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Proposed Manufacturing /Warehousing Facility
Preliminary Drainage Study
APN 0298-063-07
County of San Bernardino
August 16, 2017

Prepared for:

800 Opal, LLC
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Description

The project site is approximately 35 acres in size and is located along the west side of Opal Avenue between Nice Avenue, to the north, and Colton Avenue, to the south, in the Mentone area of San Bernardino County. The west portion of the site is currently developed with two existing buildings and paved access. The east portion of the site is currently undeveloped with an existing canopy and minor paved access. The site currently drains from east to west at an approximate grade of 2%. The majority of the site's offsite flows enter Opal Avenue that borders the project to the west. From Opal, flows are directed north or south to two existing catch basins that direct flows west to an existing storm drain channel. Ultimately, all flows enter the Santa Ana River to the northwest.

The existing frontages along Nice Avenue, Opal Avenue and Colton Avenue are fully improved with curb and gutter and sidewalk. Therefore, there will be no anticipated flows from the north, west or south to the project area. Neighboring properties in the existing housing tract to the east direct flows east to Beryl Avenue, thus, there are no anticipated flows expected from the east to the subject site.

Proposed development of the site includes grading the easterly undeveloped portion of the site to have a uniform grade from east to west. Proposed permeable, dust-proof, gravel surfacing will be placed in this area for use as outdoor storage. This gravel area is self-treating for water quality treatment as described in the Water Quality Management Plan. The two existing buildings onsite will remain. Minor pavement removals within the existing parking lot along the west portion of the site will occur to provide for ADA access and construction of required landscaped areas. In addition, the existing canopy in the proposed outdoor storage area will be removed. A block wall for screening and landscape buffer is proposed on the north and south perimeter of the project site. Flows from the site will continue as they do historically from east to west. There will be no increase in volume or intensity of flows leaving the site from pre-development to post-development conditions.

Purpose

The purpose of this study is to analyze the flows to and through the site both pre-development and post-development and demonstrate that the post-development flows leaving the site will be less than pre-development flows.

Analysis

To achieve the desired goal the following steps will be taken:

1. Determine the 10, 25 and 100 year pre-development flows.
2. Determine the 10, 25 and 100 year post-development flows.
3. Determine if any onsite mitigation will have to occur in order to have post-development flows that leave the site be less than pre-development flows in both intensity and volume.

Results

1. The 10, 25 & 100 year pre-development flows were determined utilizing the Rational Method per San Bernardino County Hydrology Manual. AES 2015 Software was utilized for the calculations and they can be found in the appendix of this report. The variables used were:

    Rainfall Values (per NOAA Atlas 14, Volume 6, Version 2 Map, Figure 4.1):
    $Y_{10} = 0.816$
    $Y_{100} = 1.41$

    Soil Group (per reference Soil Group Map in appendix, Figure 4.2): A

    Pervious Cover Designations:
    Mobile Homes
    Condominiums
    0.4 Dwellings/Acre
    Commercial
    Public Park

Node 3:

10-year peak flows: Q_{10} = 14.55 CFS
10-year time of concentration: Tc_{10}= 12.56 min
10-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(14.55cfs)(12.56\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 16,448 cubic feet**

25-year peak flows: Q_{25} = 19.54 CFS
25-year time of concentration: Tc_{25}= 12.56 min
25-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(19.54cfs)(12.56\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 22,089 cubic feet**

100-year peak flows: Q_{100} = 29.88 CFS
100-year time of concentration: Tc_{100}= 12.56 min
100-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(29.88cfs)(12.56\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 33,777 cubic feet**

Node 6:

10-year peak flows: Q_{10} = 17.17 CFS
10-year time of concentration: Tc_{10}= 12.42 min
10-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(17.17cfs)(12.42\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 19,193 cubic feet**

25-year peak flows: Q_{25} = 23.08 CFS
25-year time of concentration: Tc_{25}= 12.42 min
25-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(23.08cfs)(12.42\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 25,799 cubic feet**

100-year peak flows: Q_{100} = 35.36 CFS
100-year time of concentration: Tc_{100}= 12.42 min
100-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(35.36cfs)(12.42\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 39,515 cubic feet**

Node 9:

10-year peak flows: Q_{10} = 14.58 CFS
10-year time of concentration: Tc_{10}= 12.04 min
10-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(14.58cfs)(12.04\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 15,799 cubic feet**

25-year peak flows: Q_{25} = 19.33 CFS
25-year time of concentration: Tc_{25}= 12.04 min
25-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(19.33cfs)(12.04\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 20,946 cubic feet**

100-year peak flows: Q_{100} = 28.99 CFS
100-year time of concentration: Tc_{100}= 12.04 min
100-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(28.99cfs)(12.04\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 31,414 cubic feet**

Node 11:

10-year peak flows: Q_{10} = 8.36 CFS
10-year time of concentration: Tc_{10}= 5.38 min
10-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(8.36cfs)(5.38\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 4,048 cubic feet**

25-year peak flows: Q_{25} = 10.53 CFS
25-year time of concentration: Tc_{25}= 5.38 min
25-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(10.53cfs)(5.38\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 5,099 cubic feet**

100-year peak flows: Q_{100} = 14.54 CFS
100-year time of concentration: Tc_{100}= 5.38 min
100-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(14.54cfs)(5.38\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 7,041 cubic feet**

Pre-development Total:

10-year peak flows: Q_{10} = 54.66 CFS
10-year volume produced = 55,488 cubic feet

25-year peak flows: Q_{25} = 72.48 CFS
25-year volume produced = 73,933 cubic feet

100-year peak flows: Q_{100} = 108.77 CFS
100-year volume produced = 111,747 cubic feet

