PRELIMINARY DRAINAGE REPORT FOR:

MS 13-06
Riker Ranch
Lakeside, San Diego County, California

PREPARED FOR:

ADLAI I, LLC
8109 Santaluz Village Green South
San Diego, Ca 92127
619-559-0372

PREPARED BY:

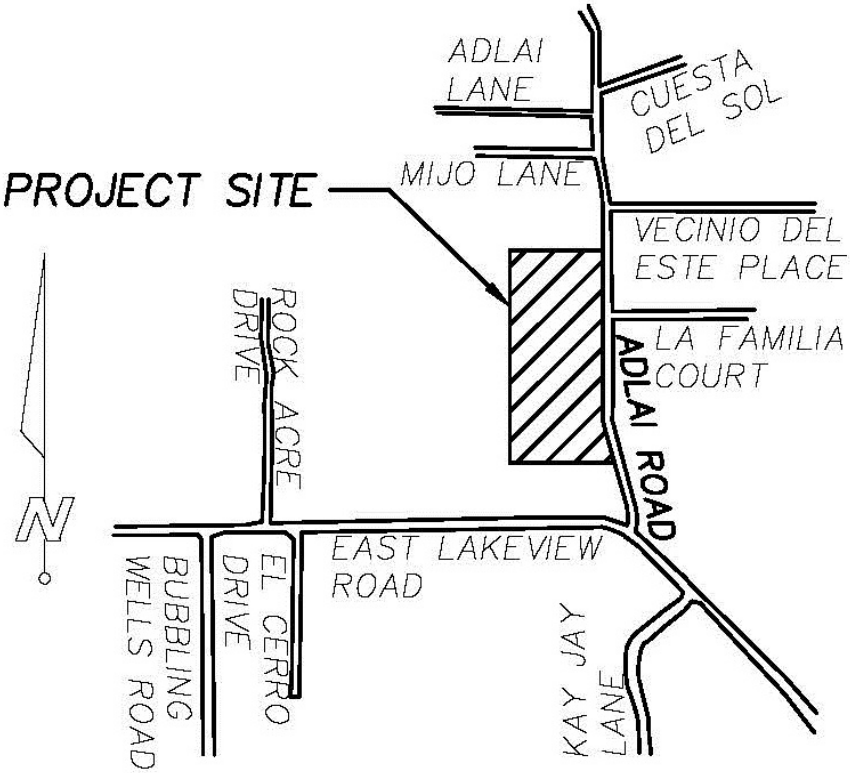
LANDMARK CONSULTING
9555 GENESEE AVENUE, SUITE 200
SAN DIEGO, CA 92121
TEL: 858-587-8070

REV. DATE: 6/5/2015

DAVID YEH, RCE 62717, EXP 6-30-16

TABLE OF CONTENTS

VICINITY MAP	**5**
INTRODUCTION	**7**
METHOD OF ANALYSIS	**9-14**
100-YEAR HYDROLOGY CALCULATIONS	**15-30**
RUNOFF VOLUME CALCULATIONS	**31-32**
STORMDRAIN HYDRAULICS	**33**
SUMMARY	**35**
APPENDIX AND HYDROLOGY MAPS	**37**


ADLAI LANE
CUESTA DEL SOL
MIJO LANE
PROJECT SITE
VECINIO DEL ESTE PLACE
LA FAMILIA COURT
ADLAI ROAD
ROCK ACRE DRIVE
N
EAST LAKEVIEW ROAD
EL CERRO DRIVE
BUBBLING WELLS ROAD
KAY JAY LANE

INTRODUCTION

The property is located at the western side of Adlai Road, north of E. Lakeview Road in the county of San Diego, State of California.

The project site is located in a developed area 3,500ft southwest of Lake Jennings. The project site is largely undeveloped with sparse vegetation and trees in the northern portion of the site. Five structures exist on the southerly half of the project area. The site sheet flows from the southeastern corner to the northwestern portion of the site where it enters the existing wetlands. The northernmost section of the project area sheet flows southerly into the existing wetlands where it is conveyed southwest within the extents of the wetlands.

There exists a curb cut-out along the existing Adlai Road adjacent to La Familia Court that conveys runoff from the area east of Adlai Road onto the project site. From here, the runoff flows westerly and into the existing wetlands.

Under the proposed conditions, the existing single-family residence and other structures will be demolished and 23 single-family lots and a bio-retention lot will be graded. On the eastern portion of the project area, a biological open space area will remain undisturbed. A proposed roadway will run through the center of the project site connecting to the existing Adlai Road near the northern and southern extents of the project area with a cul-de-sac on the northern portion of the project site. The runoff from the proposed pads flow onto the proposed road. Runoff from the road will then be conveyed via a curb and gutter to a low point on the westerly side of the proposed road at the western portion of the project site. The runoff from the easterly proposed lots will sheet flow onto the road as well. From there, the runoff will enter a proposed curb inlet and be conveyed westerly into the bio-retention lot located at the westerly edge of the project site. From the bio-retention area, the runoff will be conveyed south into the existing wetlands.

The offsite flow from the eastern portion of Adlai Road will be conveyed into a storm drain system via curb inlets on the northern connection between the proposed private street and the existing Adlai Road. The runoff will be conveyed westerly and connect to a storm drain that conveys water southerly from the offsite areas to the north before being released into the biological open space lot to the south.

The proposed development does not significantly alter the existing drainage pattern. The purpose of this report is to determine the peak flow rate and volume from the proposed development. Mitigation facilities will be designed to attenuate the anticipated increase in both the runoff rate and volume such that no additional impact will occur to downstream facilities.

METHOD OF ANAYSIS
HYDROLOGY

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 ($\Sigma[CA]$). 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.

Per the attached hydrological soil group map and the enlarged area encompassing the project site, the project site is situated on Type C soil as defined by the current County of San Diego Hydrology Manual.

Per the Off-site Landuse/Density Map, the upstream area consists of **2.9** dwelling units per acre or less. The runoff coefficient is **0.45** in accordance to the County Hydrology Manual, with Type C soil.

The project site consists of approximately 6.3 acres. The proposed 20 residential lots will have a density of **4.3** dwelling units per acre or less, the runoff coefficient is **0.48**.

RUNOFF COEFFICIENT

OFF-SITE UPSTREAM

UPSTREAM NODE	DOWNSTREAM NODE	AREA(AC)	DU	DU/AC	C
301	314	17.1	43	2.5	0.45

ON-SITE POST-DEV

UPSTREAM NODE	DOWNSTREAM NODE	AREA(AC)	DU	DU/AC	C
101	103	2.6	10	3.8	0.48
104	103	3.3	11	3.3	0.48

MAXIMUM OVERLAND FLOW LENGTH

OFF-SITE AREA				
UPSTREAM NODE	DOWNSTREAM NODE	SLOPE (%)	LDR	Lm (FT)
301	302	2.7	<2.9DU/AC	90

UPSTREAM NODE	DOWNSTREAM NODE	SLOPE (%)	LDR	Lm (FT)
101	102	1	<4.3DU/AC	50
104	105	2	<4.3DU/AC	80
106	107	7	NAT.	100

HYDROLOGY CALCULATIONS

Pre-Development Conditions

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2012 Advanced Engineering Software (aes)
              Ver. 19.0 Release Date: 06/01/2012  License ID 1503

                           Analysis prepared by:

                            LANDMARK CONSULTING
                        9555 GENESEE AVE. SUITE 200
                            SAN DIEGO, CA 92121
                    TEL:  858-587-8070, FAX:  858-587-8750

 ************************** DESCRIPTION OF STUDY **************************
* ADLAI ROAD TM                                                            *
* PRE-DEVELOPMENT CONDITIONS                                               *
* 100 YEAR STORM                                                           *
 ***************************************************************************

