HYDROLOGY AND HYDRAULICS REPORT FOR:

McNally Road TPM

CO. OF SAN DIEGO, CA

Prepared for:

Fallbrook Development
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Prepared by:

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Rev. Date: 5-30-07

David Yeh, RCE 62717, Exp. 6-30-10

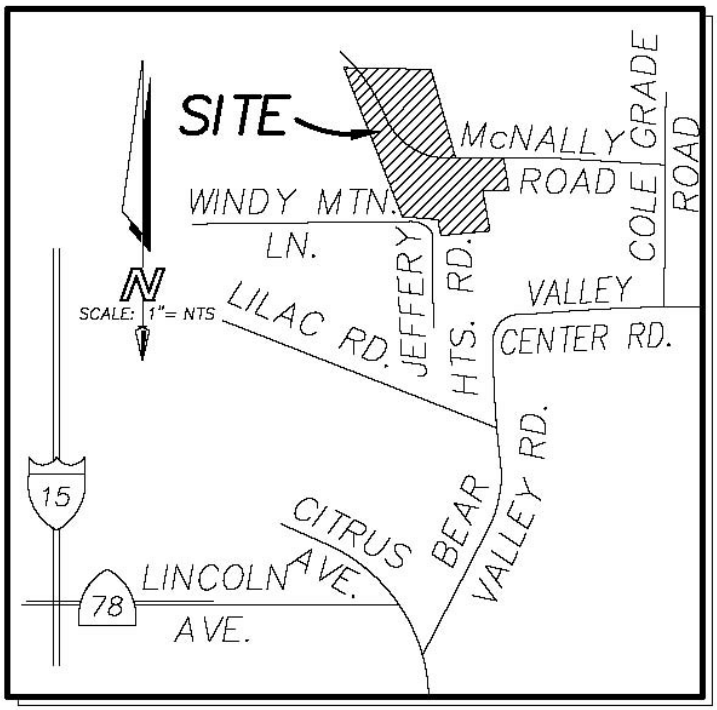
TABLE OF CONTENTS

PROJECT DISCUSSION

PURPOSE FOR PROJECT:

The proposed development consists of the construction of 5 single-family homes pads on approximately 87 acres of largely vacant land, there are currently four existing small structures located on the easterly corner of the site. These structures will remain. An existing pad with a water tank is located near the westerly project boundary. The required improvements associated with this project include the construction of a trail within McNally Road as well as the construction of private access roads. The purpose of this report is to determine the peak runoff rate from the site and compare to the pre-development conditions for the evaluation of the project's impacts to surrounding properties with regard to drainage concentrations, diversions, flooding.

VICINITY MAP



DESCRIPTION OF WATERSHED

The project is located on the northerly side of the intersection of Windy Mountain Lane and Jeffery Heights Road, North of Valley Center Road and west of Cole Grade Road. McNally Road runs through the center portion of the project. The project consists of approximately 87 acres of largely undisturbed open land with the existing McNally Road and an existing access road to an existing water tank site. The proposed development consists of the subdivision of the

site into 5 parcels for single-family home construction. The minimum parcel size is 4 acres. The proposed home construction will be custom estate type structures.

In the pre and post-development conditions, the project site is divided into 4 major drainage sub-basins, the northerly basin drains into a series of existing natural channels and exits the site near the northeasterly corner. The southerly basin drains into an existing natural channel and exits the site on the southerly boundary. The southeasterly basin also drains into an existing natural channels and exits the site at the southeasterly corner. The easterly corner of the site drains southerly into a natural channel and exits the site at the southeasterly corner.

DECLARATON OF RESPONSIBLE CHARGE

I, HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF SAN DIEGO IS CONDINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

4-18-07

DAVID H. YEH, P.E. 62717 DATE

METHOD OF ANALYSIS

3.1 THE RATIONAL METHOD

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures. The RM is recommended for analyzing the runoff response from drainage areas up to approximately 1 square mile in size. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 1 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section 3.4); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Section 4).

The RM can be applied using any design storm frequency (e.g., 100-year, 50-year, 10-year, etc.). The local agency determines the design storm frequency that must be used based on the type of project and specific local requirements. A discussion of design storm frequency is provided in Section 2.3 of this manual. A procedure has been developed that converts the 6-hour and 24-hour precipitation isopluvial map data to an Intensity-Duration curve that can be used for the rainfall intensity in the RM formula as shown in Figure 3-1. The RM is applicable to a 6-hour storm duration because the procedure uses Intensity-Duration Design Charts that are based on a 6-hour storm duration.

3.1.1 Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (T_c), which is the time required for water to

flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed as follows:

$$Q = C\,I\,A$$

Where: Q = peak discharge, in cubic feet per second (cfs)

C = runoff coefficient, proportion of the rainfall that runs off the surface (no units)

I = average rainfall intensity for a duration equal to the T_c for the area, in inches per hour (Note: If the computed T_c is less than 5 minutes, use 5 minutes for computing the peak discharge, Q)

A = drainage area contributing to the design location, in acres

Combining the units for the expression CIA yields:

$$\left(\frac{1\,\text{acre}\times\text{inch}}{\text{hour}}\right)\left(\frac{43{,}560\,\text{ft}^2}{\text{acre}}\right)\left(\frac{1\,\text{foot}}{12\,\text{inches}}\right)\left(\frac{1\,\text{hour}}{3{,}600\,\text{seconds}}\right) \Rightarrow 1.008\,\text{cfs}$$

For practical purposes the unit conversion coefficient difference of 0.8% can be ignored.

The RM formula is based on the assumption that for constant rainfall intensity, the peak discharge rate at a point will occur when the raindrop that falls at the most upstream point in the tributary drainage basin arrives at the point of interest.

Unlike the MRM (discussed in Section 3.4) or the NRCS hydrologic method (discussed in Section 4), the RM does not create hydrographs and therefore does not add separate subarea hydrographs at collection points. Instead, the RM develops peak discharges in the main line by increasing the T_c as flow travels downstream.

Characteristics of, or assumptions inherent to, the RM are listed below:

- The discharge flow rate resulting from any I is maximum when the I lasts as long as or longer than the T_c.

- The storm frequency of peak discharges is the same as that of I for the given T_c.

