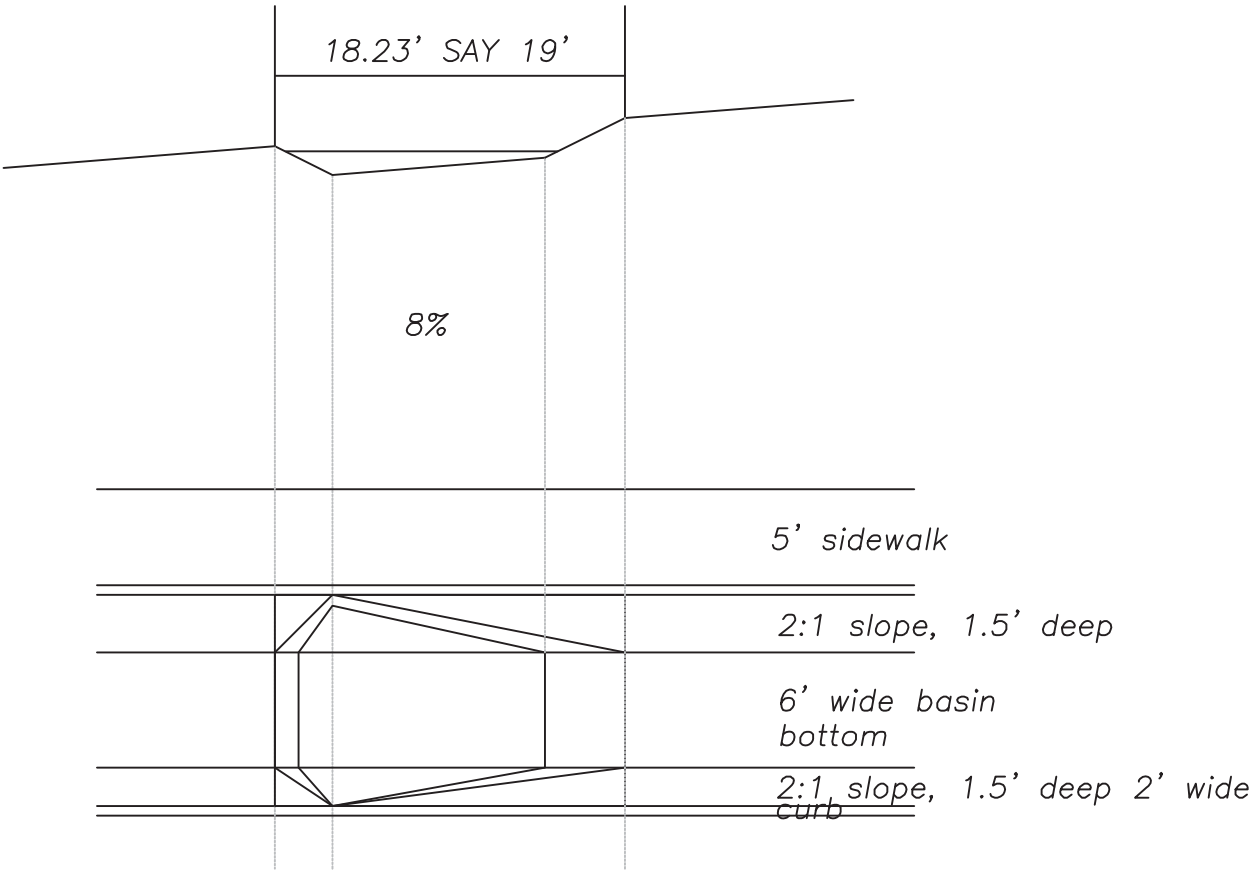
DETAIL: TYPICAL SANTA VICTORIA ROAD, EAST





OTAY RANCH
VILLAGE 2, WEST

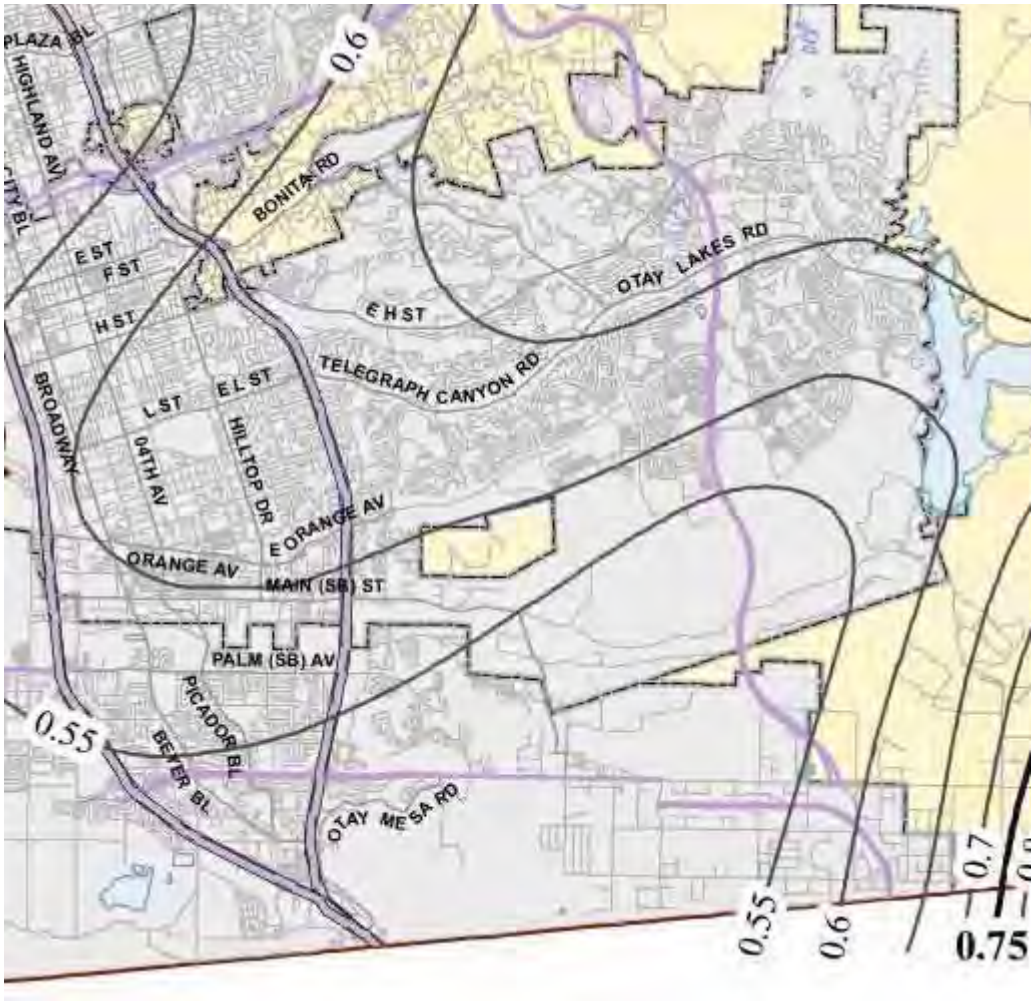
SANTA VICTORIA ROAD WEST



WQ Area Req = 103.6 every 100' LF

WQ Area Attained w/4" head =105.7 sf
Total bioretention footprint = 18.25' x 11' = 201 sf

SAN DIEGO COUNTY 85TH PERCENTILE ISOPLUVIALS



CHAPTER 6 – SOURCE CONTROL BMPS

The following Source Control BMPs are specific to the current development proposed for the Otay Ranch Village 2 West project site which comprises of the construction of servicing roads, residential lots, a park, sidewalks, and utilities.

Future development of the mass graded area with in Village 2 West will be the responsibility of the future developer/ builder. They will be required to ensure that all future developed runoff from the aforementioned pad is treated in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system.