  FILE NAME: 1911EX.DAT
  TIME/DATE OF STUDY: 07:42 05/07/2015
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.750
  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   18.0     13.0    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 =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (2.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  80
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    714.80
  DOWNSTREAM ELEVATION(FEET) =    712.40
  ELEVATION DIFFERENCE(FEET) =      2.40
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.004
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.349
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    314.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    712.40  DOWNSTREAM(FEET) =    617.39
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1037.00   CHANNEL SLOPE =  0.0916
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.354
  RESIDENTIAL (2.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  80
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      17.19
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.75
  AVERAGE FLOW DEPTH(FEET) =   0.26   TRAVEL TIME(MIN.) =   3.01
  Tc(MIN.) =   11.01
  SUBAREA AREA(ACRES) =    17.10       SUBAREA RUNOFF(CFS) =   33.51
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.450
  TOTAL AREA(ACRES) =       17.2         PEAK FLOW RATE(CFS) =      33.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.39   FLOW VELOCITY(FEET/SEC.) =   7.19
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    314.00 =    1127.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    314.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    617.39  DOWNSTREAM(FEET) =    599.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   521.00   CHANNEL SLOPE =  0.0341
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.785
```

```
  PERENNIAL GRASS GOOD COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  74
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      35.79
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.25
  AVERAGE FLOW DEPTH(FEET) =   0.50   TRAVEL TIME(MIN.) =   2.67
  Tc(MIN.) =   13.68
  SUBAREA AREA(ACRES) =     3.67       SUBAREA RUNOFF(CFS) =    4.17
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.424
  TOTAL AREA(ACRES) =       20.9         PEAK FLOW RATE(CFS) =      33.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.48   FLOW VELOCITY(FEET/SEC.) =   3.18
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    103.00 =    1648.00 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.) =   13.68
  RAINFALL INTENSITY(INCH/HR) =   3.78
  TOTAL STREAM AREA(ACRES) =    20.87
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     33.70

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.00   RAIN INTENSITY(INCH/HOUR) =  4.63
  TOTAL AREA(ACRES) =     3.72   TOTAL RUNOFF(CFS) =    104.00

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    613.40  DOWNSTREAM(FEET) =    599.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   666.00   CHANNEL SLOPE =  0.0207
  CHANNEL BASE(FEET) =   35.00   "Z" FACTOR =   4.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.874
  PERENNIAL GRASS GOOD COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  74
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     105.56
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.47
  AVERAGE FLOW DEPTH(FEET) =   0.80   TRAVEL TIME(MIN.) =   3.20
  Tc(MIN.) =   13.20
```

```
  SUBAREA AREA(ACRES) =     2.64       SUBAREA RUNOFF(CFS) =    3.07
  AREA-AVERAGE RUNOFF COEFFICIENT =  3.654
  TOTAL AREA(ACRES) =        6.4         PEAK FLOW RATE(CFS) =     104.00

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.79   FLOW VELOCITY(FEET/SEC.) =   3.46
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    103.00 =     666.00 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.) =   13.20
  RAINFALL INTENSITY(INCH/HR) =   3.87
  TOTAL STREAM AREA(ACRES) =     6.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    104.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       33.70    13.68        3.785         20.87
      2      104.00    13.20        3.874          6.36

  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      136.51    13.20       3.874
      2      135.31    13.68       3.785

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     136.51   Tc(MIN.) =   13.20
  TOTAL AREA(ACRES) =       27.2
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    103.00 =    1648.00 FEET.

+--------------------------------------------------------------------------+
| FLOW EXITS PROJECT SITE                                                  |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       27.2  TC(MIN.) =     13.20
  PEAK FLOW RATE(CFS)   =     136.51
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Post-Development Conditions

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2012 Advanced Engineering Software (aes)
              Ver. 19.0 Release Date: 06/01/2012  License ID 1503

                           Analysis prepared by:

                             LANDMARK CONSULTING
                         9555 GENESEE AVE. SUITE 200
                             SAN DIEGO, CA 92121
                    TEL:  858-587-8070, FAX:  858-587-8750

 ************************** DESCRIPTION OF STUDY **************************
* RIKER RANCH TM                                                          *
* POST-DEVELOPMENT CONDITIONS                                             *
* 100-YEAR STORM                                                          *
 **************************************************************************

  FILE NAME: 1911POST.DAT
  TIME/DATE OF STUDY: 09:32 05/07/2015
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.750
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 1.00
  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   18.0     13.0    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 =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  RESIDENTIAL (2.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  80
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    90.00
  UPSTREAM ELEVATION(FEET) =    714.80
  DOWNSTREAM ELEVATION(FEET) =    712.40
  ELEVATION DIFFERENCE(FEET) =      2.40
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.004
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.349
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.24

******************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    315.00 IS CODE =  51
------------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    712.40  DOWNSTREAM(FEET) =    617.39
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1037.00   CHANNEL SLOPE =  0.0916
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.354
  RESIDENTIAL (2.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  80
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      17.19
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.75
  AVERAGE FLOW DEPTH(FEET) =   0.26   TRAVEL TIME(MIN.) =   3.01
  Tc(MIN.) =   11.01
  SUBAREA AREA(ACRES) =    17.10       SUBAREA RUNOFF(CFS) =   33.51
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.450
  TOTAL AREA(ACRES) =       17.2         PEAK FLOW RATE(CFS) =      33.70

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.39   FLOW VELOCITY(FEET/SEC.) =   7.19
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    315.00 =    1127.00 FEET.

******************************************************************************
  FLOW PROCESS FROM NODE    315.00 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) =   612.33  DOWNSTREAM(FEET) =   611.03
  FLOW LENGTH(FEET) =   130.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.33
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      33.70
  PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =   11.24
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    120.00 =    1257.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 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.) =   11.24
  RAINFALL INTENSITY(INCH/HR) =   4.30
  TOTAL STREAM AREA(ACRES) =    17.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     33.70

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    201.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  10.00   RAIN INTENSITY(INCH/HOUR) =  4.63
  TOTAL AREA(ACRES) =     3.72   TOTAL RUNOFF(CFS) =    104.00

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 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) =   613.40  DOWNSTREAM(FEET) =   611.00
  FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  45.0 INCH PIPE IS  32.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.31
  ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     104.00
  PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =   10.32
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    120.00 =     240.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 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) =   4.54
  TOTAL STREAM AREA(ACRES) =     3.72
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    104.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       33.70    11.24        4.296         17.20
```

```
    2      104.00    10.32        4.539          3.72

  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      134.95    10.32       4.539
    2      132.14    11.24       4.296

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     134.95   Tc(MIN.) =   10.32
  TOTAL AREA(ACRES) =       20.9
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    120.00 =    1257.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 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) =   611.00  DOWNSTREAM(FEET) =   606.74
  FLOW LENGTH(FEET) =   369.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  34.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.85
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     134.95
  PIPE TRAVEL TIME(MIN.) =   0.44    Tc(MIN.) =   10.77
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    112.00 =    1626.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    606.70  DOWNSTREAM(FEET) =    600.74
  CHANNEL LENGTH THRU SUBAREA(FEET) =    20.00   CHANNEL SLOPE =  0.2980
  CHANNEL BASE(FEET) =   35.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.407
  PERENNIAL GRASS GOOD COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  74
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     135.02
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.74
  AVERAGE FLOW DEPTH(FEET) =   0.42   TRAVEL TIME(MIN.) =   0.04
  Tc(MIN.) =   10.81
  SUBAREA AREA(ACRES) =     0.10       SUBAREA RUNOFF(CFS) =    0.13
  AREA-AVERAGE RUNOFF COEFFICIENT =  1.437
  TOTAL AREA(ACRES) =       21.0         PEAK FLOW RATE(CFS) =     134.95

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
```

```
  DEPTH(FEET) =  0.42   FLOW VELOCITY(FEET/SEC.) =   8.73
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    113.00 =    1646.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .4800
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    633.00
  DOWNSTREAM ELEVATION(FEET) =    632.00
  ELEVATION DIFFERENCE(FEET) =      1.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.263
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.266
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.30