- The fraction of rainfall that becomes runoff (or the runoff coefficient, C) is independent of I or precipitation zone number (PZN) condition (PZN Condition is discussed in Section 4.1.2.4).

- The peak rate of runoff is the only information produced by using the RM.

3.1.2 Runoff Coefficient

Table 3-1 lists the estimated runoff coefficients for urban areas. The concepts related to the runoff coefficient were evaluated in a report entitled *Evaluation, Rational Method "C" Values* (Hill, 2002) that was reviewed by the Hydrology Manual Committee. The Report is available at San Diego County Department of Public Works, Flood Control Section and on the San Diego County Department of Public Works web page.

The runoff coefficients are based on land use and soil type. Soil type can be determined from the soil type map provided in Appendix A. An appropriate runoff coefficient (C) for each type of land use in the subarea should be selected from this table and multiplied by the percentage of the total area (A) included in that class. The sum of the products for all land uses is the weighted runoff coefficient (Σ[CA]). Good engineering judgment should be used when applying the values presented in Table 3-1, as adjustments to these values may be appropriate based on site-specific characteristics. In any event, the impervious percentage (% Impervious) as given in the table, for any area, shall govern the selected value for C. The runoff coefficient can also be calculated for an area based on soil type and impervious percentage using the following formula:

$$C = 0.90 \times (\% \text{ Impervious}) + C_p \times (1 - \% \text{ Impervious})$$

Where: C_p = Pervious Coefficient Runoff Value for the soil type (shown in Table 3-1 as Undisturbed Natural Terrain/Permanent Open Space, 0% Impervious). Soil type can be determined from the soil type map provided in Appendix A.

The values in Table 3-1 are typical for most urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the local agency.

3.1.4 Time of Concentration

The Time of Concentration (T_c) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The T_c is composed of two components: initial time of concentration (T_i) and travel time (T_t). Methods of computation for T_i and T_t are discussed below. The T_i is the time required for runoff to travel across the surface of the most remote subarea in the study, or "initial subarea." Guidelines for designating the initial subarea are provided within the discussion of computation of T_i. The T_t is the time required for the runoff to flow in a watercourse (e.g., swale, channel, gutter, pipe) or series of watercourses from the initial subarea to the point of interest. For the RM, the T_c at any point within the drainage area is given by:

$$T_c = T_i + T_t$$

Methods of calculation differ for natural watersheds (nonurbanized) and for urban drainage systems. When analyzing storm drain systems, the designer must consider the possibility that an existing natural watershed may become urbanized during the useful life of the storm drain system. Future land uses must be used for T_c and runoff calculations, and can be determined from the local Community General Plan.

3.1.4.1 Initial Time of Concentration

The initial time of concentration is typically based on sheet flow at the upstream end of a drainage basin. The Overland Time of Flow (Figure 3-3) is approximated by an equation developed by the Federal Aviation Agency (FAA) for analyzing flow on runaways (FAA, 1970). The usual runway configuration consists of a crown, like most freeways, with sloping pavement that directs flow to either side of the runway. This type of flow is uniform in the direction perpendicular to the velocity and is very shallow. Since these depths are ¼ of an inch (more or less) in magnitude, the relative roughness is high. Some higher relative roughness values for overland flow are presented in Table 3.5 of the *HEC-1 Flood Hydrograph Package User's Manual* (USACE, 1990).

SUMMARY

	PRE-DEVELOPMENT			POST-DEVELOPMENT		
STORM EVENT	Q (cfs)	AREA	Tc (MIN)	Q (cfs)	AREA	Tc (MIN)
100-YEAR	NODE 106 67.2	(AC) 36.8	9.5	NODE 106 66.9	(AC) 36.6	9.5
	NODE 203 56.0	30.7	9.5	NODE 209 47.7	30.9	13.2
	NODE 302 19.8	10.0	9.8	NODE 303 18.0	10.0	12.9
	NODE 402 9.8	3.4	6.2	NODE 402 9.8	3.4	6.2
	TOTAL **152.8 CFS**	**80.9 AC**		TOTAL **142.4 CFS**	**80.9 AC**	

Based on the hydrology calculations, under the post-development conditions, Basin 100 will have a decrease in discharge rate by 0.3 cfs due to the slight diversion of 0.2 Ac to Basin 200.