6.1 – Design Outdoor Material Storage Areas to Reduce Pollution

Storage areas shall include structural features that prevent pollutants from entering storm drains. Where appropriate, comply with the requirements of local Hazardous Materials Programs.

Grade and berm outdoor storage areas to prevent run-on or run-off from area.

Storage of hazardous materials and wastes shall be in compliance with federal, state, and local laws, ordinances, and regulations.

6.2 – Design Trash Storage Areas to Reduce Pollution Introduction

All outdoor trash storage areas shall meet the following requirements per Design Concept SC-3 in the Chula Vista Development Storm Water Manual dated March 2010 (limited exclusion: detached residential homes):

- Paved with an impervious surface, designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash; and
- Covered with a roof, awning or trash lid to minimize direct precipitation.
- Designed in accordance with Chula Vista Municipal Code Section 19.58.340

6.3 – Integrated Pest Management (IPM) Principles

Integrated pest management (IPM) is an ecosystem-based pollution prevention strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitation manipulation, modification of cultural practices, and use of resistant plant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the

environment. More information may be obtained at the UC Davis website (http://www.ipn.ucdavis.edu/WATER/U/index.html).

6.3.1 - Eliminate and/or reduce the need for pesticide use in the project design by:

- Plant pest-resistant or well-adapted plant varieties such as native plants
- Discourage pests by modifying the site and landscaping design.

In order to achieve this source control BMP objective, native vegetation will be used throughout the project site in accordance with the landscape architects plans.

6.3.2 - Distribute IPM educational materials to future site residents/tenants.

Minimally, educational materials must address the following topics:

- Keeping pests out of buildings and landscaping using barriers, screens, and caulking;
- Physical pest elimination techniques, such as, weeding, squashing, trapping, washing, or pruning out pests;
- Relying on natural enemies to eat pests;
- Proper use of pesticides as a last line of defense.

The homeowners will be made aware of the aforementioned RWQCB regulations through a homeowners' education program.

6.4 – Efficient Irrigation Systems & Landscaping Design

In compliance with the Water Conservation in Landscaping Act, the following methods to reduce excessive irrigation runoff shall be implemented:

- Employ rain shutoff devices to prevent irrigation during and after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Use flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

All maintained landscaped areas will include rain shutoff devices to prevent irrigation during and after precipitation. Flow reducers and shutoff valves triggered by pressure drop will be used to control water loss from broken sprinkler heads or lines.

6.5 – Storm Water Conveyance Systems Stenciling and Signage

The proposed development will incorporate concrete stamping, or equivalent, of all storm water conveyance system inlets and catch basins within the project area with prohibitive language (e.g., "No Dumping – I Live in <<name receiving water>>"), satisfactory to the City Engineer. Stamping may also be required in Spanish.

6.6 – Maintenance of Sidewalks and Parking Lots

Sidewalks and parking lots shall be swept regularly to prevent the accumulation of litter and debris.

CHAPTER 7 – SITE DESIGN & LID BMPS

The following Site Design and LID BMPs are specific to the current development proposed for the Otay Ranch Village 2 West project site which comprises of the construction of servicing roads, residential lots, a park, sidewalks, and utilities.

Future development of the mass graded area with in Village 2 West will be the responsibility of the future developer/ builder. They will be required to ensure that all future developed runoff from the aforementioned pad is treated in accordance with the governing water quality requirements at the time of construction prior to discharging to the receiving storm drain system.

7.1 – Site Design & LID BMPs

Priority projects, such as the Otay Ranch Village 2 West development, shall be designed to minimize, to the maximum extent practicable, the introduction of pollutants generated from site runoff and address conditions of concern that may impact the receiving watershed and/or downstream water conveyance systems. Site design & LID components can significantly reduce the impact of a project on the environment.

Low Impact Development is an innovative stormwater management approach with the basic principle that is modeled after nature: manage rainfall runoff at the source using uniformly distributed decentralized micro-scale controls.

LID's goal is to mimic a site's predevelopment hydrology by using design practices and techniques that effectively capture, filter, store, evaporate, detain and infiltrate runoff close to its source.

7.2 – Conserve Natural Areas

The Otay Ranch Village 2 West urban development will incorporate open space areas and vegetation throughout the development. Also, the single and multi-family portion of the project will implement natural landscaped areas to the maximum amount practical

7.3 – Minimize Impervious Footprint

Methods of accomplishing this goal include:

- Increase building density (number of stories above or below ground), where applicable;
- Construct walkways, trails, patios, overflow parking lots and alleys and other low-traffic areas with permeable surfaces, such as pervious concrete, unit pavers, and granular materials, where applicable;
- Construct streets, sidewalks and parking lot aisles to the minimum widths necessary, provided that public safety and a walkable environment for pedestrians are not compromised;
- Minimize the use of impervious surfaces in the landscape design.

7.4 – Minimize Directly Connected Impervious Areas

Methods of accomplishing this goal include:

- Where landscaping is proposed, drain rooftops into adjacent landscaping where it is safe and appropriate and will not cause damage or adverse impacts to any existing and proposed structures, slopes, pavements, or other features prior to discharging to the storm water conveyance system;
- Where landscaping is proposed, drain impervious parking lots, sidewalks, walkways, trails, and patios into adjacent landscaping where it is safe and appropriate and will not cause damage or adverse impacts to any structures, slopes, pavements, or other features.

7.5 – Minimize Soil Compaction in Landscape Areas

Prior to final landscape installation in areas disturbed due to construction and where landscaping will be placed, the subsoils below the topsoil layer shall be scarified at least 6 inches. If upper layers of topsoil exists or is imported, incorporate the upper or topsoil material to avoid stratified layers.

7.6 – Soil Amendments

Landscape top soil improvements play a significant role in maintaining plant and lawn health plus improve the soil's capacity to retain moisture, which will reduce runoff from the water quality design storm and improve water quality. San Diego Landscape regulations will be adhered to for landscaped areas.

7.7 – Protect Slopes, Channels & Energy Dissipation/Erosion Control

Methods of accomplishing this goal include:

- Use of natural drainage systems to the maximum extent practicable.
- Stabilize permanent channel crossings.
- Planting native or drought tolerant vegetation on slopes.
- Energy dissipators, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels.

CHAPTER 8 – BMPS APPLICABLE TO INDIVIDUAL PRIORITY DEVELOPMENT PROJECT CATEGORIES

8.1 –Roads

The design of private roadway drainage shall use at least one of the following:

- Rural swale system- street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings;
- Urban curb/swale system- provide periodic curb cuts to allow street runoff to drain to vegetated swale/bioretention area;
- Dual drainage system- first flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder. Connect high flows directly to storm drainage system.
- Other methods, which are comparable and equally effective within the project, as determined by the City Engineer.

Curb cuts along sections of Santa Victoria Road will allow water quality flows to enter the linear swale BMPs located behind the curb. See BMP Location Map in Chapter 12 for size and spacing requirements.

8.2 – Residential Driveways & Guest Parking

Driveways shall have one of the following:

- Shared access;
- Flared entrance (single lane at street);
- Wheelstrips (paving only under tires);
- Porous paving;
- Designed to drain into landscaping prior to discharging to the storm water conveyance system.

Uncovered temporary or guest parking on private residential lots may be:

- Paved with a permeable surface;
- Designed to drain into landscaping prior to discharging to the storm water conveyance system.

This may be incorporated within the site design for multi-family residential lots

8.3 – Dock Areas

Loading/unloading dock areas shall include the following:

- Cover loading dock areas, or design drainage to preclude urban run-on and runoff;
- An acceptable method of containment and pollutant removal, such as a shut-off valve and containment area.

Direct connections to storm drains from depressed loading docks (truck wells) are prohibited. This does not apply to this Village 2 West TM. It will apply to future development of at the industrial sites south of Santa Victoria Road in the future.