2. The 10, 25 & 100 year post-development flows were determined utilizing the Rational Method per San Bernardino County Hydrology Manual at each individual basin. AES 2015 Software was utilized for the calculations and they can be found in the appendix of this report. The variables used were:

   Rainfall Values (per NOAA Atlas 14, Volume 6, Version 2 Map, Figure 4.1):
   Y_{10} = 0.816
   Y_{100} = 1.41

   Soil Group (per reference Soil Group Map in appendix, Figure 4.2): B

   Pervious Cover Designations:
   1 Dwelling/Acre
   3-4 Dwellings/Acre
   Commercial

Node 3:

10-year peak flows: Q_{10} = 13.80 CFS
10-year time of concentration: Tc_{10}= 12.15 min
10-year volume produced = $(Q)(Tc)(60\min)\left(\frac{3}{2}\right)$

= $(13.80cfs)(12.15\min)(60\min)\left(\frac{3}{2}\right)$ **= 15,091 cubic feet**

25-year peak flows: Q_{25} = 18.89 CFS
25-year time of concentration: Tc_{25}= 12.15 min
25-year volume produced = $(Q)(Tc)(60\min)\left(\frac{3}{2}\right)$

= $(18.89cfs)(12.15\min)(60\min)\left(\frac{3}{2}\right)$ **= 20,657 cubic feet**

100-year peak flows: Q_{100} = 29.69 CFS
100-year time of concentration: Tc_{100}= 12.15 min
100-year volume produced = $(Q)(Tc)(60\min)\left(\frac{3}{2}\right)$

= $(29.69cfs)(12.15\min)(60\min)\left(\frac{3}{2}\right)$ **= 32,467 cubic feet**

Node 6:

10-year peak flows: Q_{10} = 22.42 CFS
10-year time of concentration: Tc_{10}= 12.69 min
10-year volume produced = $(Q)(Tc)(60\min)\left(\frac{3}{2}\right)$

= $(22.42cfs)(12.69\min)(60\min)\left(\frac{3}{2}\right)$ **= 25,606 cubic feet**

25-year peak flows: Q_{25} = 29.56 CFS
25-year time of concentration: Tc_{25}= 12.69 min
25-year volume produced = $(Q)(Tc)(60\min)\left(\frac{3}{2}\right)$

= $(29.56cfs)(12.69\min)(60\min)\left(\frac{3}{2}\right)$ **= 33,761 cubic feet**

100-year peak flows: Q_{100} = 43.95 CFS
100-year time of concentration: Tc_{100}= 12.69 min
100-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(43.95cfs)(12.69\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 50,196 cubic feet**

Node 9:

10-year peak flows: Q_{10} = 15.99 CFS
10-year time of concentration: Tc_{10}= 11.07 min
10-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(15.99cfs)(11.07\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 15,931 cubic feet**

25-year peak flows: Q_{25} = 20.98 CFS
25-year time of concentration: Tc_{25}= 11.07 min
25-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(20.98cfs)(11.07\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 20,903 cubic feet**

100-year peak flows: Q_{100} = 30.99 CFS
100-year time of concentration: Tc_{100}= 11.07 min
100-year volume produced = $(Q)(Tc)(60\,\text{min})\left(\frac{3}{2}\right)$

= $(30.99cfs)(11.07\,\text{min})(60\,\text{min})\left(\frac{3}{2}\right)$ **= 30,876 cubic feet**

Post-development Total:

10-year peak flows: Q_{10} = 52.21 CFS
10-year volume produced = 56,628 cubic feet

25-year peak flows: Q_{25} = 69.43 CFS
25-year volume produced = 75,321 cubic feet

100-year peak flows: Q_{100} = 104.63 CFS
100-year volume produced = 113,509 cubic feet

3. All post-development flows will be less then pre-developmetn flows leaving the site in both intensity and volume. There will be no need to provide any mitigation for increase onsite.

	Pre-development	Post-development	% Decreased
10-year flows	54.66 cfs	52.21 cfs	4.5
10-year volume	55,488 cubic feet	54,533 cubic feet	1.7
25-year flows	72.48 cfs	69.43 cfs	4.2
25-year volume	73.933 cubic feet	73,226 cubic feet	0.9
100-year flows	108.77 cfs	104.63 cfs	3.8
100-year volume	111,747 cubic feet	111,414 cubic feet	0.3

Conclusion

There will be no increase in post-development flows leaving the site from pre-development conditions. All onsite flows will continue as they have historically from the east portion of the site to Opal Avenue to the west.

Prepared By: Reviewed By:

_____ _____

Patrick C. Flanagan, Jr., P.E. M.W. “Bud” Thatcher III, P.E.
RCE 86046 Exp 9/30/18 RCE 39964 Exp 12/31/17

APPENDIX

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**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
      (c) Copyright 1983-2015 Advanced Engineering Software (aes)
          Ver. 22.0  Release Date: 07/01/2015  License ID 1533

                        Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* 154801 - APN 0298-063-07                                              *
* PRE-DEVELOPMENT DRAINAGE STUDY                                        *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: 154801PR.DAT
  TIME/DATE OF STUDY: 11:53 04/04/2017
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.816
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.410
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   10.00   1-HOUR INTENSITY(INCH/HOUR) = 0.8242
  SLOPE OF INTENSITY DURATION CURVE = 0.6000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   621.00
 ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     64.42

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.564
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.106
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN  (MIN.)
 PUBLIC PARK                A        5.19      0.98       0.850    32   12.56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
 SUBAREA RUNOFF(CFS) =      5.97
 TOTAL AREA(ACRES) =      5.19   PEAK FLOW RATE(CFS) =      5.97