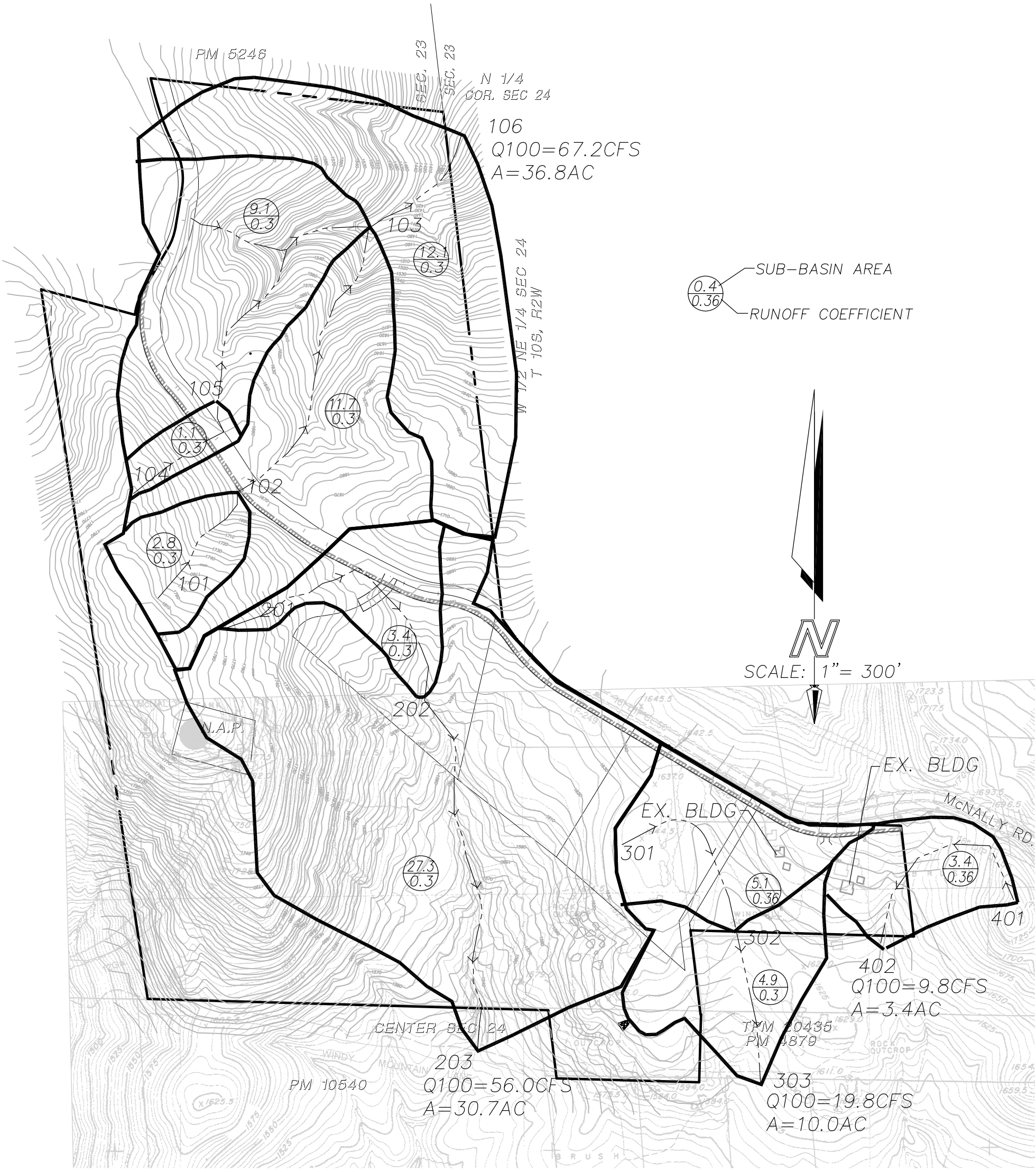
Basin 200 will have a decreased discharge by 8.3 cfs even with a slight increase in tributary area of 0.2 Ac due to the slight diversion from Basin 100. This decrease in discharge is due to the significant increase in travel time as a result of the proposed development.

Basin 300 will have a decrease in discharge of 1.8 cfs due to the increase of travel time as a result of the proposed development.

With the exception of Basins 100 and 200, no diversion of drainage areas will occur as a result of the proposed development. Since there is no increase in discharge from Basins 100 and 200, the slight diversion also has no negative impact to the down stream facilities. The total discharge from the site is 142.4 cfs under the post-development conditions, which is 10.4 cfs less than that of the pre-development conditions, no negative impact to down stream storm drainage facilities is anticipated.

The proposed development will not change the existing drainage pattern, will not divert the drainage basins that will increase discharge runoff rate from the site. Thus, no negative impact to downstream and surrounding properties is anticipated and no mitigation is proposed.

HYDROLOGY MAPS



PRE-DEVELOPMENT HYDROLOGY MAP: McNALLY ROAD

LANDMARK
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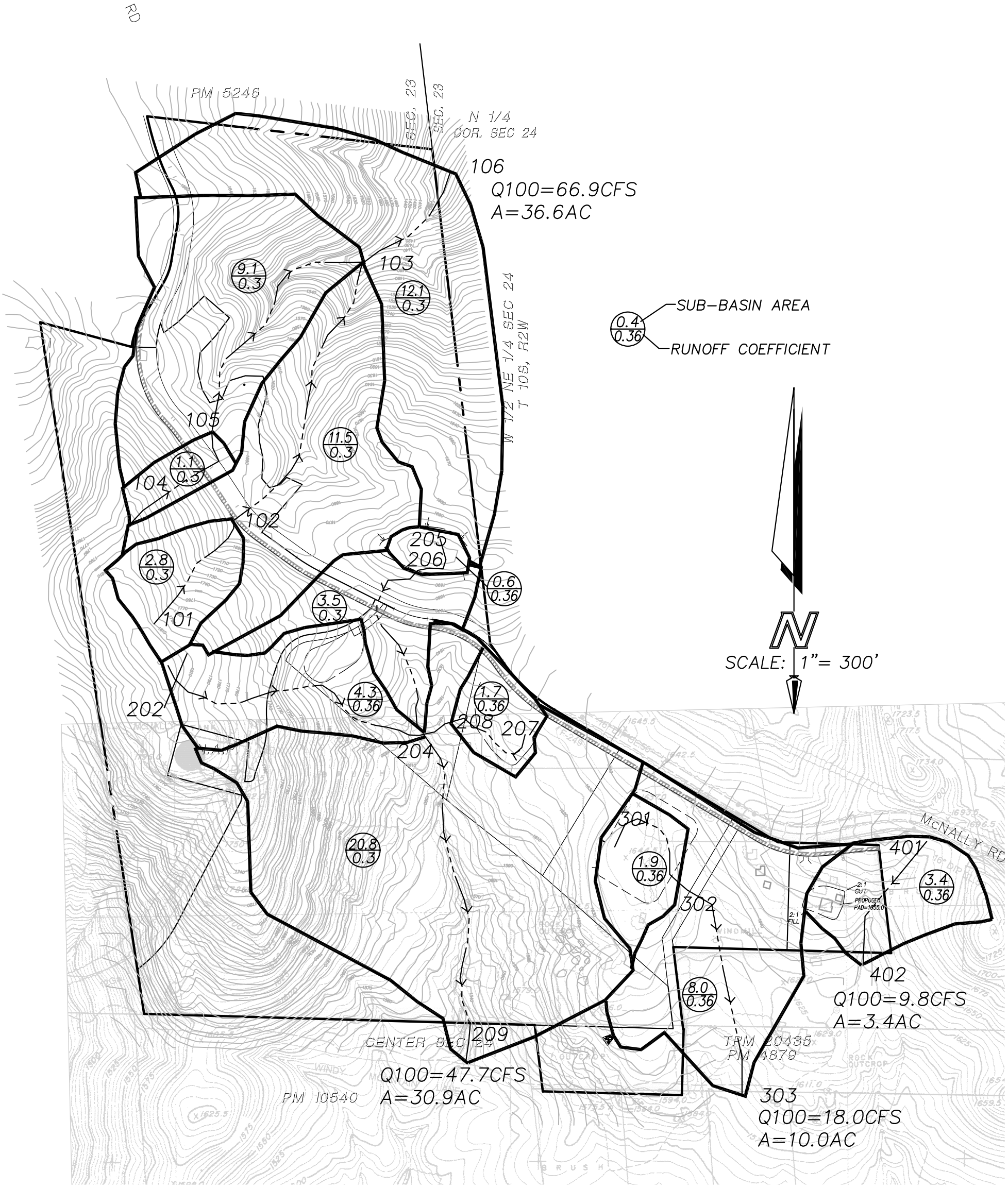
./ N ·