8.4 – Maintenance Bays

Maintenance bays shall include at least one of the following:

- Repair/ maintenance bays shall be indoors; or
- Designed to preclude urban run-on and runoff

Maintenance bays shall include a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm water conveyance system is prohibited.

This does not apply to this Village 2 West TM. In the future, it will apply to future development of at the industrial site located south of Santa Victoria Road.

8.5 – Vehicle & Equipment Wash Areas

Areas for washing/steam cleaning of vehicles and areas for outdoor equipment/accessory washing and steam cleaning shall be:

- Self-contained to preclude run-on and run-off, covered with a roof or overhang, and equipped with a clarifier or other pretreatment facility;
- Properly connected to a sanitary sewer.

This does not apply to the Village 2 West TM

8.6 – Outdoor Processing Areas

Outdoor processing areas shall:

- Cover or enclose areas that would be the most significant source of pollutants; or slope the area toward a dead-end sump; or, discharge to the sanitary sewer system.
- Grade or berm processing area to prevent run-on from surrounding areas.
- Installation of storm drains in areas of equipment repair is prohibited.

This may apply to future development of at the industrial sites but does not apply to the residential areas within the Village 2 West TM project area.

8.7 – Surface Parking Areas

Where landscaping is proposed in surface parking areas (both covered and uncovered), incorporate landscape areas into the drainage design. Overflow parking (parking in excess of the project's minimum parking requirements) may be constructed with permeable paving.

This will apply to development of the multi-family areas within the Village 2West TM project area.

8.8 – Non-Retail Fueling Areas

Non-Retail fueling areas shall be designed with the following:

- Fuel dispensing area that is: (1) paved with Portland cement concrete or equivalent smooth impervious surface (asphalt concrete is prohibited); (2) designed to extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser,

or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less; (3) sloped to prevent ponding; (4) separated from the rest of the site by a grade break that prevents run-on of urban runoff; and (5) designed to drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.

- Overhanging roof structure or canopy that is: (1) equal to or greater than the area within the fuel dispensing area's grade break; and (2) designed not to drain onto or across the fuel dispensing area.

This does not apply to the Village 2 West TM.

8.9 – Steep Hillside Landscaping

Steep hillside areas disturbed by project development shall be landscaped with deep rooted, drought tolerant and/or native plant species selected for erosion control, satisfactory to the City of Chula Vista.

Table 8.1

Priority Project Category	Site Design BMPs[1]	Source Control BMPs[2]	Requirements Applicable to Individual Priority Project Categories[(3)]										
			a. Private Roads	b. Residential Driveways & Guest Parking	c. Dock Areas	d. Maintenance Bays	e. Vehicle Wash Areas	f. Outdoor Processing Areas	g. Equipment Wash Areas	h. Parking Areas	i. Roadways	j. Fueling Areas	k. Hillside Landscaping
Detached Residential Development	R	R	R	R									R
Attached Residential Development	R	R	R										
Commercial Development	R	R			R	R	R	R					
Automotive Repair Shop	R	R			R	R	R		R			R	
Restaurants	R	R			R				R				
Hillside Development	R	R	R										R
Parking Lots	R	R								R[(4)]			
Streets, Highways, & Freeways	R	R									R		

R = Required; select BMPs as required from the applicable steps in Section 3.6.2.a & b, or equivalent as identified in Section 3.6.2 of the Development Storm Water Manual.

(1) Refer to Section 3.6.2.a of the Development Storm Water Manual.
(2) Refer to Section 3.6.2.b of the Development Storm Water Manual.
(3) Priority project categories must apply specific storm water BMP requirements, where applicable. Projects are subject to the requirements of all priority project categories that apply.
(4) Applies if the paved area totals>5,000 square feet or with>15 parking spaces and is potentially exposed to urban runoff.

Per Table 8.1, the future development shall incorporate Site Design and Source Control BMPs as well as the requirements applicable individual priority projects as highlighted above.

CHAPTER 9 – OPERATIONS & MAINTENANCE PLAN

9.1 – Maintenance Requirements

Maintenance of the site BMPs within the Santa Victoria Road public right-of-way (between back of street curb and property line) will be the responsibility of the Landscape Maintenance District to be funded by a Community Facilities District (CFD). The bioretention basin will also be maintained through the CFD. A maintenance plan will be developed and will include the following information:

Specification of routine and non-routine maintenance activities to be performed.

A schedule for maintenance activities.

Name, qualifications, and contact information for the parties responsible for maintaining the BMPs.

Refer to BMP Location Exhibit 1.3 in Chapter 12 for designation of areas

9.2 – Operations and Maintenance Plan

9.2.1 – Bioretention IMPs

Target Maintenance Dates – March 15th, September 15th
Maintenance Activity – Inspection and removal of foreign debris, silt, mulch and trash. Evaluate filter media and recharge as necessary. Evaluate health of plant and prune or replace as necessary. Replace mulch.

For proper maintenance to be performed, all storm water treatment facilities must be accessible to both maintenance personnel and their equipment and materials.

9.2.2 – Bioretention Basin

Target Maintenance Date – February 15 (Rainy Season Inspection)
Maintenance Activity - Periodic inspection and removal of trash, debris and excess sediment, clear any clogged riser orifices, perform basin area repairs

Target Maintenance Date – May 15 (Annual Inspection – Post-Rainy Season)
Maintenance Activity - Annual Basin Inspection & Maintenance…includes full silt removal from dry weather storage area, remove ½ of basin vegetation removal, annual inspection by registered civil engineer, removal of trash, debris and excess sediment above dry weather zone, clear any clogged riser orifices, perform basin area repairs)

Target Maintenance Date – September 15 (Pre-Rainy Season Inspection)
Maintenance Activity - Periodic inspection and removal of trash, debris and excess sediment, clear any clogged riser orifices, perform basin area repairs

Target Maintenance Date – December 15 (Rainy Season Inspection)

Maintenance Activity - Periodic inspection and removal of trash, debris and excess sediment, clear any clogged riser orifices, perform basin area repairs

Additional Maintenance – (Post-Major Rainfall Event)…following major rainfall event (24-hour rainfall volume greater than 1.0 inch) unless next scheduled target maintenance date is within 1 month

Maintenance Activity – Post-rainfall inspection and removal of trash, debris and excess sediment, clear any clogged riser orifices, perform basin area repairs

For proper maintenance to be performed, all storm water treatment facilities must be accessible to both maintenance personnel and their equipment and materials.

9.3 – Annual Operations & Maintenance Costs

The following costs are intended only to provide a magnitude of the costs involved in maintaining BMPs within the public right-of-way. Funding shall be provided by the Community Facilities District.

Approximate annual maintenance costs for the proposed Bioretention BMPs and the Bioretention Basin are outlined below.

9.3.1 – Bioretention IMPs

For Santa Victoria Road - Inspection and Maintenance ($0.35 per SF x 2 times a year x 6,053 SF) = $4,237

Bioretention IMPs Total (inclusive of 10% Contingency) = $4,661

9.3.2 – Bioretention Basin

Inspection and Maintenance

Assume Silt Clogging of 2.0' Dry Weather Storage Area = 1.09 acre-feet
= 1,759 CY

Annual Silt Removal Costs = 1,759 CY @ $10/CY = $17,585

Annual Inspection by Engineer = $1,500

Periodic and Post-Major Rainfall Inspections and Trash/Debris/Sediment Cleanout…assume (4) periodic/post-major rainfall inspections per year…assume (3) man crew…assume ½ -day cleanout time…assume $50 hourly rate…Periodic Inspection and Maintenance Annual Cost = $2,400

Total Maintenance Costs = $21,485

Bioretention Basin Total (inclusive of 10% Contingency) = $23,634

Chapter 10 – FISCAL RESOURCES

10.1 – Agreements (Mechanisms to Assure Maintenance)

There are multiple BMPs within the Otay Ranch Village 2 West site for storm water quality treatment.