****************************************************************************
 FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   636.00
 ELEVATION DATA: UPSTREAM(FEET) =     64.42  DOWNSTREAM(FEET) =     48.69

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.313
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.520
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)   (DECIMAL)  CN  (MIN.)
 MOBILE HOME PARK           A        2.63      0.98       0.250    32    9.31
 CONDOMINIUMS               A        2.63      0.98       0.350    32    9.98
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.300
 SUBAREA AREA(ACRES) =    5.26   INITIAL SUBAREA RUNOFF(CFS) =   10.55

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.56
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.106
 SUBAREA AREA(ACRES) =    5.26      SUBAREA RUNOFF(CFS) =    8.58
 EFFECTIVE AREA(ACRES) =     10.45   AREA-AVERAGED Fm(INCH/HR) =  0.56
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.57
 TOTAL AREA(ACRES) =       10.5       PEAK FLOW RATE(CFS) =      14.55

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   695.00
  ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     53.42

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.421
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.120
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"          A        7.44      0.98      0.900    32   12.42
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =      8.32
  TOTAL AREA(ACRES) =      7.44   PEAK FLOW RATE(CFS) =      8.32

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  82
----------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   925.00
  ELEVATION DATA: UPSTREAM(FEET) =     53.42  DOWNSTREAM(FEET) =     45.62

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.138
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.150
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  A        4.86      0.98      0.100    32   12.14
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     4.86   INITIAL SUBAREA RUNOFF(CFS) =     8.98

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   12.42
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.120
  SUBAREA AREA(ACRES) =     4.86      SUBAREA RUNOFF(CFS) =     8.85
  EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.57
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.58
  TOTAL AREA(ACRES) =       12.3       PEAK FLOW RATE(CFS) =      17.17

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   679.00
  ELEVATION DATA: UPSTREAM(FEET) =     86.62  DOWNSTREAM(FEET) =     52.76
```

```
 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.042
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.160
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 ".4 DWELLING/ACRE"          A        4.85      0.98      0.900    32   12.04
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA RUNOFF(CFS) =      5.60
 TOTAL AREA(ACRES) =      4.85   PEAK FLOW RATE(CFS) =      5.60

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   629.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.76  DOWNSTREAM(FEET) =     47.51

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.424
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.356
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 A        4.84      0.98      0.100    32   10.42
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     4.84   INITIAL SUBAREA RUNOFF(CFS) =     9.84

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.04
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.160
 SUBAREA AREA(ACRES) =     4.84      SUBAREA RUNOFF(CFS) =     8.98
 EFFECTIVE AREA(ACRES) =      9.69   AREA-AVERAGED Fm(INCH/HR) =  0.49
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.50
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      14.58

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   217.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.40  DOWNSTREAM(FEET) =     46.53

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.383
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.502
```

Figure 1.1

```
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        2.73      0.98      0.100    32    5.38
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      8.36
 TOTAL AREA(ACRES) =      2.73   PEAK FLOW RATE(CFS) =      8.36
================================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =        2.7  TC(MIN.) =      5.38
 EFFECTIVE AREA(ACRES) =      2.73  AREA-AVERAGED Fm(INCH/HR)=  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS)    =       8.36
================================================================================
================================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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          Ver. 22.0  Release Date: 07/01/2015  License ID 1533

                        Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* 154801 - APN 0298-063-07                                              *
* PRE-DEVELOPMENT DRAINAGE STUDY                                        *
* 25-YEAR STORM EVENT                                                   *
 *************************************************************************

  FILE NAME: 154801PR.DAT
  TIME/DATE OF STUDY: 11:52 04/04/2017
=========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.816
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.410
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   25.00   1-HOUR INTENSITY(INCH/HOUR) = 1.0318
  SLOPE OF INTENSITY DURATION CURVE = 0.6000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
  FLOW PROCESS FROM NODE       1.00 TO NODE       2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   621.00
  ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     64.42

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.564
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.636
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                 A        5.19      0.98      0.850    32   12.56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =      8.44
  TOTAL AREA(ACRES) =      5.19   PEAK FLOW RATE(CFS) =      8.44

****************************************************************************
  FLOW PROCESS FROM NODE       2.00 TO NODE       3.00 IS CODE =  82
----------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   636.00
  ELEVATION DATA: UPSTREAM(FEET) =     64.42  DOWNSTREAM(FEET) =     48.69

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.313
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.155
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  MOBILE HOME PARK            A        2.63      0.98      0.250    32    9.31
  CONDOMINIUMS                A        2.63      0.98      0.350    32    9.98
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.300
  SUBAREA AREA(ACRES) =    5.26   INITIAL SUBAREA RUNOFF(CFS) =   13.55

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   12.56
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.636
  SUBAREA AREA(ACRES) =    5.26      SUBAREA RUNOFF(CFS) =   11.10
  EFFECTIVE AREA(ACRES) =     10.45   AREA-AVERAGED Fm(INCH/HR) =  0.56
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.57
  TOTAL AREA(ACRES) =       10.5       PEAK FLOW RATE(CFS) =      19.54

****************************************************************************
  FLOW PROCESS FROM NODE       4.00 TO NODE       5.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   695.00
  ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     53.42

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.421
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.655
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"          A        7.44      0.98      0.900    32   12.42
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =     11.90
  TOTAL AREA(ACRES) =      7.44   PEAK FLOW RATE(CFS) =     11.90

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  82
----------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   925.00
  ELEVATION DATA: UPSTREAM(FEET) =     53.42  DOWNSTREAM(FEET) =     45.62

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.138
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.692
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  A        4.86      0.98      0.100    32   12.14
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     4.86   INITIAL SUBAREA RUNOFF(CFS) =   11.35