POST-DEVELOPMENT HYDROLOGY MAP: McNALLY ROAD

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HYDROLOGY CALCULATIONS

PRE-DEVLEOPMENT CONDITONS

100-YEAR STORM

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2004 Advanced Engineering Software (aes)
              Ver. 2.0 Release Date: 01/01/2004  License ID 1503

                              Analysis prepared by:

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                                SAN DIEGO, CA 92121
                                 TEL:  858-587-8070

 ************************** DESCRIPTION OF STUDY **************************
* McNALLY ROAD TPM                                                       *
* 100-YEAR STORM                                                         *
* PRE-DEVELOPMENT CONDITIONS                                             *
 ************************************************************************

  FILE NAME: 553EX.DAT
  TIME/DATE OF STUDY: 15:45 06/07/2007
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.500
  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 =  0.00 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    101.00 TO NODE    102.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
==========================================================================
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   396.00
  UPSTREAM ELEVATION(FEET) =   1820.00
  DOWNSTREAM ELEVATION(FEET) =   1670.00
  ELEVATION DIFFERENCE(FEET) =    150.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
  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) =  7.647
  SUBAREA RUNOFF(CFS) =      6.42
  TOTAL AREA(ACRES) =      2.80   TOTAL RUNOFF(CFS) =      6.42

**************************************************************************
  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) =   1670.00  DOWNSTREAM(FEET) =   1450.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   906.00   CHANNEL SLOPE =  0.2428
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      6.42
  FLOW VELOCITY(FEET/SEC) =   7.08 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.13   Tc(MIN.) =   8.82
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =  1302.00 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) =  6.396
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =   11.70   SUBAREA RUNOFF(CFS) =   22.45
  TOTAL AREA(ACRES) =     14.50   TOTAL RUNOFF(CFS) =   27.82
  TC(MIN.) =   8.82

**************************************************************************
  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.) =   8.82
  RAINFALL INTENSITY(INCH/HR) =   6.40
  TOTAL STREAM AREA(ACRES) =    14.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.82
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   404.00
  UPSTREAM ELEVATION(FEET) =   1790.00
  DOWNSTREAM ELEVATION(FEET) =   1645.00
  ELEVATION DIFFERENCE(FEET) =    145.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
  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) =  7.647
  SUBAREA RUNOFF(CFS) =      2.52
  TOTAL AREA(ACRES) =      1.10   TOTAL RUNOFF(CFS) =      2.52

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    103.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1645.00  DOWNSTREAM(FEET) =   1450.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   778.00   CHANNEL SLOPE =  0.2506
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      2.52
  FLOW VELOCITY(FEET/SEC) =   5.72 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.27   Tc(MIN.) =   8.95
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =  1182.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.334
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =    9.10   SUBAREA RUNOFF(CFS) =   17.29
  TOTAL AREA(ACRES) =     10.20   TOTAL RUNOFF(CFS) =   19.38
  TC(MIN.) =   8.95

****************************************************************************
  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.) =   8.95
  RAINFALL INTENSITY(INCH/HR) =   6.33
  TOTAL STREAM AREA(ACRES) =    10.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.38

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       27.82     8.82        6.396         14.50
      2       19.38     8.95        6.334         10.20

  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       46.91     8.82       6.396
      2       46.93     8.95       6.334

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     46.93   Tc(MIN.) =    8.95
  TOTAL AREA(ACRES) =     24.70
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =  1302.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    106.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1450.00  DOWNSTREAM(FEET) =   1360.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   403.00   CHANNEL SLOPE =  0.2233
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =     46.93
  FLOW VELOCITY(FEET/SEC) =  12.02 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.56   Tc(MIN.) =   9.51
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    106.00 =  1705.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.091
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =   12.10   SUBAREA RUNOFF(CFS) =   22.11
  TOTAL AREA(ACRES) =     36.80   TOTAL RUNOFF(CFS) =   67.24
  TC(MIN.) =   9.51

+----------------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                                |
|                                                                            |
|                                                                            |
```

```
+----------------------------------------------------------------------+

**********************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
======================================================================
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   886.00
  UPSTREAM ELEVATION(FEET) =   1790.00
  DOWNSTREAM ELEVATION(FEET) =   1610.00
  ELEVATION DIFFERENCE(FEET) =    180.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
  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) =  7.647
  SUBAREA RUNOFF(CFS) =      7.80
  TOTAL AREA(ACRES) =      3.40   TOTAL RUNOFF(CFS) =      7.80

**********************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  52
----------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
======================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1610.00  DOWNSTREAM(FEET) =   1530.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1088.00   CHANNEL SLOPE =  0.0735
  CHANNEL FLOW THRU SUBAREA(CFS) =      7.80
  FLOW VELOCITY(FEET/SEC) =   6.37 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.85   Tc(MIN.) =   9.53
  LONGEST FLOWPATH FROM NODE    201.00 TO NODE    203.00 =  1974.00 FEET.