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  632.00  DOWNSTREAM ELEVATION(FEET) =  611.40
  STREET LENGTH(FEET) =   410.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  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 =  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) =       3.58
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    8.17
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.56
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.32
  STREET FLOW TRAVEL TIME(MIN.) =   1.50   Tc(MIN.) =    7.76
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.456
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .4800
```

```
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.480
  SUBAREA AREA(ACRES) =    2.50      SUBAREA RUNOFF(CFS) =    6.55
  TOTAL AREA(ACRES) =        2.6        PEAK FLOW RATE(CFS) =       6.81

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.87
  FLOW VELOCITY(FEET/SEC.) =  5.24   DEPTH*VELOCITY(FT*FT/SEC.) =   1.80
  LONGEST FLOWPATH FROM NODE    101.00 TO NODE    103.00 =     460.00 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.) =    7.76
  RAINFALL INTENSITY(INCH/HR) =   5.46
  TOTAL STREAM AREA(ACRES) =     2.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.81

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .4800
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =    628.40
  DOWNSTREAM ELEVATION(FEET) =    626.80
  ELEVATION DIFFERENCE(FEET) =      1.60
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.923
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.384
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    103.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  626.80  DOWNSTREAM ELEVATION(FEET) =  611.40
  STREET LENGTH(FEET) =   403.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  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 =  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) =       3.92
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    9.09
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.15
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.28
  STREET FLOW TRAVEL TIME(MIN.) =   1.62   Tc(MIN.) =    9.54
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.776
  RESIDENTIAL (4.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .4800
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  81
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.480
  SUBAREA AREA(ACRES) =    3.18      SUBAREA RUNOFF(CFS) =    7.29
  TOTAL AREA(ACRES) =        3.3        PEAK FLOW RATE(CFS) =       7.52

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.98
  FLOW VELOCITY(FEET/SEC.) =  4.84   DEPTH*VELOCITY(FT*FT/SEC.) =   1.77
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =     483.00 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.) =    9.54
  RAINFALL INTENSITY(INCH/HR) =   4.78
  TOTAL STREAM AREA(ACRES) =     3.28
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.52

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.81     7.76        5.456          2.60
      2        7.52     9.54        4.776          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       12.93     7.76       5.456
      2       13.48     9.54       4.776

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =      13.48   Tc(MIN.) =    9.54
  TOTAL AREA(ACRES) =        5.9
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.00 =     483.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.10 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   611.40  DOWNSTREAM(FEET) =   610.30
  FLOW LENGTH(FEET) =   106.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.51
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.48
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =    9.78
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.10 =     589.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.20 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   610.00  DOWNSTREAM(FEET) =   609.40
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.40
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.48
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =    9.91
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    103.20 =     649.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    108.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    602.70  DOWNSTREAM(FEET) =    602.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   700.00   CHANNEL SLOPE =  0.0010
  CHANNEL BASE(FEET) =    7.00   "Z" FACTOR =   0.100
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   5.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      13.48
  FLOW VELOCITY(FEET/SEC.) =   2.37   FLOW DEPTH(FEET) =   0.80
  TRAVEL TIME(MIN.) =   4.93   Tc(MIN.) =   14.84
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    108.00 =    1349.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    113.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    602.00  DOWNSTREAM(FEET) =    600.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =    20.00   CHANNEL SLOPE =  0.0650
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      13.48
  FLOW VELOCITY(FEET/SEC.) =   3.38   FLOW DEPTH(FEET) =   0.34
  TRAVEL TIME(MIN.) =   0.10   Tc(MIN.) =   14.94
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    113.00 =    1369.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
==============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  LAWNS, GOLF COURSES, ETC. GOOD COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  74
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    629.50
  DOWNSTREAM ELEVATION(FEET) =    622.50
  ELEVATION DIFFERENCE(FEET) =      7.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.528
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.565
  SUBAREA RUNOFF(CFS) =      0.17
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    113.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    622.50  DOWNSTREAM(FEET) =    600.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   490.00   CHANNEL SLOPE =  0.0445
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.050   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.078
  LAWNS, GOLF COURSES, ETC. GOOD COVER RUNOFF COEFFICIENT = .3000
  SOIL CLASSIFICATION IS "C"
  S.C.S. CURVE NUMBER (AMC II) =  74
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.30
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.72
  AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =  11.33
  Tc(MIN.) =   18.86
  SUBAREA AREA(ACRES) =     0.28       SUBAREA RUNOFF(CFS) =    0.26
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.300
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       0.35
```

```
  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   0.80
  LONGEST FLOWPATH FROM NODE    106.00 TO NODE    113.00 =     590.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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        0.35    18.86       3.078        0.38
  LONGEST FLOWPATH FROM NODE    106.00 TO NODE    113.00 =     590.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1      134.95    10.81       4.407       21.02
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    113.00 =    1646.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1     135.15      10.81        4.407
      2      94.59      18.86        3.078

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     135.15   Tc(MIN.) =   10.81
  TOTAL AREA(ACRES) =       21.4

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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      135.15    10.81       4.407       21.40
  LONGEST FLOWPATH FROM NODE    301.00 TO NODE    113.00 =    1646.00 FEET.

  ** MEMORY BANK #  2 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1       13.48    14.94       3.577        5.88
  LONGEST FLOWPATH FROM NODE    104.00 TO NODE    113.00 =    1369.00 FEET.

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
```

```
     1     144.90      10.81        4.407
     2     123.17      14.94        3.577

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     144.90   Tc(MIN.) =   10.81
  TOTAL AREA(ACRES) =       27.3

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       27.3  TC(MIN.) =     10.81
  PEAK FLOW RATE(CFS)   =     144.90
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

RUNOFF VOLUME ANALYSIS: PRE-DEVELOPMENT

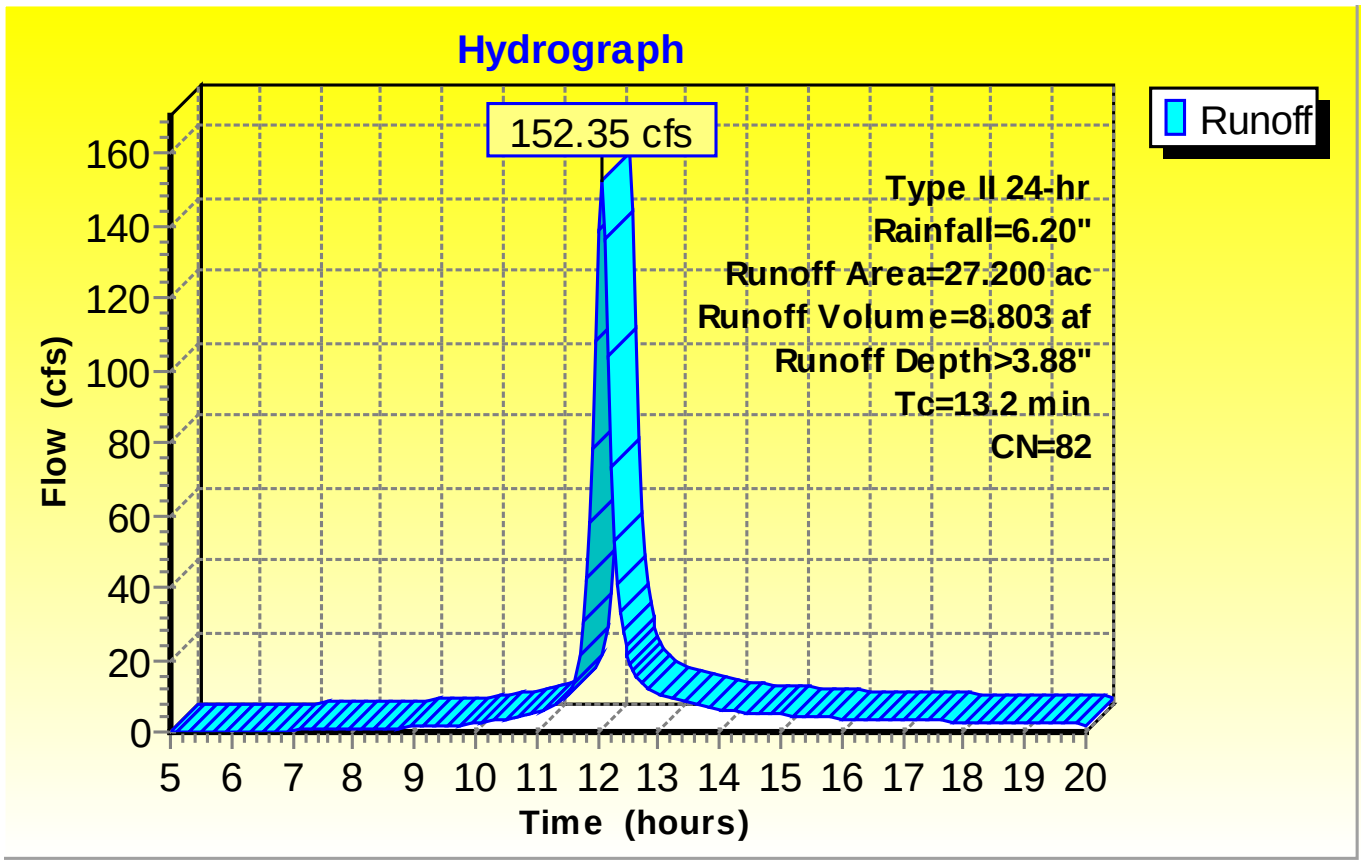
Summary for Subcatchment 1S: (new Subcat)