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   12.42
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.655
  SUBAREA AREA(ACRES) =     4.86      SUBAREA RUNOFF(CFS) =   11.18
  EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.57
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.58
  TOTAL AREA(ACRES) =       12.3       PEAK FLOW RATE(CFS) =      23.08

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   679.00
  ELEVATION DATA: UPSTREAM(FEET) =     86.62  DOWNSTREAM(FEET) =     52.76
```

```
 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.042
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.704
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 ".4 DWELLING/ACRE"          A        4.85      0.98      0.900    32   12.04
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA RUNOFF(CFS) =      7.97
 TOTAL AREA(ACRES) =      4.85   PEAK FLOW RATE(CFS) =      7.97

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   629.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.76  DOWNSTREAM(FEET) =     47.51

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.424
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.949
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        4.84      0.98      0.100    32   10.42
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     4.84   INITIAL SUBAREA RUNOFF(CFS) =   12.42

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.04
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.704
 SUBAREA AREA(ACRES) =     4.84      SUBAREA RUNOFF(CFS) =   11.36
 EFFECTIVE AREA(ACRES) =      9.69   AREA-AVERAGED Fm(INCH/HR) =  0.49
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.50
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      19.33

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   217.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.40  DOWNSTREAM(FEET) =     46.53

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.383
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  4.384
```

```
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        2.73      0.98      0.100    32    5.38
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =     10.53
 TOTAL AREA(ACRES) =      2.73   PEAK FLOW RATE(CFS) =     10.53
================================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =        2.7  TC(MIN.) =      5.38
 EFFECTIVE AREA(ACRES) =      2.73  AREA-AVERAGED Fm(INCH/HR)=  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS)    =      10.53
================================================================================
================================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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          Ver. 22.0  Release Date: 07/01/2015  License ID 1533

                        Analysis prepared by:

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                      1461 FORD STREET, SUITE 105
                          REDLANDS, CA 92373
              PHONE: (909) 748-7777   FAX: (909) 748-7776

 ************************* DESCRIPTION OF STUDY *************************
* 154801 - APN 0298-063-07                                              *
* PRE-DEVELOPMENT DRAINAGE STUDY                                        *
* 100-YEAR STORM EVENT                                                  *
 ************************************************************************

  FILE NAME: 154801PR.DAT
  TIME/DATE OF STUDY: 11:52 04/04/2017
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.816
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.410
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) = 1.4100
  SLOPE OF INTENSITY DURATION CURVE = 0.6000

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *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.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   621.00
 ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     64.42

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.564
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.603
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 PUBLIC PARK                 A        5.19      0.74      0.850    52   12.56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
 SUBAREA RUNOFF(CFS) =     13.88
 TOTAL AREA(ACRES) =      5.19   PEAK FLOW RATE(CFS) =     13.88

****************************************************************************
 FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   636.00
 ELEVATION DATA: UPSTREAM(FEET) =     64.42  DOWNSTREAM(FEET) =     48.69

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.313
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.312
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 MOBILE HOME PARK            A        2.63      0.74      0.250    52    9.31
 CONDOMINIUMS                A        2.63      0.74      0.350    52    9.98
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.300
 SUBAREA AREA(ACRES) =    5.26   INITIAL SUBAREA RUNOFF(CFS) =   19.36

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.56
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.603
 SUBAREA AREA(ACRES) =    5.26      SUBAREA RUNOFF(CFS) =   16.00
 EFFECTIVE AREA(ACRES) =     10.45   AREA-AVERAGED Fm(INCH/HR) =  0.43
 AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.57
 TOTAL AREA(ACRES) =       10.5       PEAK FLOW RATE(CFS) =      29.88

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   695.00
  ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     53.42

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.421
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.628
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"          A        7.44      0.74      0.900    52   12.42
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =     19.82
  TOTAL AREA(ACRES) =      7.44   PEAK FLOW RATE(CFS) =     19.82

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  82
----------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   925.00
  ELEVATION DATA: UPSTREAM(FEET) =     53.42  DOWNSTREAM(FEET) =     45.62

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.138
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.678
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  A        4.86      0.74      0.100    52   12.14
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     4.86   INITIAL SUBAREA RUNOFF(CFS) =   15.76

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   12.42
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.628
  SUBAREA AREA(ACRES) =     4.86      SUBAREA RUNOFF(CFS) =   15.54
  EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.58
  TOTAL AREA(ACRES) =       12.3       PEAK FLOW RATE(CFS) =      35.36

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   679.00
  ELEVATION DATA: UPSTREAM(FEET) =     86.62  DOWNSTREAM(FEET) =     52.76
```

```
 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.042
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.696
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 ".4 DWELLING/ACRE"          A        4.85      0.74      0.900    52   12.04
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA RUNOFF(CFS) =     13.22
 TOTAL AREA(ACRES) =      4.85   PEAK FLOW RATE(CFS) =     13.22

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   629.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.76  DOWNSTREAM(FEET) =     47.51

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.424
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.030
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        4.84      0.74      0.100    52   10.42
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     4.84   INITIAL SUBAREA RUNOFF(CFS) =   17.23

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.04
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.696
 SUBAREA AREA(ACRES) =     4.84      SUBAREA RUNOFF(CFS) =   15.77
 EFFECTIVE AREA(ACRES) =      9.69   AREA-AVERAGED Fm(INCH/HR) =  0.37
 AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.50
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      28.99

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   217.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.40  DOWNSTREAM(FEET) =     46.53

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.383
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.991
```