**********************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
======================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.082
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =   27.30   SUBAREA RUNOFF(CFS) =   49.81
  TOTAL AREA(ACRES) =     30.70   TOTAL RUNOFF(CFS) =   56.02
  TC(MIN.) =   9.53

+----------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                          |
|                                                                      |
|                                                                      |
+----------------------------------------------------------------------+

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

```
 FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
 SOIL CLASSIFICATION IS "C"
 S.C.S. CURVE NUMBER (AMC II) =  76
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   565.00
 UPSTREAM ELEVATION(FEET) =   1644.50
 DOWNSTREAM ELEVATION(FEET) =   1624.00
 ELEVATION DIFFERENCE(FEET) =     20.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.669
 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) =  6.466
 SUBAREA RUNOFF(CFS) =     11.87
 TOTAL AREA(ACRES) =      5.10   TOTAL RUNOFF(CFS) =     11.87

****************************************************************************
 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) =   1624.00  DOWNSTREAM(FEET) =   1590.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   468.00   CHANNEL SLOPE =  0.0726
 CHANNEL FLOW THRU SUBAREA(CFS) =     11.87
 FLOW VELOCITY(FEET/SEC) =   7.04 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.11   Tc(MIN.) =   9.78
 LONGEST FLOWPATH FROM NODE    301.00 TO NODE    303.00 =  1033.00 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) =  5.984
 CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
 SOIL CLASSIFICATION IS "C"
 S.C.S. CURVE NUMBER (AMC II) =  81
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3306
 SUBAREA AREA(ACRES) =    4.90   SUBAREA RUNOFF(CFS) =    8.80
 TOTAL AREA(ACRES) =     10.00   TOTAL RUNOFF(CFS) =   19.78
 TC(MIN.) =   9.78

+----------------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
================================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  76
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   675.00
  UPSTREAM ELEVATION(FEET) =   1735.00
  DOWNSTREAM ELEVATION(FEET) =   1635.00
  ELEVATION DIFFERENCE(FEET) =    100.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.183
  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) =  8.041
  SUBAREA RUNOFF(CFS) =      9.84
  TOTAL AREA(ACRES) =      3.40   TOTAL RUNOFF(CFS) =      9.84

+----------------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      3.40  TC(MIN.) =      6.18
  PEAK FLOW RATE(CFS)   =      9.84
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

POST-DEVLEOPMENT CONDITIONS

100-YEAR STORM

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2004 Advanced Engineering Software (aes)
              Ver. 2.0 Release Date: 01/01/2004  License ID 1503

                              Analysis prepared by:

                                LANDMARK CONSULTING
                           9555 GENESEE AVENUE, SUITE 200
                                SAN DIEGO, CA 92121
                                 TEL:  858-587-8070

  ************************** DESCRIPTION OF STUDY **************************
 * McNALLY ROAD TPM                                                       *
 * 100-YEAR FLOW                                                          *
 * POST-DEVELOPMENT CONDITIONS                                            *
  ************************************************************************

   FILE NAME: 553POST.DAT
   TIME/DATE OF STUDY: 10:20 06/08/2007
 ------------------------------------------------------------------------
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ------------------------------------------------------------------------
   2003 SAN DIEGO MANUAL CRITERIA

   USER SPECIFIED STORM EVENT(YEAR) = 100.00
   6-HOUR DURATION PRECIPITATION (INCHES) =   3.500
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
   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 =  0.00 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    101.00 TO NODE    102.00 IS CODE =  21
 ------------------------------------------------------------------------
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 ========================================================================
```

```
  CHAPARRAL(BROADLEAF) GOOD COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  71
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   396.00
  UPSTREAM ELEVATION(FEET) =   1820.00
  DOWNSTREAM ELEVATION(FEET) =   1670.00
  ELEVATION DIFFERENCE(FEET) =    150.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
  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) =  7.647
  SUBAREA RUNOFF(CFS) =      6.42
  TOTAL AREA(ACRES) =      2.80   TOTAL RUNOFF(CFS) =      6.42

****************************************************************************
  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) =   1670.00  DOWNSTREAM(FEET) =   1450.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   906.00   CHANNEL SLOPE =  0.2428
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      6.42
  FLOW VELOCITY(FEET/SEC) =   7.08 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.13   Tc(MIN.) =   8.82
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =  1302.00 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) =  6.396
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =   11.50   SUBAREA RUNOFF(CFS) =   22.07
  TOTAL AREA(ACRES) =     14.30   TOTAL RUNOFF(CFS) =   27.44
  TC(MIN.) =   8.82

****************************************************************************
  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.) =   8.82
  RAINFALL INTENSITY(INCH/HR) =   6.40
  TOTAL STREAM AREA(ACRES) =    14.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.44

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

```
 FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
 SOIL CLASSIFICATION IS "C"
 S.C.S. CURVE NUMBER (AMC II) =  81
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   404.00
 UPSTREAM ELEVATION(FEET) =   1790.00
 DOWNSTREAM ELEVATION(FEET) =   1645.00
 ELEVATION DIFFERENCE(FEET) =    145.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.684
 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) =  7.647
 SUBAREA RUNOFF(CFS) =      2.52
 TOTAL AREA(ACRES) =      1.10   TOTAL RUNOFF(CFS) =      2.52

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    103.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1645.00  DOWNSTREAM(FEET) =   1450.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   778.00   CHANNEL SLOPE =  0.2506
 NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
 CHANNEL FLOW THRU SUBAREA(CFS) =      2.52
 FLOW VELOCITY(FEET/SEC) =   5.72 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.27   Tc(MIN.) =   8.95
 LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =  1182.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.334
 CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
 SOIL CLASSIFICATION IS "C"
 S.C.S. CURVE NUMBER (AMC II) =  81
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
 SUBAREA AREA(ACRES) =    9.10   SUBAREA RUNOFF(CFS) =   17.29
 TOTAL AREA(ACRES) =     10.20   TOTAL RUNOFF(CFS) =   19.38
 TC(MIN.) =   8.95

****************************************************************************
 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.) =   8.95
```

```
  RAINFALL INTENSITY(INCH/HR) =   6.33
  TOTAL STREAM AREA(ACRES) =    10.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.38

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       27.44     8.82        6.396        14.30
      2       19.38     8.95        6.334        10.20

  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       46.53     8.82       6.396
      2       46.55     8.95       6.334

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     46.55   Tc(MIN.) =    8.95
  TOTAL AREA(ACRES) =     24.50
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =  1302.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    106.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1450.00  DOWNSTREAM(FEET) =   1360.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   403.00   CHANNEL SLOPE =  0.2233
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =     46.55
  FLOW VELOCITY(FEET/SEC) =  11.99 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.56   Tc(MIN.) =   9.51
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    106.00 =  1705.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.090
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3000
  SUBAREA AREA(ACRES) =   12.10   SUBAREA RUNOFF(CFS) =   22.11
  TOTAL AREA(ACRES) =     36.60   TOTAL RUNOFF(CFS) =   66.87
  TC(MIN.) =   9.51