Runoff = 152.35 cfs @ 12.05 hrs, Volume= 8.803 af, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=6.20"

	Area (ac)	CN	Description
*	27.200	82	
	27.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2					**Direct Entry,**



*The runoff volume analysis utilizes a different method than the hydrology analysis thus resulting in different values for peak flow. This analysis is for the calculation of runoff volume only.

RUNOFF VOLUME ANALYSIS: POST-DEVELOPMENT

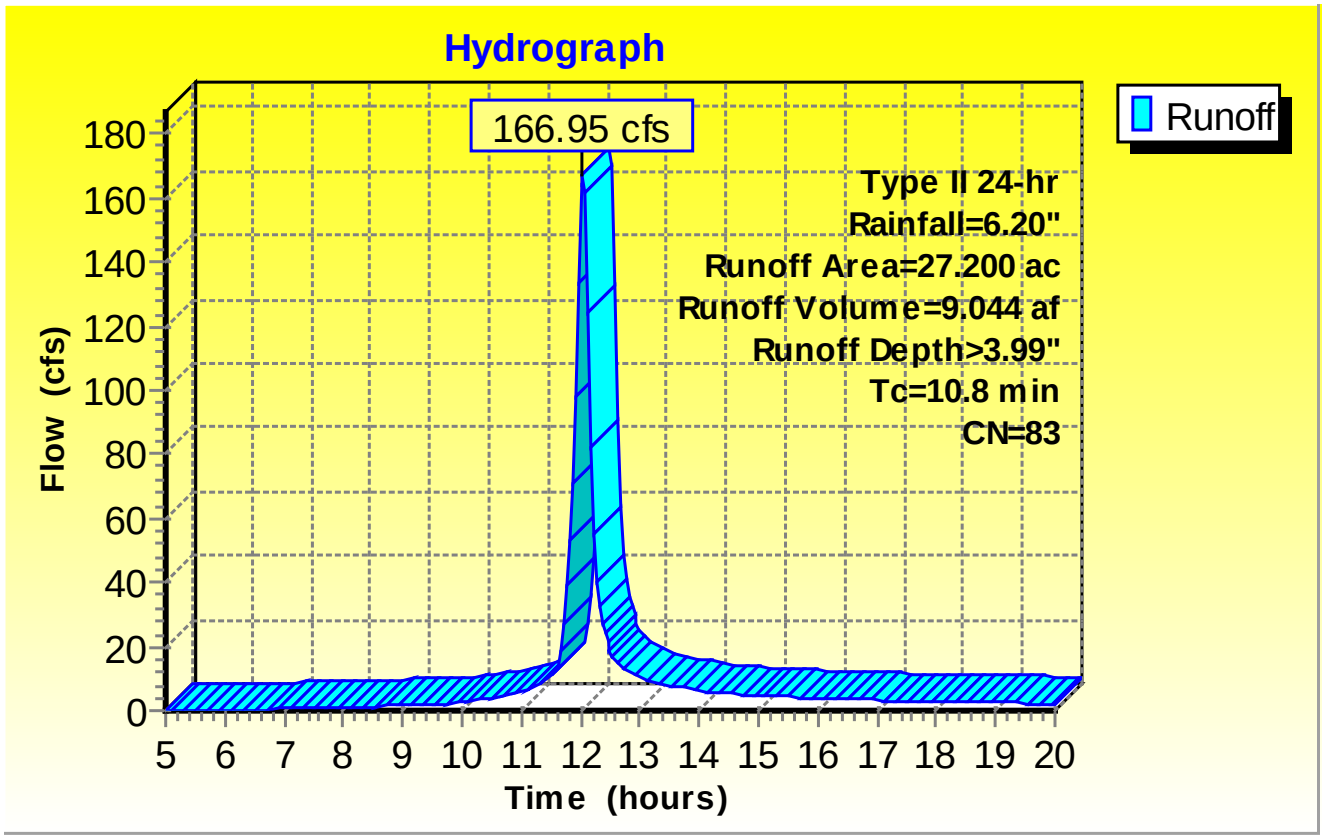
Summary for Subcatchment 2S: (new Subcat)

Runoff = 166.95 cfs @ 12.02 hrs, Volume= 9.044 af, Depth> 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=6.20"