Funding for water quality treatment BMP's within the public right-of-way for Santa Victoria Road and the bioretention basin will be provided by the Community Facilities Maintenance District (CFD) for the Otay Ranch Village 2 West development. The CFD will be responsible to perform the maintenance activities and ensure adequate funding into perpetuity.

The City of Chula Vista Watershed Protection, Stormwater Management, and Discharge Control Ordinance require ongoing maintenance of BMPs to ensure the proper function and operation of theses BMPs. Costs for this maintenance will be the covered by the CFD following completion and acceptance and by the contractor during construction of the development.

The CFD for the development will be fiscally responsible for the maintenance and upkeep of the onsite BMPs indefinitely.

Additionally, a BMP Maintenance Agreement with Easement and/or Covenant will be entered into with the City of Chula Vista.

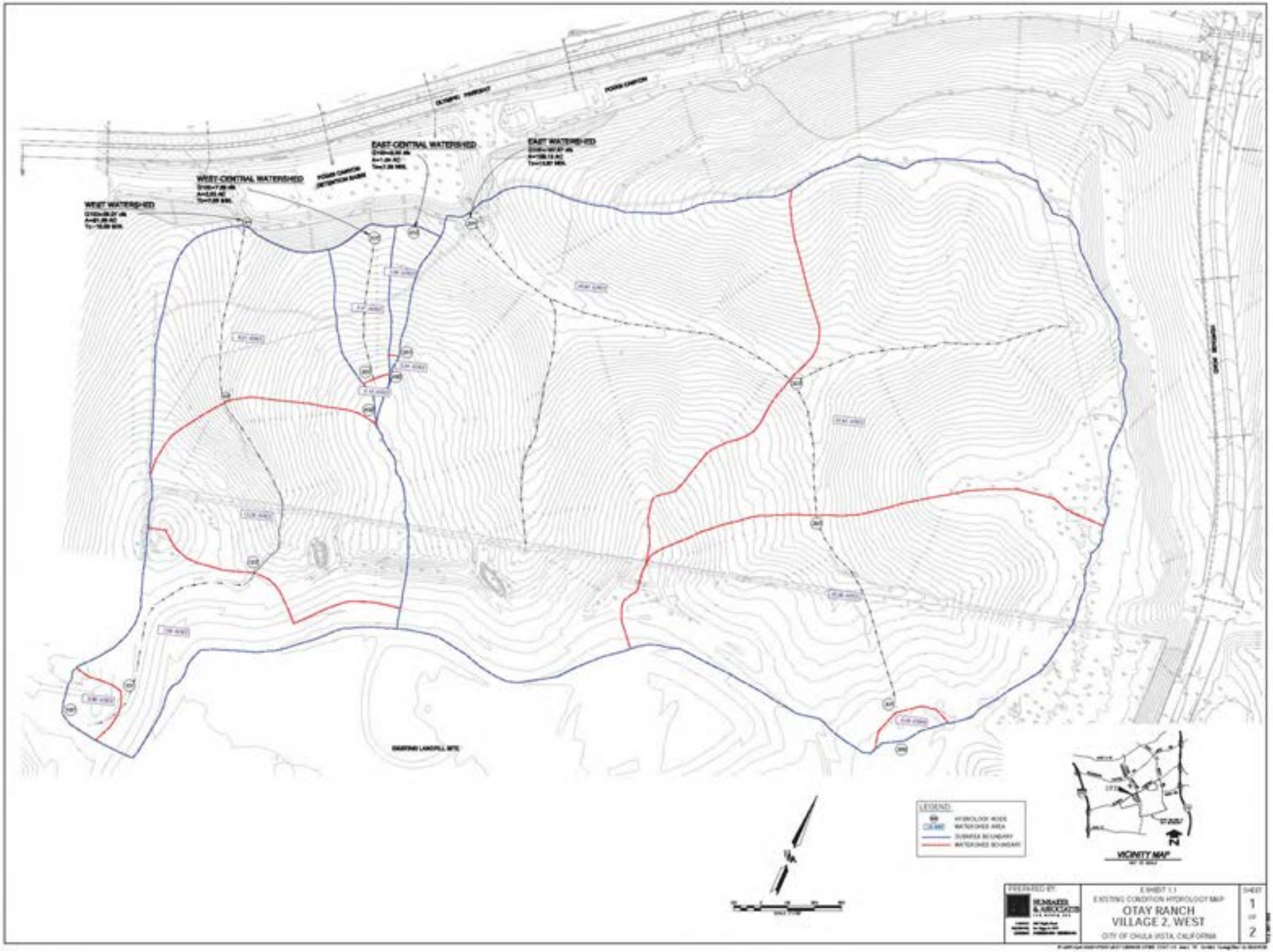
The agreement will commit the land to being used only for purposes of the BMP; the agreement will include an obligation to maintain the facilities in accordance with the water quality technical report. The final map will include an easement giving the City the right to enter onto the land for access to inspect the BMPs.