```
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 A        2.73      0.74      0.100    52    5.38
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =     14.54
 TOTAL AREA(ACRES) =      2.73   PEAK FLOW RATE(CFS) =     14.54
================================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =        2.7  TC(MIN.) =      5.38
 EFFECTIVE AREA(ACRES) =      2.73  AREA-AVERAGED Fm(INCH/HR)=  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS)    =      14.54
================================================================================
================================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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          Ver. 22.0  Release Date: 07/01/2015  License ID 1533

                        Analysis prepared by:

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                    1461 FORD STREET, SUITE 105
                       REDLANDS, CA 92373
             PHONE: (909) 748-7777   FAX: (909) 748-7776

 ************************* DESCRIPTION OF STUDY *************************
* 154801 - APN 0298-063-07                                              *
* POST-DEVELOPMENT DRAINAGE STUDY                                       *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: 154801PO.DAT
  TIME/DATE OF STUDY: 13:27 04/04/2017
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.816
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.410
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   10.00   1-HOUR INTENSITY(INCH/HOUR) = 0.8242
  SLOPE OF INTENSITY DURATION CURVE = 0.6000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   621.00
 ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     64.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.149
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.149
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"          A        5.19      0.98      0.800    32   12.15
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      6.39
 TOTAL AREA(ACRES) =      5.19   PEAK FLOW RATE(CFS) =      6.39

****************************************************************************
 FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   710.00
 ELEVATION DATA: UPSTREAM(FEET) =     64.00  DOWNSTREAM(FEET) =     48.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.172
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.146
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "3-4 DWELLINGS/ACRE"       A        5.26      0.98      0.600    32   12.17
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
 SUBAREA AREA(ACRES) =    5.26   INITIAL SUBAREA RUNOFF(CFS) =    7.39

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.15
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.149
 SUBAREA AREA(ACRES) =    5.26      SUBAREA RUNOFF(CFS) =    7.40
 EFFECTIVE AREA(ACRES) =     10.45   AREA-AVERAGED Fm(INCH/HR) =  0.68
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.70
 TOTAL AREA(ACRES) =       10.5       PEAK FLOW RATE(CFS) =      13.80

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   657.00
  ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     65.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.693
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.093
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "1 DWELLING/ACRE"           A        7.44      0.98      0.800    32   12.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
  SUBAREA RUNOFF(CFS) =      8.79
  TOTAL AREA(ACRES) =      7.44   PEAK FLOW RATE(CFS) =      8.79

********************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  82
--------------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   893.00
  ELEVATION DATA: UPSTREAM(FEET) =     65.00  DOWNSTREAM(FEET) =     45.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.844
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.438
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  A        4.86      0.98      0.100    32    9.84
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     4.86   INITIAL SUBAREA RUNOFF(CFS) =   10.24

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   12.69
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.093
  SUBAREA AREA(ACRES) =     4.86      SUBAREA RUNOFF(CFS) =     8.73
  EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.51
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.52
  TOTAL AREA(ACRES) =       12.3       PEAK FLOW RATE(CFS) =      17.52

********************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
```

```
 TIME OF CONCENTRATION(MIN.) =   12.69
 RAINFALL INTENSITY(INCH/HR) =   2.09
 AREA-AVERAGED Fm(INCH/HR) =  0.51
 AREA-AVERAGED Fp(INCH/HR) =  0.98
 AREA-AVERAGED Ap =  0.52
 EFFECTIVE STREAM AREA(ACRES) =      12.30
 TOTAL STREAM AREA(ACRES) =      12.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      17.52

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   619.00
 ELEVATION DATA: UPSTREAM(FEET) =     85.20  DOWNSTREAM(FEET) =     52.76

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.066
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.273
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           A        4.85      0.98      0.800    32   11.07
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      6.52
 TOTAL AREA(ACRES) =      4.85   PEAK FLOW RATE(CFS) =      6.52

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   629.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.76  DOWNSTREAM(FEET) =     47.51

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.424
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.356
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        4.84      0.98      0.100    32   10.42
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     4.84   INITIAL SUBAREA RUNOFF(CFS) =     9.84

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   11.07
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.273
```

Figure 2.1

```
 SUBAREA AREA(ACRES) =     4.84      SUBAREA RUNOFF(CFS) =     9.47
 EFFECTIVE AREA(ACRES) =      9.69   AREA-AVERAGED Fm(INCH/HR) =  0.44
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.45
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      15.99

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE      6.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   349.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.40  DOWNSTREAM(FEET) =     45.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.835
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.034
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        2.73      0.98      0.100    32    6.83
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      7.22
 TOTAL AREA(ACRES) =      2.73   PEAK FLOW RATE(CFS) =      7.22

****************************************************************************
 FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.83
 RAINFALL INTENSITY(INCH/HR) =   3.03
 AREA-AVERAGED Fm(INCH/HR) =  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.98
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       2.73
 TOTAL STREAM AREA(ACRES) =       2.73
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.22

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
     1       17.52   12.69    2.093  0.98( 0.51) 0.52      12.3       4.00
     2        7.22    6.83    3.034  0.98( 0.10) 0.10       2.7      10.00

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

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
```

```
 NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       22.26    6.83    3.034  0.98( 0.39) 0.40       9.4      10.00
    2       22.42   12.69    2.093  0.97( 0.44) 0.45      15.0       4.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      22.42    Tc(MIN.) =    12.69
 EFFECTIVE AREA(ACRES) =      15.03   AREA-AVERAGED Fm(INCH/HR) =  0.44
 AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.45
 TOTAL AREA(ACRES) =       15.0
 LONGEST FLOWPATH FROM NODE      4.00 TO NODE      6.00 =     657.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =       15.0  TC(MIN.) =     12.69
 EFFECTIVE AREA(ACRES) =     15.03  AREA-AVERAGED Fm(INCH/HR)=  0.44
 AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.447
 PEAK FLOW RATE(CFS)    =      22.42