	Area (ac)	CN	Description
*	27.200	83	
	27.200		100.00% Pervious Area

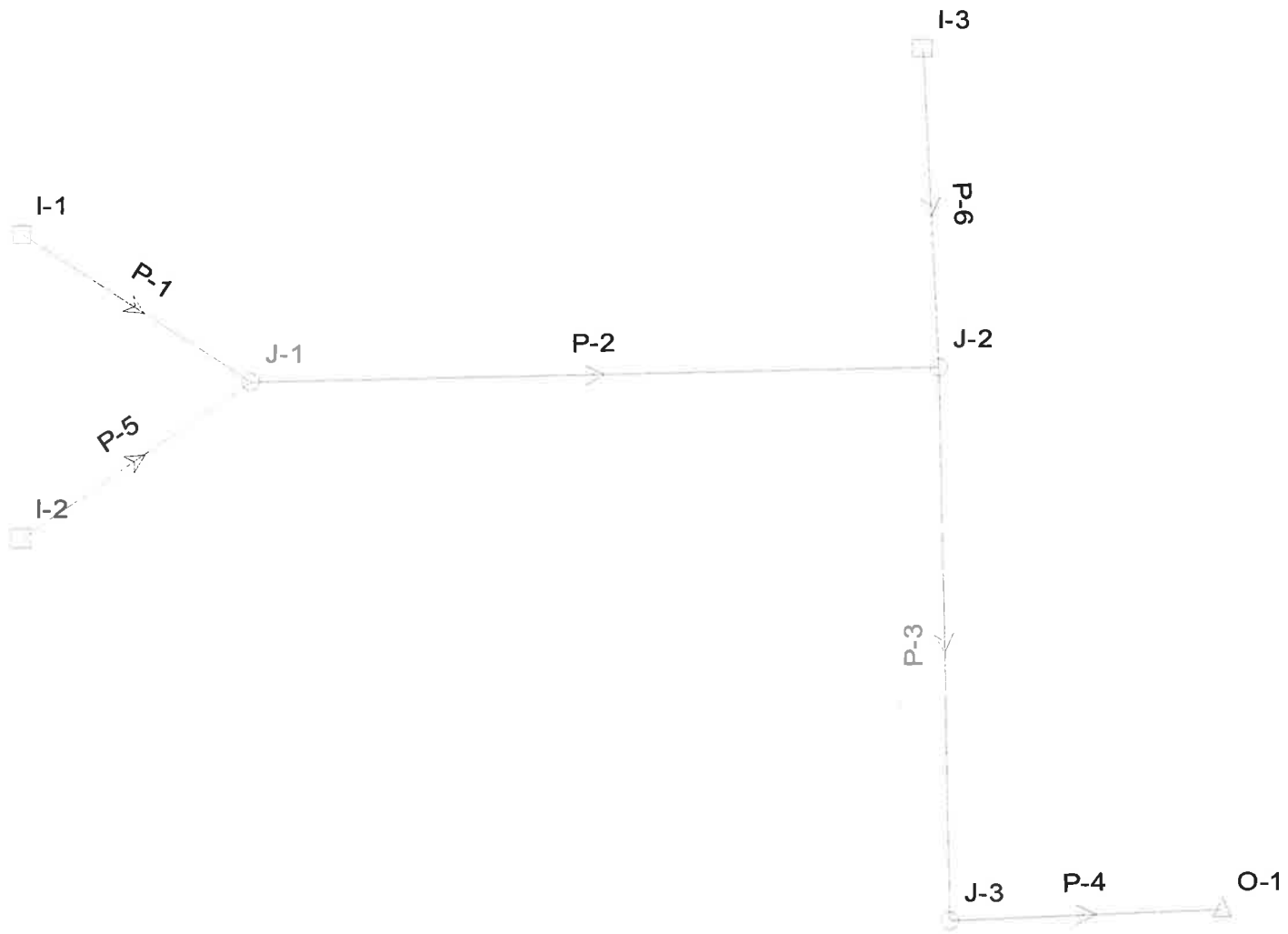
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8					**Direct Entry,**



*The runoff volume analysis utilizes a different method than the hydrology analysis thus resulting in different values for peak flow. This analysis is for the calculation of runoff volume only.

STORMDRAIN HYDRAULICS (PUBLIC 48” RCP)

Scenario: Base



Detailed Report for Pipe: P-1

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-1		Number of Sections	1	
Downstream Node	J-1		Section Shape	Circular	
Bend Angle	34.15	degrees	Section Size	48 inch	
Length	44.00	ft	Material	Concrete	
Constructed Slope	0.143182	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	104.00	cfs	Full Capacity	543.51	cfs
Profile Description	S2		Energy Slope	0.029453	ft/ft
Gravity Element Headloss	7.82	ft	Velocity In	9.99	ft/s
Average Velocity	33.35	ft/s	Velocity Out	22.80	ft/s
Constructed Slope	0.143182	ft/ft	Design Capacity	543.51	cfs
Excess Full Capacity	439.51	cfs	Excess Design Capacity	439.51	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	620.00	626.00	624.00	2.00	3.09	623.09	624.64
Downstrear	613.70	626.00	617.70	8.30	1.57	615.27	623.34

Pipe Design Options					
Design Pipe?	true		Design Upstream Invert?	true	
Design Downstream Invert?	true		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	3.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Message List

Time (hr)	Message

Detailed Report for Pipe: P-2

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	J-1		Number of Sections	1	
Downstream Node	J-2		Section Shape	Circular	
Bend Angle	90.11	degrees	Section Size	48 inch	
Length	207.00	ft	Material	Concrete	
Constructed Slope	0.029517	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	107.00	cfs	Full Capacity	246.77	cfs
Profile Description	Composite S1 S2		Energy Slope	0.029277	ft/ft
Gravity Element Headloss	5.82	ft	Velocity In	10.14	ft/s
Average Velocity	18.94	ft/s	Velocity Out	9.36	ft/s
Constructed Slope	0.029517	ft/ft	Design Capacity	246.77	cfs
Excess Full Capacity	139.77	cfs	Excess Design Capacity	139.77	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	613.60	626.00	617.60	8.40	3.13	616.73	618.33
Downstrear	607.49	613.00	611.49	1.51	3.42	610.91	612.27

Pipe Design Options					
Design Pipe?	true		Design Upstream Invert?	true	
Design Downstream Invert?	true		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	3.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Message List

Time (hr)	Message

Detailed Report for Pipe: P-3

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	J-2		Number of Sections	1	
Downstream Node	J-3		Section Shape	Circular	
Bend Angle	91.13	degrees	Section Size	48 inch	
Length	239.90	ft	Material	Concrete	
Constructed Slope	0.009962	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	140.70	cfs	Full Capacity	143.37	cfs
Profile Description	S2		Energy Slope	0.009637	ft/ft
Gravity Element Headloss	2.69	ft	Velocity In	12.02	ft/s
Average Velocity	13.00	ft/s	Velocity Out	13.00	ft/s
Constructed Slope	0.009962	ft/ft	Design Capacity	143.37	cfs
Excess Full Capacity	2.67	cfs	Excess Design Capacity	2.67	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	607.39	613.00	611.39	1.61	3.52	610.91	613.15
Downstrear	605.00	610.00	609.00	1.00	3.21	608.21	610.84

Pipe Design Options					
Design Pipe?	true		Design Upstream Invert?	true	
Design Downstream Invert?	true		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	3.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Message List

Time (hr)	Message

Detailed Report for Pipe: P-4

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	J-3		Number of Sections	1	
Downstream Node	O-1		Section Shape	Circular	
Bend Angle	0.00	degrees	Section Size	48 inch	
Length	109.60	ft	Material	Concrete	
Constructed Slope	0.026460	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	140.70	cfs	Full Capacity	233.64	cfs
Profile Description	S2		Energy Slope	0.014872	ft/ft
Gravity Element Headloss	3.93	ft	Velocity In	12.02	ft/s
Average Velocity	19.45	ft/s	Velocity Out	17.09	ft/s
Constructed Slope	0.026460	ft/ft	Design Capacity	233.64	cfs
Excess Full Capacity	92.94	cfs	Excess Design Capacity	92.94	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	604.90	610.00	608.90	1.10	3.52	608.42	610.66
Downstrear	602.00	606.00	606.00	0.00	2.49	604.49	609.03

Pipe Design Options					
Design Pipe?	true		Design Upstream Invert?	true	
Design Downstream Invert?	true		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	3.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Message List

Time (hr)	Message

Detailed Report for Pipe: P-5

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-2		Number of Sections	1	
Downstream Node	J-1		Section Shape	Circular	
Bend Angle	32.87	degrees	Section Size	18 inch	
Length	36.70	ft	Material	Concrete	
Constructed Slope	0.035422	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	3.00	cfs	Full Capacity	19.77	cfs
Profile Description	Pressure		Energy Slope	0.000816	ft/ft
Gravity Element Headloss	0.03	ft	Velocity In	1.70	ft/s
Average Velocity	1.70	ft/s	Velocity Out	1.70	ft/s
Constructed Slope	0.035422	ft/ft	Design Capacity	19.77	cfs
Excess Full Capacity	16.77	cfs	Excess Design Capacity	16.77	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	615.00	620.00	616.50	3.50	1.76	616.76	616.81
Downstrear	613.70	626.00	615.20	10.80	3.03	616.73	616.78

Pipe Design Options					
Design Pipe?	true		Design Upstream Invert?	true	
Design Downstream Invert?	true		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	3.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

User Data
Date Installed

Message List

Time (hr)	Message

Detailed Report for Pipe: P-6

Scenario Summary	
Scenario	Base
Physical Properties Alternative	Base-Physical Properties
Catchments Alternative	Base-Catchments
System Flows Alternative	Base-System Flows
Structure Headlosses Alternative	Base-Structure Headlosses
Boundary Conditions Alternative	Base-Boundary Conditions
Design Constraints Alternative	Base-Design Constraints
Capital Cost Alternative	Base-Capital Cost
User Data Alternative	Base-User Data