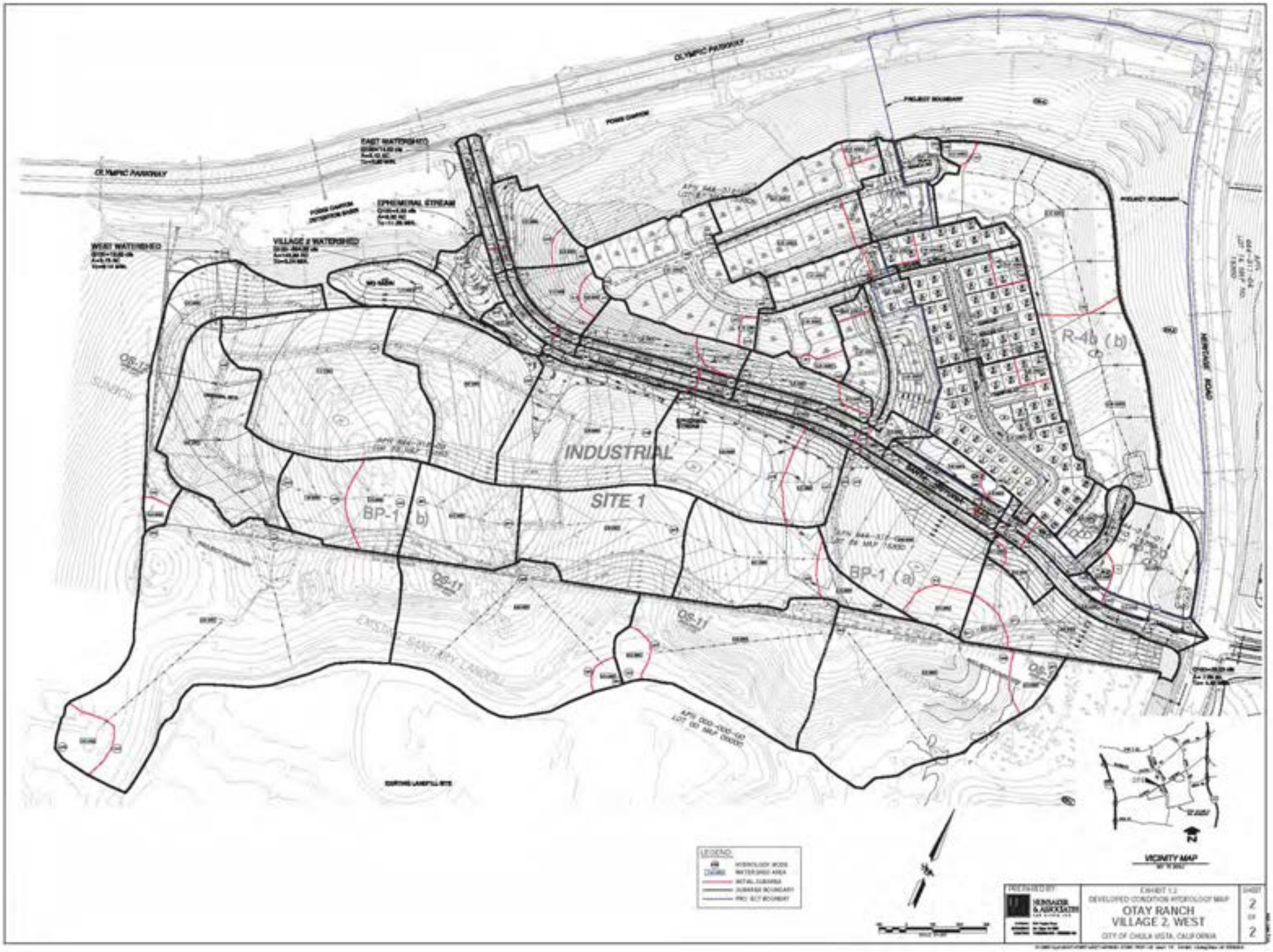
CHAPTER 11 – HYDROMODIFICATION ANALYSIS

Per both the *Technical Memorandum: Susceptibility Analysis of Poggi Creek* (January 2013) and the *Technical Memorandum: Urban Infill Hydromodification Exemption, Otay Ranch Village 2 West* (January 2013) prepared by Tory Walker Engineering, Inc.,

'the Otay Ranch Village 2 West project satisfies the conditions for an infill exemption' and *'is exempt from hydromodification compliance'. … 'the recommended BMPs must only satisfy water quality constraints per the City of Chula Vista SUSMP requirements'.*

CHAPTER 12 – EXHIBITS/MAPS

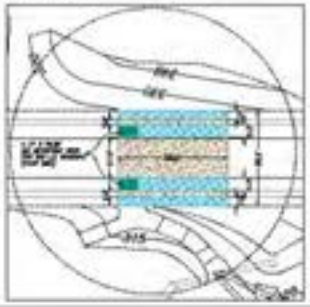

EAST-CENTRAL WATERSHED
EAST WATERSHED
WEST-CENTRAL WATERSHED
WEST WATERSHED
LEGEND
VICINITY MAP
PREPARED BY:
EXHIBIT 1.1
EXISTING CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, WEST
CITY OF CHULA VISTA, CALIFORNIA
SHEET
1
OF
2

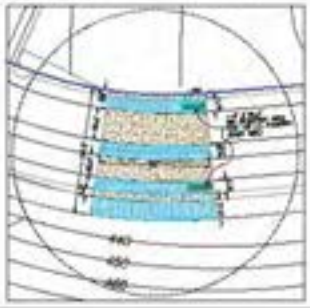

OLYMPIC PARKWAY
EAST WATERSHED
EPHEMERAL STREAM
WEST WATERSHED
VILLAGE 2 WATERSHED
PROJECT BOUNDARY
INDUSTRIAL
SITE 1
BP-1 (b)
BP-1 (a)
R-4b (b)
OS-11
EXISTING SANITARY LANDFILL
HERITAGE ROAD
LEGEND
VICINITY MAP
PREPARED BY
HUNSAKER & ASSOCIATES
EXHIBIT 1.2
DEVELOPED CONDITION HYDROLOGY MAP
OTAY RANCH
VILLAGE 2, WEST
CITY OF CHULA VISTA, CALIFORNIA
SHEET
2
OF
2

DETAIL: TYPICAL SANTA VICTORIA ROAD WEST

DETAIL: HOPE RANCH ROAD

DETAIL: TYPICAL SANTA VICTORIA ROAD EAST





PREPARED BY:

EXHIBIT 1
DRAINAGE MANAGEMENT
AREA MAP
OTAY RANCH
VILLAGE 2, WEST
CITY OF CHULA VISTA, CALIFORNIA

SHEET 1 OF 1

Appendix A – Excerpt from Master Drainage Study for Otay Ranch Villages 2, 3, & 4

HUNSAKER
& ASSOCIATES
SAN DIEGO, INC

PLANNING
ENGINEERING
SURVEYING

IRVINE
LOS ANGELES
RIVERSIDE
SAN DIEGO

MASTER DRAINAGE STUDY
for
OTAY RANCH VILLAGES 2, 3 & 4

Includes Addendum to
Poggi Canyon Creek Master Drainage Study

In the City of Chula Vista, California

Prepared for
Otay Ranch Company
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July 14, 2005

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CIVIL
STATE OF CALIFORNIA

Canyon Creek was the 100 year 6-hour type B rainfall distribution. Methodology and requirements have changed subsequent to the 1999 submittal. Therefore, 24 hour storm distributions for the 100 year, 10 year and 2 year storm have been included for reference in Chapter 4 of this report.

The Vicinity map below shows the locations of Villages 2, 3, and 4.

Figure 1: Vicinity Map

Summary of Existing Conditions

The Otay Ranch Village 2, 3 & 4 sites currently contain no development and are characterized by rolling hills and heavily grazed land. Runoff from the existing sites drain via incised canyons to either Poggi Canyon, Wolf Canyon, or unnamed tributaries of the Otay River.

Poggi Canyon

The constructed Poggi Canyon Creek channel enters the Otay Ranch property just downstream of the existing 7-foot x 8-foot box culverts under La Media. Runoff from the McMillin property south of Olympic Parkway empties into Poggi Canyon Creek via an 84-inch and a 96-inch RCP in the downstream headwall of the 7-foot x 8-foot RCBCs. At that location, the McMillin runoff confluences with runoff from the existing Eastlake Greens development, the Eastlake Land Swap Area, as well as the Otay Ranch Company's portion of Otay Ranch Village 6, Village 12, Village 5 and a portion of Village 2 Phase 1 (Village 2 Northeast from HEC-1 analysis).

The combined runoff then flows in a westerly direction via a constructed channel on the north side of Olympic Parkway through the Otay Ranch Village 1 – Phase 4 area. In this stretch of the channel, a 48-inch RCP conveys flows from the northeastern portion of Otay Ranch Village 2 (south of Olympic Parkway) to the channel.

Poggi Canyon Creek crosses under Olympic Parkway via two existing 12-foot x 8-foot RCBCs near the boundary of Village 1 - Phases 4 and 7. At the downstream headwall, runoff from the existing high school site confluences with runoff in Poggi Canyon Creek.

Between the high school site and Heritage Road, runoff is conveyed via a constructed trapezoidal channel with a bottom width of 40 feet and 3:1 side slopes. Runoff from the undeveloped Village 2 site enters the channel from the south along this reach. Runoff from the developed Otay Ranch Village 1 – Phase 7 site enters the main channel at the intersection of Olympic Parkway and Heritage Road.

Downstream of the Heritage Road culvert structure, runoff flows in a westerly direction via a constructed trapezoidal channel with a bottom width of 50 feet. Again, runoff from the undeveloped Village 2 site drains to the channel from the south.

Near the proposed Village 2 entrance road from Olympic Parkway, runoff from Otay Ranch Village One West enters from the north. The combined runoff flows through two 12-foot x 8-foot RCBCs under the proposed entrance road (stubbed out from Olympic Parkway in existing conditions) and into the existing Poggi Canyon Regional Detention Facility. The existing detention basin is located at the western boundary of the Otay Ranch Company's ownership. HEC RAS output for the 2 year, 10 year and 100 year 6-hour and 24-hour storm events are included in Chapter 5 of this report. Freeboard at various locations throughout the channel is summarized in a table in Chapter 5 of this report.