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
  NUMBER     (CFS)   (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1       22.26    6.83    3.034  0.98( 0.39) 0.40       9.4      10.00
    2       22.42   12.69    2.093  0.97( 0.44) 0.45      15.0       4.00
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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                          Analysis prepared by:

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                      REDLANDS, CA 92373
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 ************************* DESCRIPTION OF STUDY *************************
* 154801 - APN 0298-063-07                                              *
* POST-DEVELOPMENT DRAINAGE STUDY                                       *
* 25-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: 154801PO.DAT
  TIME/DATE OF STUDY: 13:26 04/04/2017
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.816
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.410
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   25.00   1-HOUR INTENSITY(INCH/HOUR) = 1.0318
  SLOPE OF INTENSITY DURATION CURVE = 0.6000

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *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.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
 FLOW PROCESS FROM NODE       1.00 TO NODE       2.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   621.00
 ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     64.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.149
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.690
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"          A        5.19      0.98      0.800    32   12.15
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      8.92
 TOTAL AREA(ACRES) =      5.19   PEAK FLOW RATE(CFS) =      8.92

****************************************************************************
 FLOW PROCESS FROM NODE       2.00 TO NODE       3.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   710.00
 ELEVATION DATA: UPSTREAM(FEET) =     64.00  DOWNSTREAM(FEET) =     48.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.172
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.687
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "3-4 DWELLINGS/ACRE"       A        5.26      0.98      0.600    32   12.17
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
 SUBAREA AREA(ACRES) =    5.26   INITIAL SUBAREA RUNOFF(CFS) =    9.95

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.15
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.690
 SUBAREA AREA(ACRES) =    5.26      SUBAREA RUNOFF(CFS) =    9.97
 EFFECTIVE AREA(ACRES) =     10.45   AREA-AVERAGED Fm(INCH/HR) =  0.68
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.70
 TOTAL AREA(ACRES) =       10.5       PEAK FLOW RATE(CFS) =      18.89

****************************************************************************
 FLOW PROCESS FROM NODE       4.00 TO NODE       5.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   657.00
  ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     65.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.693
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.620
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "1 DWELLING/ACRE"          A        7.44      0.98      0.800    32   12.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
  SUBAREA RUNOFF(CFS) =     12.32
  TOTAL AREA(ACRES) =      7.44   PEAK FLOW RATE(CFS) =     12.32

********************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  82
--------------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   893.00
  ELEVATION DATA: UPSTREAM(FEET) =     65.00  DOWNSTREAM(FEET) =     45.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.844
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.052
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        4.86      0.98      0.100    32    9.84
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     4.86   INITIAL SUBAREA RUNOFF(CFS) =   12.92

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   12.69
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.620
  SUBAREA AREA(ACRES) =     4.86      SUBAREA RUNOFF(CFS) =   11.03
  EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.51
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.52
  TOTAL AREA(ACRES) =       12.3       PEAK FLOW RATE(CFS) =      23.36

********************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
```

```
 TIME OF CONCENTRATION(MIN.) =   12.69
 RAINFALL INTENSITY(INCH/HR) =   2.62
 AREA-AVERAGED Fm(INCH/HR) =  0.51
 AREA-AVERAGED Fp(INCH/HR) =  0.98
 AREA-AVERAGED Ap =  0.52
 EFFECTIVE STREAM AREA(ACRES) =      12.30
 TOTAL STREAM AREA(ACRES) =      12.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      23.36

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   619.00
 ELEVATION DATA: UPSTREAM(FEET) =     85.20  DOWNSTREAM(FEET) =     52.76

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.066
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.845
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           A        4.85      0.98      0.800    32   11.07
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =      9.01
 TOTAL AREA(ACRES) =      4.85   PEAK FLOW RATE(CFS) =      9.01

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   629.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.76  DOWNSTREAM(FEET) =     47.51

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.424
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.949
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        4.84      0.98      0.100    32   10.42
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     4.84   INITIAL SUBAREA RUNOFF(CFS) =   12.42

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   11.07
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.845
```

```
 SUBAREA AREA(ACRES) =     4.84      SUBAREA RUNOFF(CFS) =    11.97
 EFFECTIVE AREA(ACRES) =      9.69   AREA-AVERAGED Fm(INCH/HR) =  0.44
 AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.45
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      20.98

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE      6.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   349.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.40  DOWNSTREAM(FEET) =     45.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.835
 *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.799
 SUBAREA Tc AND LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        2.73      0.98      0.100    32    6.83
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      9.09
 TOTAL AREA(ACRES) =      2.73   PEAK FLOW RATE(CFS) =      9.09

****************************************************************************
 FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.83
 RAINFALL INTENSITY(INCH/HR) =   3.80
 AREA-AVERAGED Fm(INCH/HR) =  0.10
 AREA-AVERAGED Fp(INCH/HR) =  0.98
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       2.73
 TOTAL STREAM AREA(ACRES) =       2.73
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       9.09

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
     1       23.36   12.69    2.620  0.98( 0.51) 0.52      12.3       4.00
     2        9.09    6.83    3.799  0.98( 0.10) 0.10       2.7      10.00