Pipe Characteristics					
Upstream Node	I-3		Number of Sections	1	
Downstream Node	J-2		Section Shape	Circular	
Bend Angle	1.84	degrees	Section Size	30 inch	
Length	163.00	ft	Material	Concrete	
Constructed Slope	0.039939	ft/ft	Mannings n	0.013	

Hydraulic Summary					
Total System Flow	33.70	cfs	Full Capacity	81.97	cfs
Profile Description	Composite Pressure S1 S2		Energy Slope	0.032856	ft/ft
Gravity Element Headloss	5.07	ft	Velocity In	8.10	ft/s
Average Velocity	15.88	ft/s	Velocity Out	6.87	ft/s
Constructed Slope	0.039939	ft/ft	Design Capacity	81.97	cfs
Excess Full Capacity	48.27	cfs	Excess Design Capacity	48.27	cfs

Elevations/Depths

	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	Hydraulic Grade (ft)	EGL (ft)
Upstream	614.00	620.00	616.50	3.50	1.97	615.97	617.00
Downstrear	607.49	613.00	609.99	3.01	3.42	610.91	611.64

Pipe Design Options					
Design Pipe?	true		Design Upstream Invert?	true	
Design Downstream Invert?	true		Specify Local Pipe Constraints?	false	
Part Full Design?	false		Design Percent Full	N/A	%
Allow Multiple Sections?	false		Maximum Number Sections	N/A	
Limit Section Size?	false		Maximum Section Rise	N/A	in

Pipe Design Constraints					
Minimum Velocity	2.00	ft/s	Maximum Velocity	15.00	ft/s
Minimum Cover	3.00	ft	Maximum Cover	15.00	ft
Minimum Slope	0.005000	ft/ft	Maximum Slope	0.100000	ft/ft

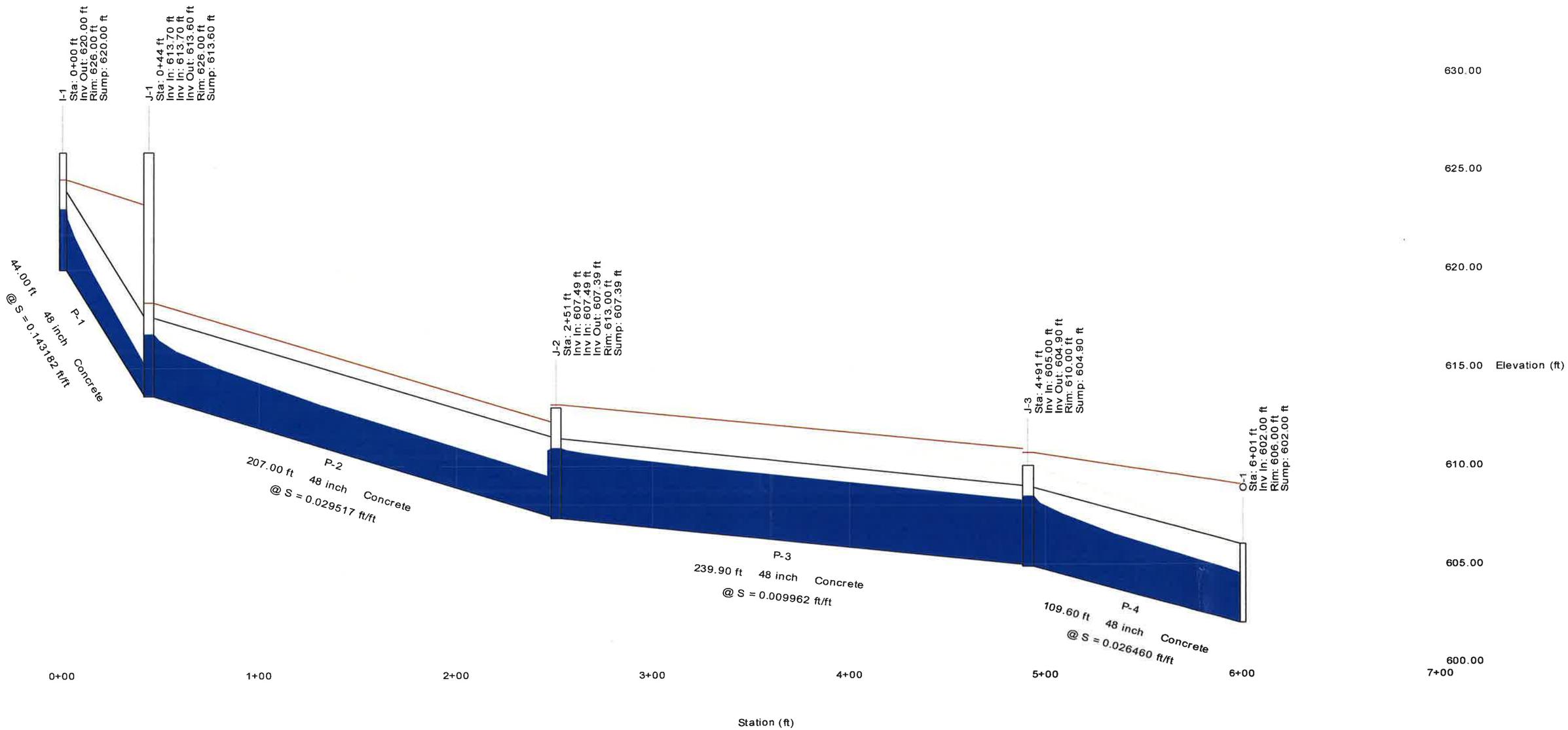
User Data
Date Installed

Message List

Time (hr)	Message

Profile: Profile - 1

Scenario: Base



SUMMARY

Based on the hydrology calculations presented in this report, the proposed development will increase the runoff from the site by 8.4 cfs, from 136.5 cfs to 144.9 cfs. The proposed development increases the density of the dwelling units and also the impervious area on the project site. The proposed storm drain system will also reduce the time of concentration, therefore, the runoff is expected to increase. The proposed HMP mitigation concrete vault system has approximately 11,800cf of dead storage volume capacity below the orifice opening. This capacity is adequate to retain the increase of 0.24 AcFt, or 10500 cf of excess runoff volume from the proposed development. The HMP outlet structure will regulate the release of runoff to be less than the pre-development rate such that no adverse effects to downstream facilities will occur as a result of the proposed development.