The existing detention facility was designed to mitigate the 100-year developed condition peak flowrate in Poggi Canyon below the pre-developed 100-year peak flow. Per the October 14, 1999 "Master Drainage Study for Poggi Canyon Creek," the pre–developed 100-year flow at the detention basin location was determined to be roughly 1,300 cfs. Thus, the basin must mitigate developed condition peak flowrates to 1,300 cfs or less.

Wolf Canyon

In existing conditions, the Wolf Canyon watershed contains no development and is characterized by rolling hills and heavily grazed land. The Wolf Canyon area east of the proposed extension of La Media (south of Birch Parkway) will be home to Otay Ranch Village 7 and the proposed Eastern Urban Center.

Wolf Canyon Creek's main drainage course forms the southern and eastern boundary for Otay Ranch Village 2 and the northern boundary the for Otay Ranch Village 4 park site. A large tributary confluences with Wolf Canyon Creek near the downstream limit of the Otay Ranch Village 2 ownership. A significant portion of the undeveloped Village 2 property drains to this tributary while the remainder drains directly to Wolf Canyon Creek.

Following the aforementioned confluence, Wolf Canyon Creek flows in a southerly direction just east of the Village 3 property boundary. Wolf Canyon discharges runoff to the Otay River in the existing rock quarry area.

HEC HMS analyses to quantify existing and developed condition flows to Wolf Canyon Creek are included in Chapters 6 and 7 of this report, respectively. The following table summarizes pre-developed verses developed condition flows at the Village 4 Park site outlet and at the location at which Wolf Canyon Creek confluences with the Village 2 basin outflows.

Table 1: Wolf Canyon HEC HMS Summary

Location	Pre-Development Drainage Area (ac)	Pre-Development Q100 (cfs)	Developed Drainage Area (ac)	Routed Outflow (cfs)
Wolf Canyon Creek at Village 4 Outfall	523	537	533 (+10)	494 (-43)
Wolf Canyon Creek at Village 2 confluence	822	859	832 (+10)	704 (-118)

Otay Valley Road Watershed

Runoff from the Village 3 property drains to one of two unnamed tributaries of the Otay River. Both of these tributaries are located west of the confluence of Wolf Canyon and the Otay River. In existing conditions, this area of the watershed contains no development.

Summary of Developed Conditions

Development of Otay Ranch Village 2 will include the construction of single-family residential homes, multi-family homes, commercial sites, industrial sites, park sites, multi-use areas and major traffic arterials while development of Village 3 will include the construction of industrial sites. Development of Village 4 will consist of a neighborhood park.

The overall drainage divides between Poggi Canyon and Wolf Canyon will vary only slightly as compared to existing conditions. Runoff within the developed Village 2 site will be directed toward either Poggi or Wolf Canyon Creeks via internal storm drain systems. Existing and developed areas and 100-year flows for each watershed are summarized in the following table.

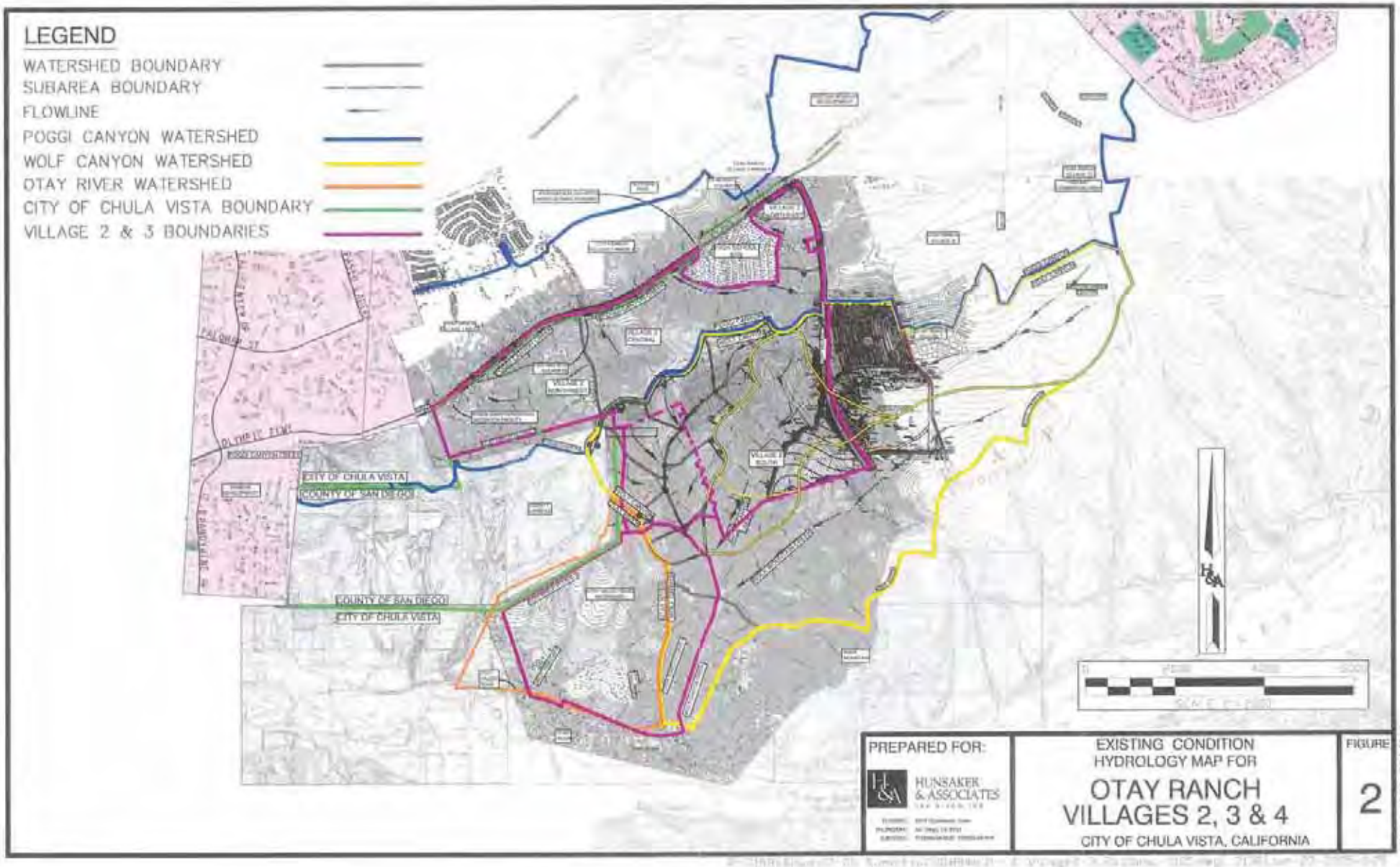

LEGEND
WATERSHED BOUNDARY
SUBAREA BOUNDARY
FLOWLINE
POGGI CANYON WATERSHED
WOLF CANYON WATERSHED
OTAY RIVER WATERSHED
CITY OF CHULA VISTA BOUNDARY
VILLAGE 2 & 3 BOUNDARIES
CITY OF CHULA VISTA
COUNTY OF SAN DIEGO
COUNTY OF SAN DIEGO
CITY OF CHULA VISTA
PREPARED FOR:
HUNSAKER & ASSOCIATES
EXISTING CONDITION
HYDROLOGY MAP FOR
OTAY RANCH
VILLAGES 2, 3 & 4
CITY OF CHULA VISTA, CALIFORNIA
FIGURE
2
W.O.# 0025-394/543

Table 2: Poggi Canyon, Wolf Canyon & Otay River Pre vs. Post Development Flow Summary

Watershed	Pre-Development Drainage Area (ac)	Pre-Development Q100 (cfs)	Developed Drainage Area (ac)	Routed Outflow (cfs)	Freeboard (ft)
*Poggi Canyon @ Regional Detention Basin	2,070	1,320	2,093 (+23)	1,115 (-205)	1.5
**Wolf Canyon (from Village 2 Site only) @ Detention Site	227	330	247 (+20)	187 (-143)	2.01
***Otay River (Village 3 Site only)	324	823	379 (+55)	375 (-448)	3.99

* Pre-Development Poggi Canyon data taken from "Master Drainage Study for Poggi Canyon Creek", dated October 1999; 23 acre diversion from grading subsequent to 1999 study preparation

** Composite Wolf Canyon analysis to be provided at final engineering phase; 28 acre diversion to unnamed tributary from other portion of existing Wolf Canyon watershed (In other words, diversion is internal and not from out of basin effects)

*** Diversion from Wolf Canyon Watershed

Runoff to Poggi Canyon will be routed through the existing Poggi Canyon Regional Detention Facility. After slight modification to the detention basin (raising of the berm), calculations predict a developed-condition basin outflow of 1,115 cfs (significantly lower than the pre-developed condition flow of 1,320 cfs). Therefore, the Poggi Canyon Regional Detention Facility effectively attenuates the 100-year developed peak flow for the 100 year 6-hour storm.