+----------------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    204.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  76
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   941.00
  UPSTREAM ELEVATION(FEET) =   1811.00
  DOWNSTREAM ELEVATION(FEET) =   1605.00
  ELEVATION DIFFERENCE(FEET) =    206.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.183
  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) =  8.041
  SUBAREA RUNOFF(CFS) =     12.45
  TOTAL AREA(ACRES) =      4.30   TOTAL RUNOFF(CFS) =     12.45

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 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.) =   6.18
  RAINFALL INTENSITY(INCH/HR) =   8.04
  TOTAL STREAM AREA(ACRES) =     4.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.45

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  76
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   172.00
  UPSTREAM ELEVATION(FEET) =   1700.00
  DOWNSTREAM ELEVATION(FEET) =   1698.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.781
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.44
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.618
  SUBAREA RUNOFF(CFS) =      1.21
  TOTAL AREA(ACRES) =      0.60   TOTAL RUNOFF(CFS) =      1.21

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    204.00 IS CODE =  52
```

```
------------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1698.00  DOWNSTREAM(FEET) =   1605.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   610.00   CHANNEL SLOPE =  0.1525
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      1.21
  FLOW VELOCITY(FEET/SEC) =   4.92 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.07   Tc(MIN.) =  12.85
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    204.00 =   782.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    204.00 IS CODE =  81
------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.017
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3088
  SUBAREA AREA(ACRES) =    3.50   SUBAREA RUNOFF(CFS) =    5.27
  TOTAL AREA(ACRES) =      4.10   TOTAL RUNOFF(CFS) =    6.35
  TC(MIN.) =  12.85

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 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.) =  12.85
  RAINFALL INTENSITY(INCH/HR) =   5.02
  TOTAL STREAM AREA(ACRES) =     4.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.35

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    208.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  76
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   264.00
  UPSTREAM ELEVATION(FEET) =   1630.00
  DOWNSTREAM ELEVATION(FEET) =   1627.00
  ELEVATION DIFFERENCE(FEET) =      3.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.834
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    72.05
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.600
  SUBAREA RUNOFF(CFS) =      3.43
```

```
  TOTAL AREA(ACRES) =      1.70   TOTAL RUNOFF(CFS) =      3.43

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1622.00  DOWNSTREAM(FEET) =  1605.00
  FLOW LENGTH(FEET) =   133.00   MANNING'S N =  0.011
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.93
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      3.43
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =  10.98
  LONGEST FLOWPATH FROM NODE    207.00 TO NODE    204.00 =   397.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 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.) =  10.98
  RAINFALL INTENSITY(INCH/HR) =   5.55
  TOTAL STREAM AREA(ACRES) =     1.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.43

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.45     6.18        8.041          4.30
      2        6.35    12.85        5.017          4.10
      3        3.43    10.98        5.551          1.70

  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       17.43     6.18       8.041
      2       17.45    10.98       5.551
      3       17.22    12.85       5.017

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     17.45   Tc(MIN.) =   10.98
  TOTAL AREA(ACRES) =     10.10
  LONGEST FLOWPATH FROM NODE    202.00 TO NODE    204.00 =   941.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    209.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
```

```
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1605.00  DOWNSTREAM(FEET) =   1530.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1027.00   CHANNEL SLOPE =  0.0730
  CHANNEL FLOW THRU SUBAREA(CFS) =     17.45
  FLOW VELOCITY(FEET/SEC) =   7.81 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.19   Tc(MIN.) =  13.18
  LONGEST FLOWPATH FROM NODE    202.00 TO NODE    209.00 =  1968.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    209.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.936
  CHAPARRAL(NARROWLEAF) FAIR COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3128
  SUBAREA AREA(ACRES) =   20.80   SUBAREA RUNOFF(CFS) =   30.80
  TOTAL AREA(ACRES) =     30.90   TOTAL RUNOFF(CFS) =   47.71
  TC(MIN.) =  13.18

+----------------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  76
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   409.00
  UPSTREAM ELEVATION(FEET) =   1644.00
  DOWNSTREAM ELEVATION(FEET) =   1640.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   11.156
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    69.12
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.495
  SUBAREA RUNOFF(CFS) =      3.76
  TOTAL AREA(ACRES) =      1.90   TOTAL RUNOFF(CFS) =      3.76

****************************************************************************
  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) =   1640.00  DOWNSTREAM(FEET) =   1550.00
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =   667.00   CHANNEL SLOPE =  0.1349
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      3.76
  FLOW VELOCITY(FEET/SEC) =   6.25 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.78   Tc(MIN.) =  12.94
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    303.00 =  1076.00 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) =  4.995
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  76
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3600
  SUBAREA AREA(ACRES) =    8.10   SUBAREA RUNOFF(CFS) =   14.56
  TOTAL AREA(ACRES) =     10.00   TOTAL RUNOFF(CFS) =   17.98
  TC(MIN.) =  12.94