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

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
```

NUMBER	(CFS)	(MIN.)	(INCH/HR)	(INCH/HR)		(ACRES)	NODE
1	28.70	6.83	3.799	0.98(0.39)	0.40	9.4	10.00
2	29.56	12.69	2.620	0.97(0.44)	0.45	15.0	4.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 29.56 Tc(MIN.) = 12.69
EFFECTIVE AREA(ACRES) = 15.03 AREA-AVERAGED Fm(INCH/HR) = 0.44
AREA-AVERAGED Fp(INCH/HR) = 0.97 AREA-AVERAGED Ap = 0.45
TOTAL AREA(ACRES) = 15.0
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 6.00 = 657.00 FEET.

==========

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 15.0 TC(MIN.) = 12.69
EFFECTIVE AREA(ACRES) = 15.03 AREA-AVERAGED Fm(INCH/HR)= 0.44
AREA-AVERAGED Fp(INCH/HR) = 0.97 AREA-AVERAGED Ap = 0.447
PEAK FLOW RATE(CFS) = 29.56

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	28.70	6.83	3.799	0.98(0.39)	0.40	9.4	10.00
2	29.56	12.69	2.620	0.97(0.44)	0.45	15.0	4.00

==========
==========

END OF RATIONAL METHOD ANALYSIS

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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          Ver. 22.0  Release Date: 07/01/2015  License ID 1533

                        Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* 154801 - APN 0298-063-07                                              *
* POST-DEVELOPMENT DRAINAGE STUDY                                       *
* 100-YEAR STORM EVENT                                                  *
 ************************************************************************

  FILE NAME: 154801PO.DAT
  TIME/DATE OF STUDY: 13:26 04/04/2017
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.816
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.410
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) = 1.4100
  SLOPE OF INTENSITY DURATION CURVE = 0.6000

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *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.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
**************************************************************************
 FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
--------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   621.00
 ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     64.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.149
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.676
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           A        5.19      0.74      0.800    52   12.15
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =     14.40
 TOTAL AREA(ACRES) =      5.19   PEAK FLOW RATE(CFS) =     14.40

**************************************************************************
 FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  82
--------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
==========================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   710.00
 ELEVATION DATA: UPSTREAM(FEET) =     64.00  DOWNSTREAM(FEET) =     48.10

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.172
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.672
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "3-4 DWELLINGS/ACRE"        A        5.26      0.74      0.600    52   12.17
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
 SUBAREA AREA(ACRES) =     5.26   INITIAL SUBAREA RUNOFF(CFS) =   15.28

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   12.15
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.676
 SUBAREA AREA(ACRES) =     5.26      SUBAREA RUNOFF(CFS) =   15.29
 EFFECTIVE AREA(ACRES) =     10.45   AREA-AVERAGED Fm(INCH/HR) =  0.52
 AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.70
 TOTAL AREA(ACRES) =       10.5       PEAK FLOW RATE(CFS) =      29.69

**************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  21
--------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   657.00
  ELEVATION DATA: UPSTREAM(FEET) =     84.53  DOWNSTREAM(FEET) =     65.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.693
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.581
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "1 DWELLING/ACRE"           A        7.44      0.74      0.800    52   12.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
  SUBAREA RUNOFF(CFS) =     20.00
  TOTAL AREA(ACRES) =      7.44   PEAK FLOW RATE(CFS) =     20.00

********************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  82
--------------------------------------------------------------------------------
  >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
  >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   893.00
  ELEVATION DATA: UPSTREAM(FEET) =     65.00  DOWNSTREAM(FEET) =     45.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.844
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.171
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  A        4.86      0.74      0.100    52    9.84
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     4.86   INITIAL SUBAREA RUNOFF(CFS) =   17.92

  ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
  MAINLINE Tc(MIN.) =   12.69
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.581
  SUBAREA AREA(ACRES) =     4.86      SUBAREA RUNOFF(CFS) =   15.34
  EFFECTIVE AREA(ACRES) =     12.30   AREA-AVERAGED Fm(INCH/HR) =  0.39
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.52
  TOTAL AREA(ACRES) =       12.3       PEAK FLOW RATE(CFS) =      35.34

********************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =   1
--------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
```

```
 TIME OF CONCENTRATION(MIN.) =   12.69
 RAINFALL INTENSITY(INCH/HR) =   3.58
 AREA-AVERAGED Fm(INCH/HR) =  0.39
 AREA-AVERAGED Fp(INCH/HR) =  0.74
 AREA-AVERAGED Ap =  0.52
 EFFECTIVE STREAM AREA(ACRES) =      12.30
 TOTAL STREAM AREA(ACRES) =      12.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      35.34

****************************************************************************
 FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   619.00
 ELEVATION DATA: UPSTREAM(FEET) =     85.20  DOWNSTREAM(FEET) =     52.76

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.066
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.888
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 "1 DWELLING/ACRE"           A        4.85      0.74      0.800    52   11.07
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.800
 SUBAREA RUNOFF(CFS) =     14.38
 TOTAL AREA(ACRES) =      4.85   PEAK FLOW RATE(CFS) =     14.38

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  82
----------------------------------------------------------------------------
 >>>>>ADD SUBAREA RUNOFF TO MAINLINE, AT MAINLINE Tc,<<<<<
 >>>>>(AND COMPUTE INITIAL SUBAREA RUNOFF)<<<<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   629.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.76  DOWNSTREAM(FEET) =     47.51

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.424
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.030
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        4.84      0.74      0.100    52   10.42
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =     4.84   INITIAL SUBAREA RUNOFF(CFS) =   17.23

 ** ADD SUBAREA RUNOFF TO MAINLINE AT MAINLINE Tc:
 MAINLINE Tc(MIN.) =   11.07
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.888
```

```
 SUBAREA AREA(ACRES) =     4.84      SUBAREA RUNOFF(CFS) =    16.61
 EFFECTIVE AREA(ACRES) =      9.69   AREA-AVERAGED Fm(INCH/HR) =  0.33
 AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.45
 TOTAL AREA(ACRES) =        9.7       PEAK FLOW RATE(CFS) =      30.99

****************************************************************************
 FLOW PROCESS FROM NODE     10.00 TO NODE      6.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   349.00
 ELEVATION DATA: UPSTREAM(FEET) =     52.40  DOWNSTREAM(FEET) =     45.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.835
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.191
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                  A        2.73      0.74      0.100    52    6.83
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =     12.57
 TOTAL AREA(ACRES) =      2.73   PEAK FLOW RATE(CFS) =     12.57

****************************************************************************
 FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.83
 RAINFALL INTENSITY(INCH/HR) =   5.19
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.74
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       2.73
 TOTAL STREAM AREA(ACRES) =       2.73
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.57

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)           (ACRES)     NODE
     1       35.34   12.69    3.581  0.74( 0.39) 0.52      12.3       4.00
     2       12.57    6.83    5.191  0.74( 0.07) 0.10       2.7      10.00

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

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae      HEADWATER
```