The majority of runoff to Wolf Canyon will be routed through a proposed detention basin located in the unnamed tributary just upstream of its confluence with Wolf Canyon Creek. Village 2, Neighborhood R-16 will be built as part of Phase 1 and will drain to the storm drain system located in La Media Road which will be built in association with Otay Ranch Village 7. Details regarding flows from this area and hydraulics for the Village 7 La Media Road storm drain system can be found in the Master Drainage study for Village 7, dated April 1, 2005.

The majority of Village 2 Phase 1 straddles Santa Victoria Road. Rational method hydrology analysis for Village 2 Phase is contained in the Otay Ranch Village 2, Phase 2 Rough Grading Hydrology Study prepared by Hunsaker & Associates. The Phase 1 area has been divided into three watersheds. A portion of the Village 2 Phase 1 site will discharge into the existing natural channel located west, north west

of the existing Otay Ranch School site. Flows to this tributary in developed conditions will be considerably less than in existing conditions. A Detailed HEC RAS analysis for this channel will be provided at the final engineering stage for Village 2 Phase 1. The remainder of this planning area will discharge to existing storm drain systems and ultimately will discharge to Poggi Canyon Channel. Hydraulic analyses of these systems are included in the Otay Ranch Village 2, Phase 2 Rough Grading Hydrology Study prepared by Hunsaker & Associates also.

Water quality treatment will be addressed with flow based treatment units at several locations through Villages 2, 3 & 4. Flow from Village R-15 will be treated in the Vortechs unit located to the east of La Media Road upstream of the Otay Ranch Village 7 detention basin. Additional details regarding water quality treatment can be found in the *"Water Quality Technical Report for Otay 2, 3, 4"* and *"Water Quality Technical Report for Village 7"* prepared by Hunsaker & Associates.

All runoff from Village 3 will be routed via storm drain to a basin north of the intersection of Heritage Road and Otay Valley Road. Attenuated peak flows from this detention basin will discharge into the Otay River south of Otay Valley Road. Water quality treatment for village 3 will take place in a flow based treatment unit upstream of the basin. A diversion structure will direct the 85th percentile flow to the unit while allowing flow in excess of this amount to proceed to the detention facility. Additional details regarding the water quality treatment of these flows can be found in the *"Water Quality Technical Report for Otay 2, 3, 4"* prepared by Hunsaker & Associates.

HEC-HMS output and stage-storage-discharge information for the Otay Ranch Village 3 basin are located in Chapter 11 of this report. Inflow and outflow hydrographs are also provided in Chapter 11.

The drainage areas contributing to the Wolf Canyon Basin and Otay Valley Road basin are each less than one square mile, thus a 100-year 6 hour rational method analysis was prepared for each of these watersheds. AES output for the Wolf Canyon Basin and Otay Valley Road basin appears in Chapters

Summary of Results & Recommendations

The original watershed model for Poggi Canyon was prepared in association with the "Master Drainage Study for Poggi Canyon Creek," dated October 1999 and approved by the City of Chula Vista. This report includes an addendum prepared to update assumptions made regarding ultimate condition watershed boundaries, curve numbers, and mitigation grading which reduced the storage volume of the Poggi Canyon regional detention basin. Detention basin storage volume reductions, associated with the mitigation grading, are proposed to be offset by the raised berm design modeled in this analysis.

The Poggi Canyon addendum analysis is consistent with methodology approved for the October 1999 Master Drainage Study. The following list summarizes

methodology used in the Poggi Canyon hydrologic analysis and discusses updates to methodology between the original 1999 study and the current addendum.

- 6-Hour, Type B Rainfall Distribution per 1993 San Diego County Hydrology Manual (effective at the time of 1999 Master Drainage Study)
- 24-Hour, Type B Rainfall Distribution Output for the Poggi Canyon watershed has been included in this report for reference; However, the approved methodology remains the 6-Hour Type B distribution.
- 100-Year, 6-Hour Rainfall Depth = 2.5 inches
- 100-Year, 24-hour Rainfall Depth = 4.1 inches
- Curve Numbers Determined Based on Antecedent Moisture Condition = 2.0 (this standard was approved by City of Chula Vista and Dr. David Williams of West Consultants);
- Curve number for Village 2 development have been updated based on PZN adjustment factor of 2.3, per city's request
- Soil group D assumed for each subbasin
- Curve numbers for 1999 study selected based on criteria set forth in 1993 San Diego County Hydrology Manual (CN = 98 for major arterials, CN = 92 for commercial areas, CN = 91 for school and mixed-use sites, CN = 90 for high-density residential sites, CN = 88 for medium-density residential sites, CN = 82 for open areas).
- Curve numbers for current study included in this report selected based on criteria set forth in 2003 San Diego County Hydrology Manual (CN = 98 for major arterials, CN = 95 for commercial areas, CN = 91 for school and mixed-use sites, CN = 92 for high-density residential sites, CN = 87 for medium-density residential sites, CN = 82 for open areas); developed-condition composite sub basin curve numbers for the Otay Ranch areas range from 86 to 92.
- Kinematic Wave Method used to transform excess rainfall to runoff; overland flow planes assumed to have Manning's overland roughness value ranging from 0.2 to 0.3; shallow concentrated gutter flow regime assumed to have Manning's roughness value of 0.015 and a length of 1,000 feet; collector storm drain flow regime assumed to have Manning's roughness value of 0.013; Poggi Canyon channel element assumed to have Manning's roughness value of 0.06.

The table on the following page summarizes developed condition input and output data for both the 1999 Master Drainage Study and the 2004 Addendum analysis.

Results contained in Table 1 are conditional pending final approval of Tentative Maps for Otay Ranch Villages 2, 7 and the Eastern Urban Center.