+----------------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+

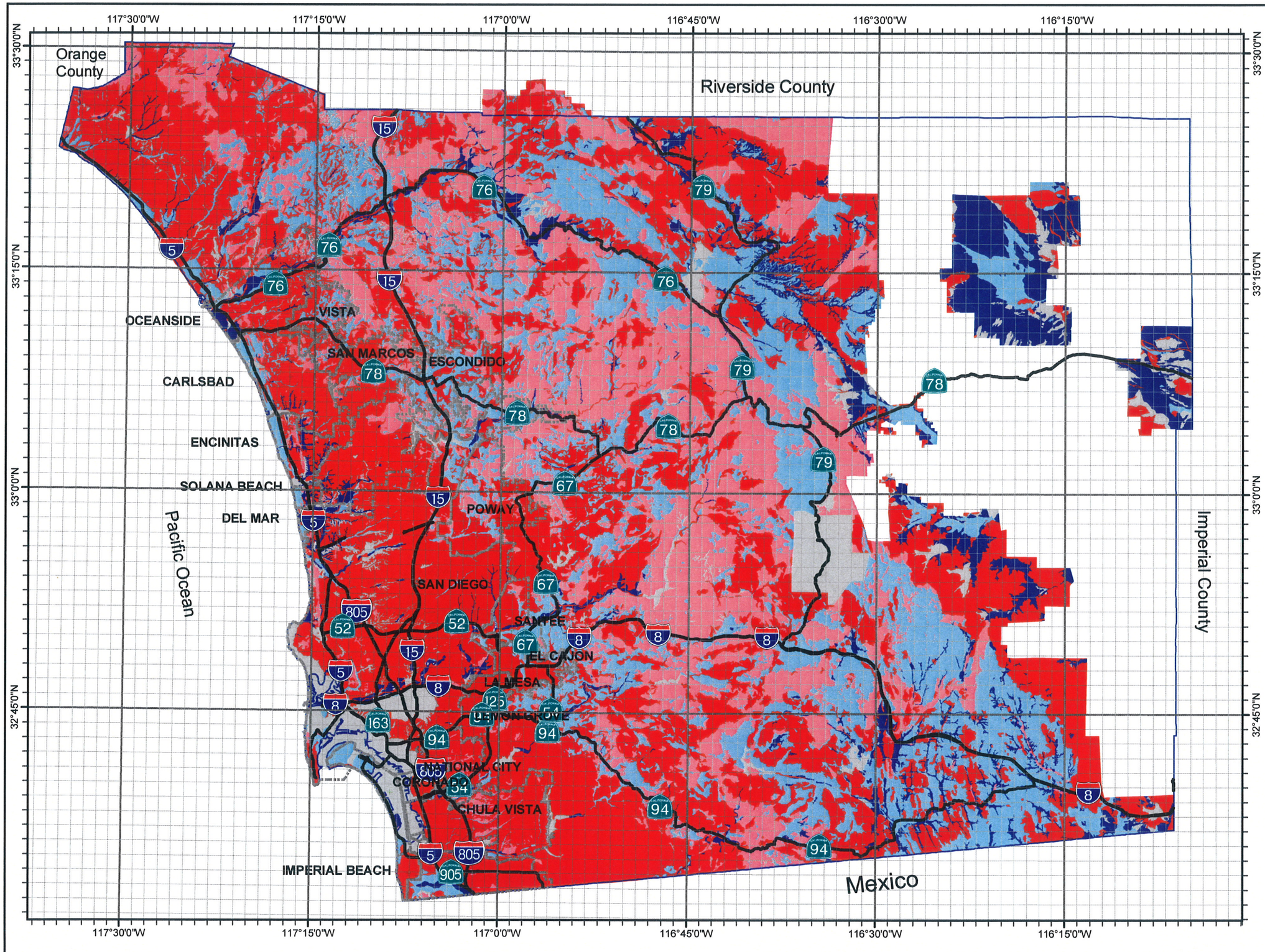
****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3600
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  76
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   675.00
  UPSTREAM ELEVATION(FEET) =   1735.00
  DOWNSTREAM ELEVATION(FEET) =   1635.00
  ELEVATION DIFFERENCE(FEET) =    100.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.183
  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) =  8.041
  SUBAREA RUNOFF(CFS) =      9.84
  TOTAL AREA(ACRES) =      3.40   TOTAL RUNOFF(CFS) =      9.84