APPENDIX AND HYDROLOGY MAPS

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

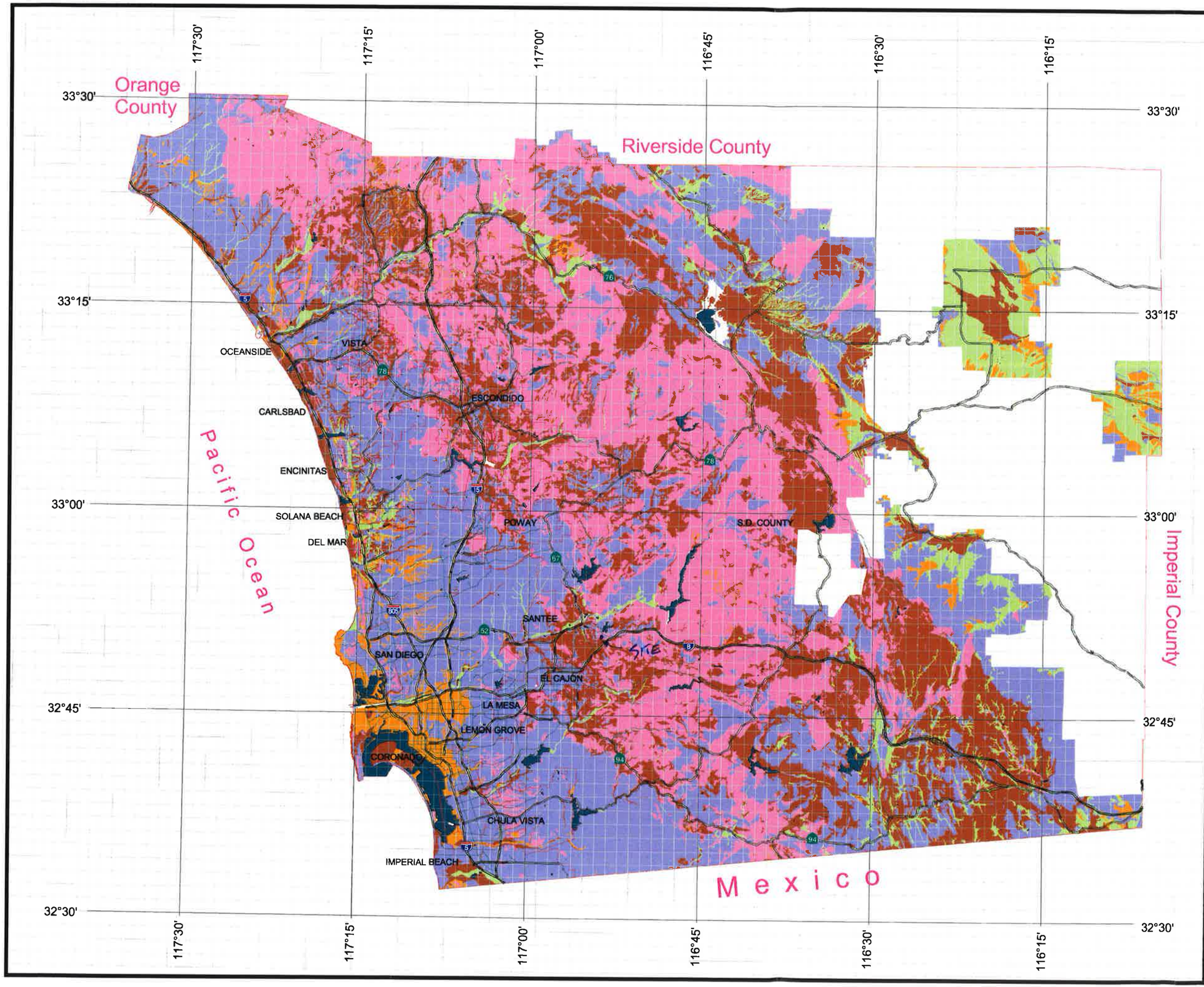
MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

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	← OFFSITE
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3	← ONSITE POST-DEV
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

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

SEE ENLARGED MAP FOR SOIL GROUP DETAILS

DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

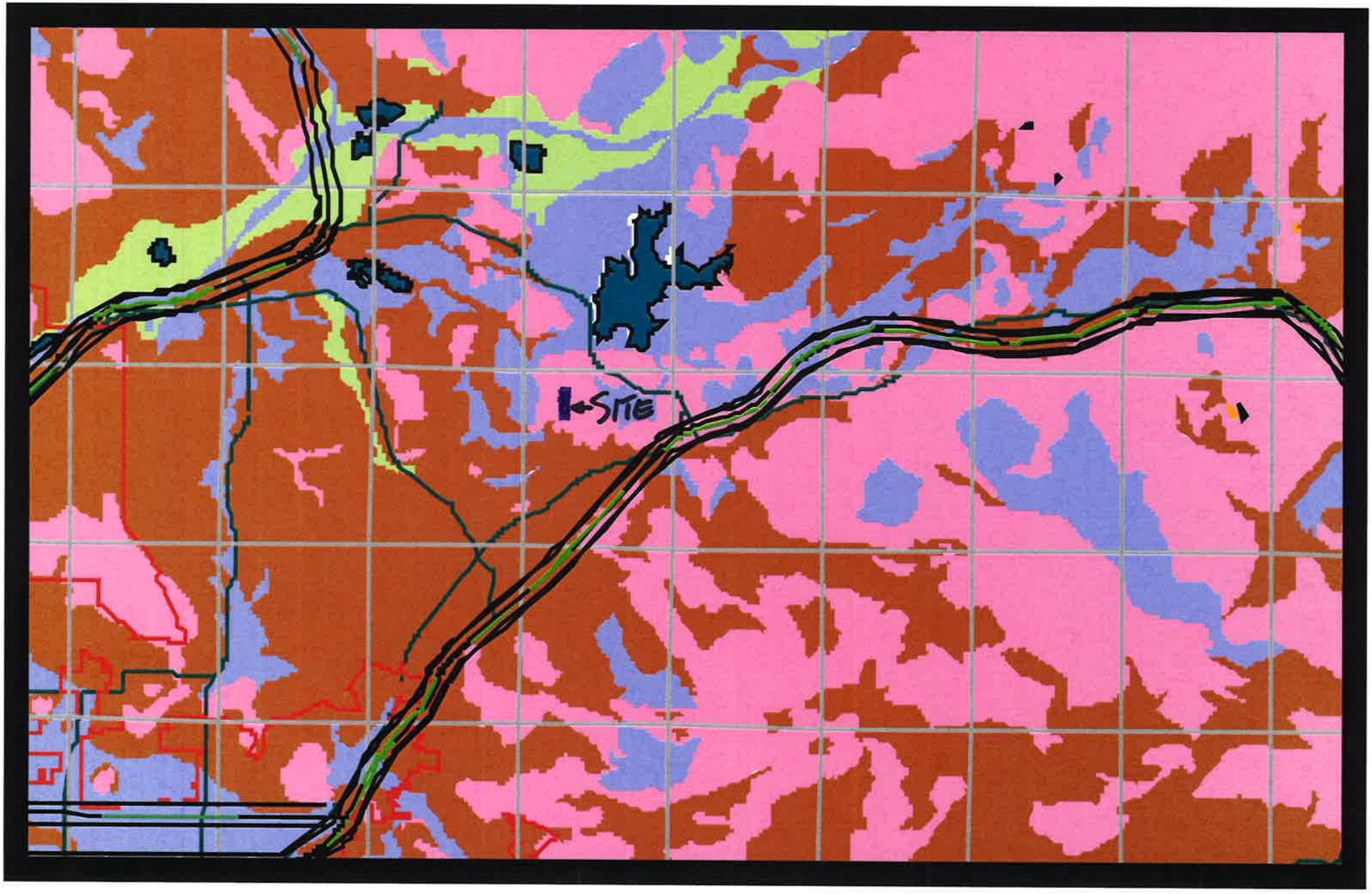
N W E S

THIS MAP IS PROVIDED WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Copyright SanGIS. All Rights Reserved.

This products may contain information from the SANDAG Regional Information System which cannot be reproduced without the written permission of SANDAG.

This product may contain information which has been reproduced with permission granted by Thomas Brothers Maps.