TABLE 3: POGGI CANYON WATERSHED MODEL DATA
100 Year 6 Hour Type B Distribution
Developed Conditions

Location	1999 Master Drainage Study for Poggi Canyon			2005 Addendum to Master Drainage Study		
	Drainage Area (acres)	Composite Upstream Curve No.	Q_{100} (cfs)	Drainage Area (acres)	Composite Upstream Curve No.	Q_{100} (cfs)
Upstream of East Palomar Crossing	495	86.6	455	588	89.6	753
Downstream of East Palomar Crossing	590	87.1	560	690	89.5	877
Upstream of La Media Crossing	670	87.3	630	804	89.7	1,020
Downstream of La Media Crossing	1,240	87.2	1,175	1,275	90.1	1,651
Upstream of Olympic Parkway Crossing	1,305	87.1	1,215	1,430	90.3	1,854
Downstream of Olympic Parkway Crossing	1,490	87.0	1,345	1,485	90.4	1,909
Downstream of Heritage Road Crossing	1,730	87.0	1,490	1,760	90.2	2,111
Inflow to Poggi Canyon Regional Detention Basin	2,075	86.8	1,675	2,093	n/a	2,295
Outflow from Poggi Canyon Regional Detention Basin	2,075	86.8	950	2,093	n/a	1,115
Brandywine Culvert Headwall	2,450	86.7	1,070	2,477	n/a	1,236

TABLE 4: POGGI CANYON WATERSHED MODEL DATA
Developed Conditions
100 year, 10 Year and 2 Year HEC-1 Results
For 6-Hour and 24-Hour Type B Rainfall Distributions

Location	6 Hour Type B			24-Hour Type B Distribution		
	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	Q_2 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
Upstream of East Palomar Crossing	140	367	753	297	553	825
Downstream of East Palomar Crossing	162	425	877	349	648	967
Upstream of La Media Crossing	189	494	1,020	398	749	1,124
Downstream of La Media Crossing	312	798	1,651	647	1,203	1,793
Upstream of Olympic Parkway Crossing	354	896	1,854	709	1,336	2,002
Downstream of Olympic Parkway Crossing	365	922	1,909	739	1,389	2,077
Downstream of Heritage Road Crossing	409	1,011	2,111	818	1,581	2,414
Inflow to Poggi Canyon Regional Detention Basin	448	1,089	2,295	893	1,761	2,733
Outflow from Poggi Canyon Regional Detention Basin	359	684	1,115	679	1,145	2,596
Brandywine Culvert Headwall	390	748	1,236	768	1,402	2,959

HEC-1 detention routing calculations show the Poggi Canyon regional detention basin capable of mitigating the 100-year, 6-hour design runoff below the pre-development flow level at both the Otay Ranch – Sunbow boundary and downstream at Brandywine Avenue. Raising of the detention basin berm will provide 2 feet of freeboard within the basin as required by the soon to be enacted revisions to freeboard requirements within the City of Chula Vista Subdivision Manual.

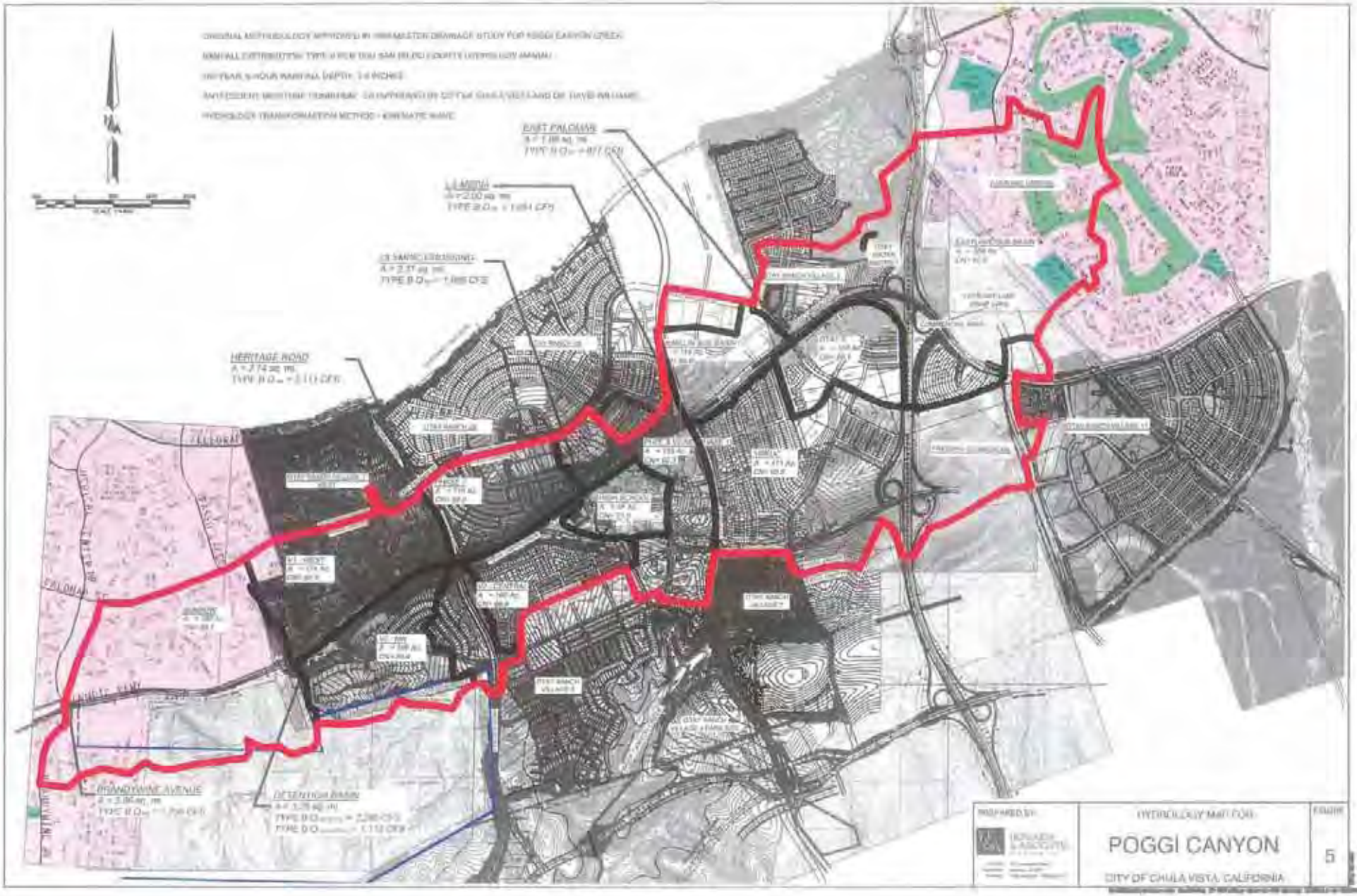
HEC RAS results for the Poggi Canyon Channel from the proposed SR125 to the Poggi Canyon Regional Detention Facility are included in Chapter 5 of this report. Stationing for Poggi Canyon Channel corresponds to channel centerline stationing as provided on the improvement plans for Olympic Parkway (Drawing Number 0-2024-01) Velocities in the Poggi Channel are at non erosive levels at all locations with the exception of the drop structures which are designed to create a hydraulic drop by increasing velocity. The following table demonstrate that WSE at culverts are at acceptable levels based on the higher flows and will not adversely impact upstream storm drain systems.

Table 5
Culvert Performance Data
100 Year Storm

Location	Culvert Type and Dimensions	Road Weir Elevation (ft)	100-Year WSE (ft)
East Palomar	(2) 8' x 6' RCBCs	505.4	500.86
La Media	(2) 7' x 8' RCBCs	446.0	440.0
Olympic Parkway Culvert	(2) 12' x 8' RCBCs	403.0	398.73
Paseo Ranchero	(2) 12' x 8' RCBCs	353.7	349.26
Village 2 Entrance Road	(2) 12' x 8' RCBCs	306.6	302.02
Detention Basin	(2) 8' x 4' RCBCs	298.0	295.64

Methodology used for the hydrologic analyses for the Wolf Canyon and the Otay Village 3 basins is consistent with criteria set forth in the 2003 "San Diego County Hydrology Manual". Since the contributing drainage area to both proposed detention basins is less than 1 square mile, rational method analyses were used to determine 100-year basin inflows. The HEC HMS computer program was used to route flows through the detention basins.

Tables 6-8 below summarize the 100-year, 10-year and 2-year pre and post-development results for the Wolf Canyon and Otay Village 3 detention facilities.


EAST PALOMAR
HERITAGE ROAD
BRANDYWINE AVENUE
DETENTION BASIN
PREPARED BY:
HYDROLOGY MAP FOR:
POGGI CANYON
CITY OF CHULA VISTA, CALIFORNIA
FIGURE
5