+----------------------------------------------------------------------------+
| FLOW EXITS PROJECT BOUNDARY                                                |
|                                                                            |
|                                                                            |
+----------------------------------------------------------------------------+
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      3.40  TC(MIN.) =      6.18
  PEAK FLOW RATE(CFS)   =      9.84
```

==========
==========
END OF RATIONAL METHOD ANALYSIS

APPENDIX

County of San Diego Hydrology Manual Soil Hydrologic Group



Legend

- Major Roads
- Incorporated City Bdy

HYDROLOGIC SOIL GROUP

- Hydrologic Group Undefined
- Hydrologic Group A
- Hydrologic Group B
- Hydrologic Group C
- Hydrologic Group D
- No Soil Data

Note: Soil Data Source
USDA/NRCS
SSURGO Soils 2007

N

31.50 3 Miles

DPW GIS

SanGIS

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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

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

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

$I_6 = 3.5$ in/hr

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

SITE

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

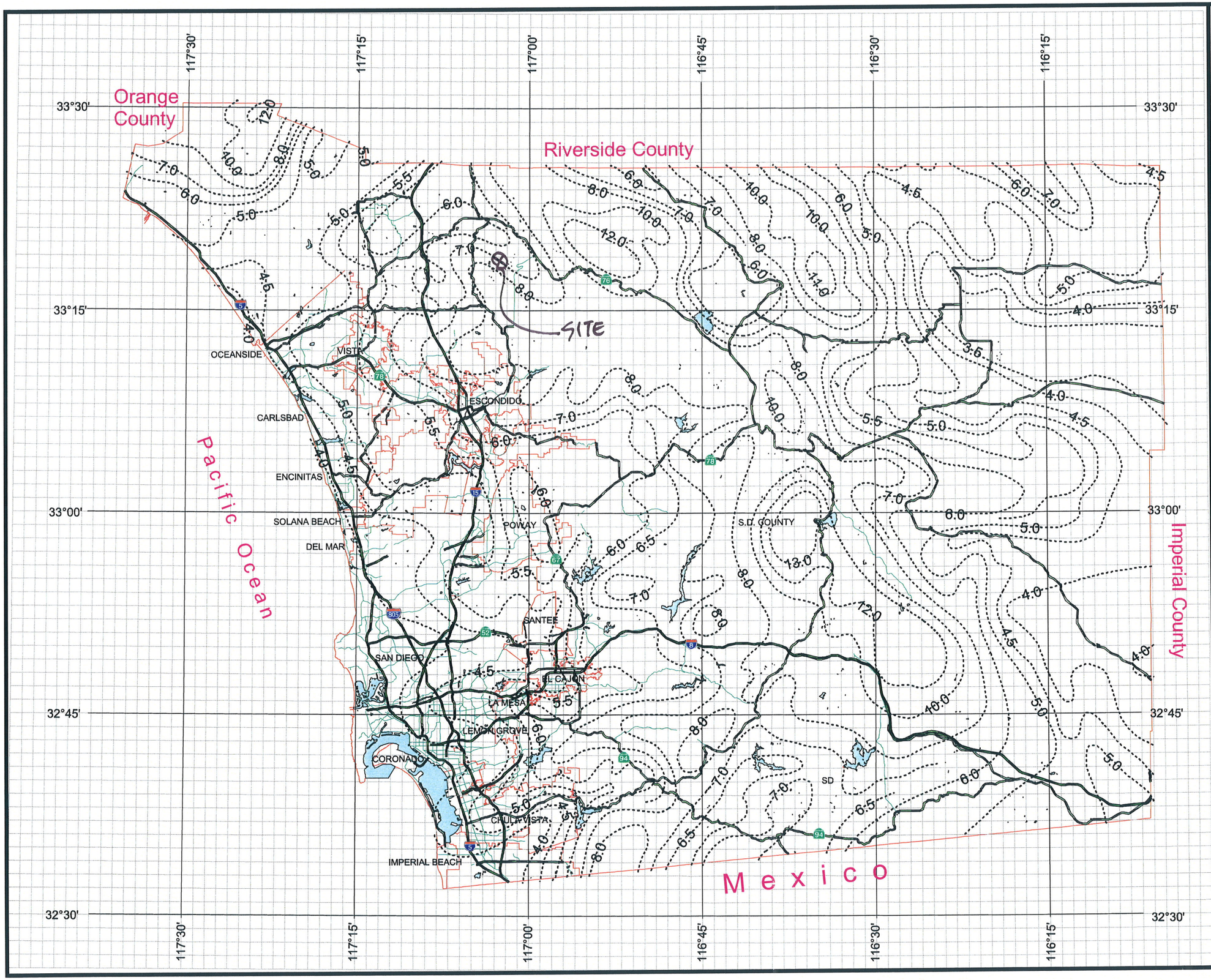
County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$I_{24} = 7.0$ in/hr



DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

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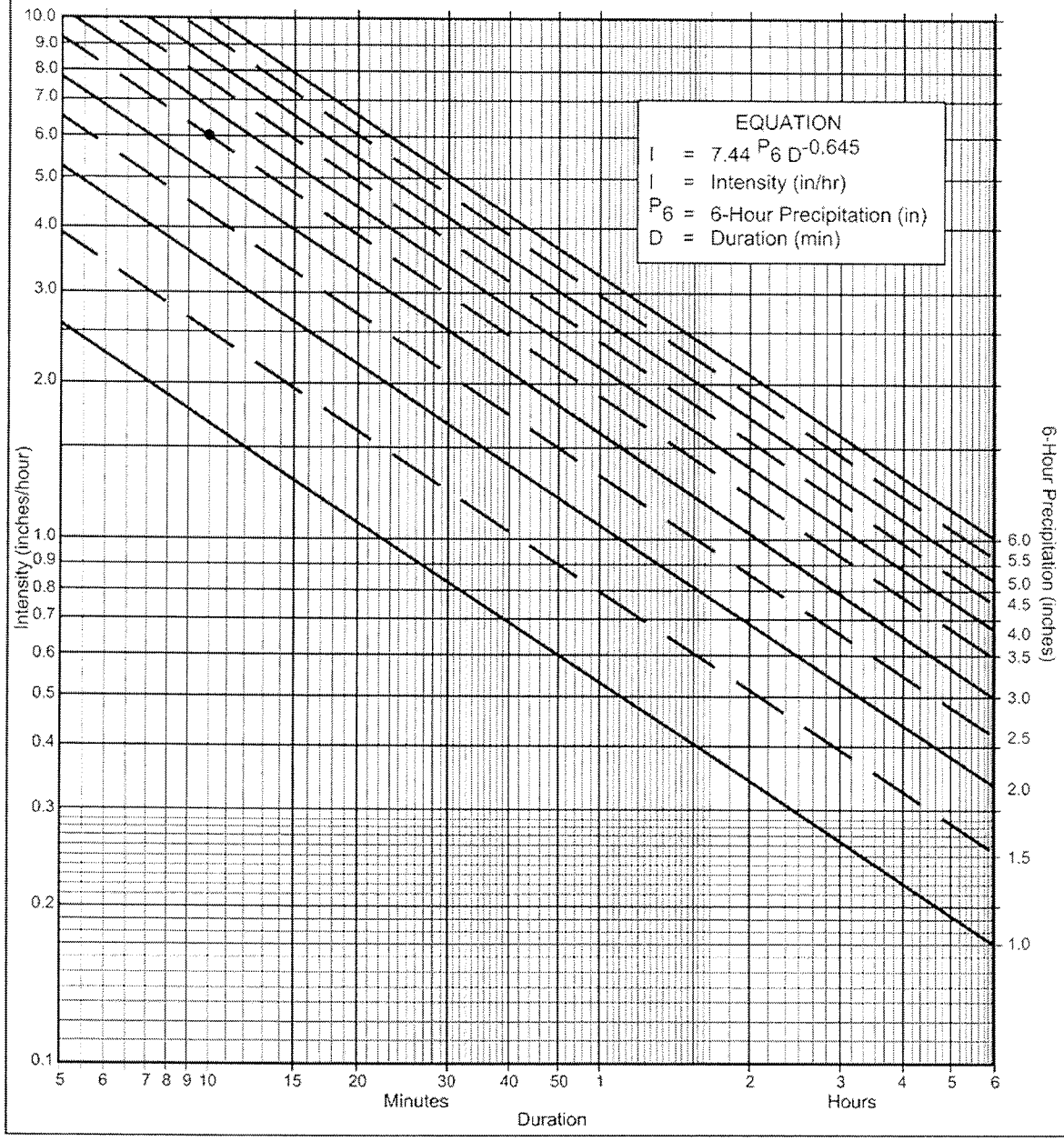

Directions for Application:

(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 100 year

(b) P_6 = 3.5 in., P_{24} = 7.0, $\frac{P_6}{P_{24}}$ = 50 %(2)

(c) Adjusted P_6(2) = 3.5 in.

(d) t_x = 10 min.

(e) I = 6.0 in./hr.

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

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
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