3 0 3 Miles



SOIL GROUP DETAIL

OFF-SITE LANDUSE/DENSITY MAP FOR ADLAI ROAD

LEGEND
DRAINAGE BASIN — —

SCALE: 1" = NTS

LANDMARK
CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-8070

OFF-SITE HYDROLOGY MAP FOR ADLAI ROAD

LEGEND

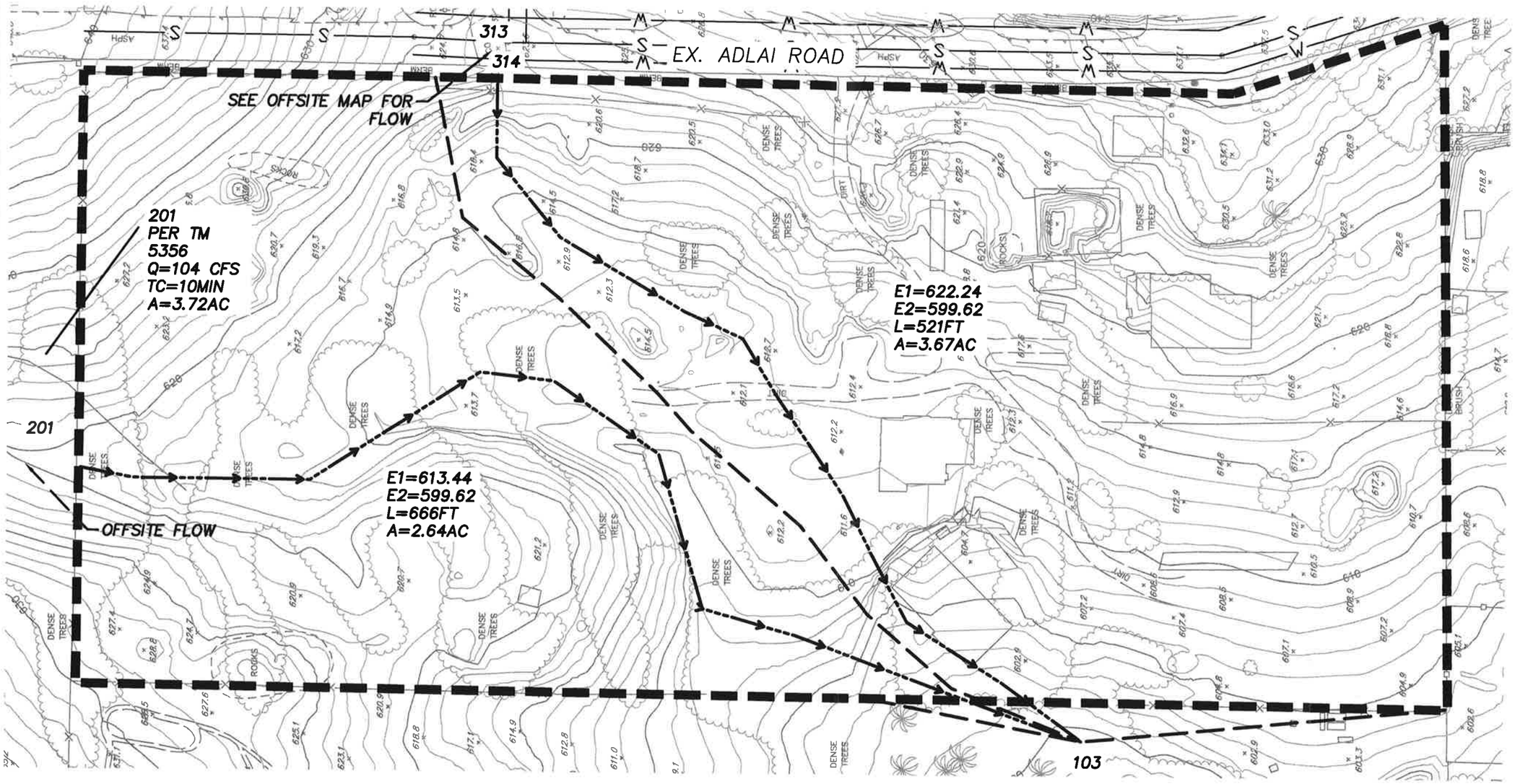
DRAINAGE BASIN

FLOW DIRECTION

SCALE: 1" = NTS

LANDMARK CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-8070

PRE-DEVELOPMENT HYDROLOGY MAP FOR RIKER RANCH ON-SITE



LEGEND

PROJECT BOUNDARY

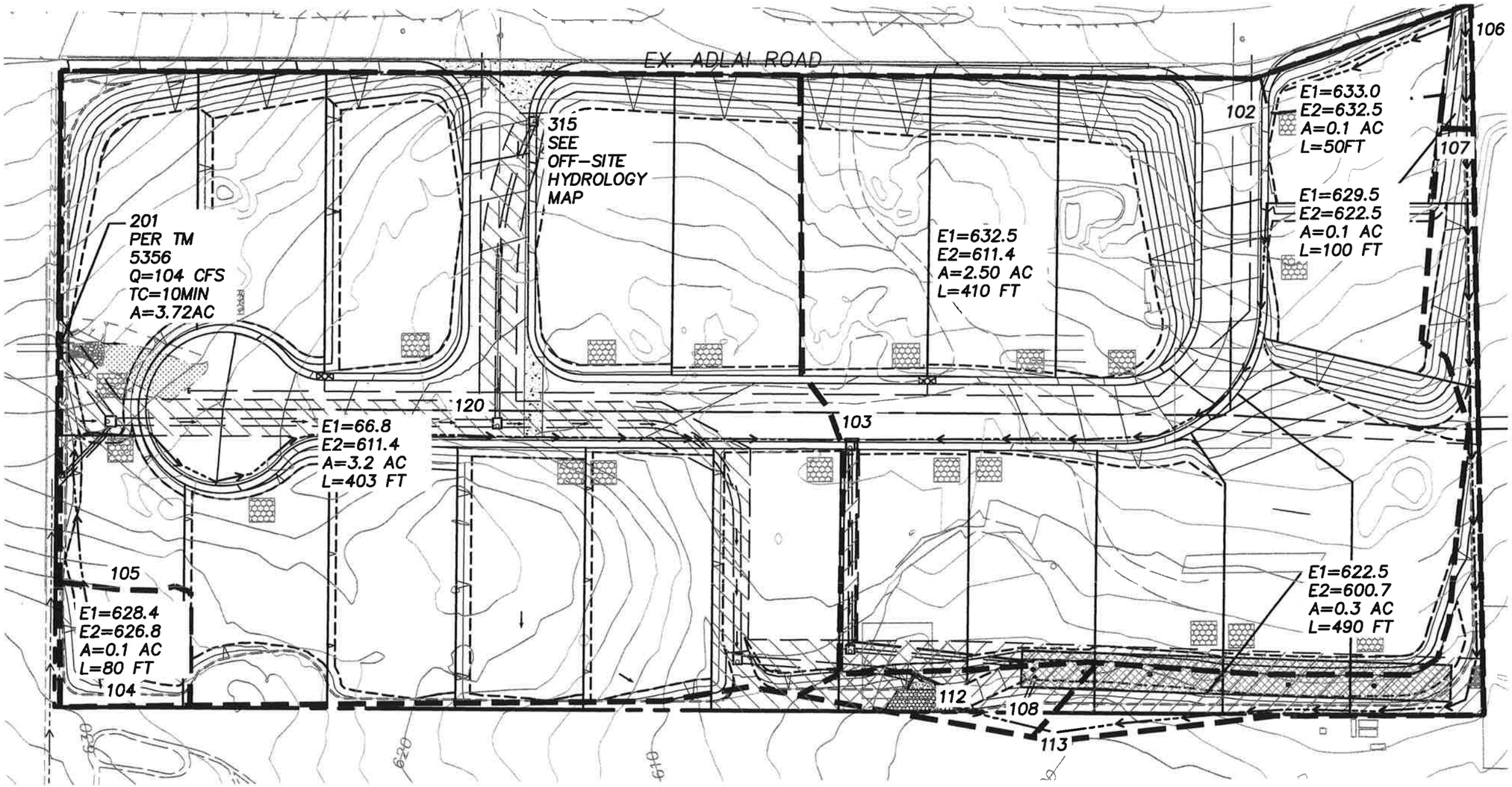
DRAINAGE BASIN

FLOW DIRECTION

SCALE: 1" = 60'

LANDMARK
CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-8070

POST-DEVELOPMENT HYDROLOGY MAP FOR RIKER RANCH ON-SITE



LEGEND

DRAINAGE BASIN

FLOW DIRECTION

PROPOSED STORM DRAIN

SCALE: 1"= 60'

LANDMARK
CONSULTING
Planning Engineering Surveying
9555 Genesee Avenue, Suite 200
San Diego, CA 92121, (858) 587-8070