NUMBER	(CFS)	(MIN.)	(INCH/HR)	(INCH/HR)		(ACRES)	NODE
1	41.20	6.83	5.191	0.74(0.30)	0.40	9.4	10.00
2	43.95	12.69	3.581	0.74(0.33)	0.45	15.0	4.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 43.95 Tc(MIN.) = 12.69
EFFECTIVE AREA(ACRES) = 15.03 AREA-AVERAGED Fm(INCH/HR) = 0.33
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.45
TOTAL AREA(ACRES) = 15.0
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 6.00 = 657.00 FEET.

==========

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 15.0 TC(MIN.) = 12.69
EFFECTIVE AREA(ACRES) = 15.03 AREA-AVERAGED Fm(INCH/HR)= 0.33
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.447
PEAK FLOW RATE(CFS) = 43.95

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	41.20	6.83	5.191	0.74(0.30)	0.40	9.4	10.00
2	43.95	12.69	3.581	0.74(0.33)	0.45	15.0	4.00

==========
==========

END OF RATIONAL METHOD ANALYSIS

NOAA Atlas 14, Volume 6, Version 2
Location name: Mentone, California, US*
Coordinates: 34.0648, -117.1323
Elevation: 1666 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.105** (0.087-0.127)	**0.139** (0.115-0.169)	**0.187** (0.155-0.228)	**0.229** (0.188-0.282)	**0.291** (0.231-0.370)	**0.341** (0.265-0.443)	**0.396** (0.300-0.528)	**0.456** (0.336-0.625)	**0.544** (0.384-0.778)	**0.617** (0.420-0.914)
10-min	**0.150** (0.125-0.182)	**0.199** (0.166-0.242)	**0.268** (0.222-0.327)	**0.329** (0.270-0.404)	**0.416** (0.331-0.530)	**0.489** (0.380-0.636)	**0.568** (0.430-0.756)	**0.654** (0.481-0.896)	**0.779** (0.550-1.11)	**0.884** (0.602-1.31)
15-min	**0.181** (0.151-0.220)	**0.241** (0.200-0.293)	**0.325** (0.269-0.396)	**0.397** (0.327-0.488)	**0.504** (0.400-0.641)	**0.591** (0.460-0.769)	**0.686** (0.520-0.915)	**0.790** (0.582-1.08)	**0.942** (0.665-1.35)	**1.07** (0.729-1.58)
30-min	**0.266** (0.221-0.323)	**0.353** (0.293-0.429)	**0.476** (0.394-0.580)	**0.582** (0.479-0.716)	**0.738** (0.586-0.939)	**0.867** (0.674-1.13)	**1.01** (0.762-1.34)	**1.16** (0.853-1.59)	**1.38** (0.975-1.98)	**1.57** (1.07-2.32)
60-min	**0.373** (0.310-0.452)	**0.495** (0.411-0.601)	**0.666** (0.552-0.812)	**0.816** (0.670-1.00)	**1.03** (0.821-1.31)	**1.21** (0.943-1.58)	**1.41** (1.07-1.88)	**1.62** (1.20-2.23)	**1.93** (1.36-2.77)	**2.19** (1.50-3.25)
2-hr	**0.536** (0.446-0.651)	**0.696** (0.579-0.846)	**0.919** (0.761-1.12)	**1.11** (0.912-1.36)	**1.38** (1.10-1.76)	**1.61** (1.25-2.09)	**1.85** (1.40-2.46)	**2.10** (1.55-2.89)	**2.48** (1.75-3.54)	**2.78** (1.90-4.12)
3-hr	**0.657** (0.547-0.798)	**0.846** (0.703-1.03)	**1.10** (0.916-1.35)	**1.33** (1.09-1.63)	**1.64** (1.30-2.09)	**1.90** (1.47-2.46)	**2.17** (1.64-2.89)	**2.46** (1.81-3.37)	**2.87** (2.03-4.11)	**3.21** (2.19-4.75)
6-hr	**0.919** (0.765-1.12)	**1.17** (0.974-1.42)	**1.51** (1.25-1.85)	**1.80** (1.48-2.22)	**2.21** (1.75-2.81)	**2.53** (1.97-3.29)	**2.87** (2.18-3.83)	**3.23** (2.38-4.43)	**3.73** (2.63-5.34)	**4.14** (2.82-6.13)
12-hr	**1.25** (1.04-1.51)	**1.59** (1.32-1.93)	**2.05** (1.70-2.50)	**2.43** (1.99-2.98)	**2.95** (2.35-3.76)	**3.36** (2.62-4.37)	**3.79** (2.87-5.05)	**4.23** (3.12-5.80)	**4.84** (3.42-6.93)	**5.33** (3.63-7.90)
24-hr	**1.68** (1.49-1.93)	**2.16** (1.91-2.49)	**2.79** (2.46-3.23)	**3.31** (2.90-3.86)	**4.03** (3.41-4.85)	**4.58** (3.80-5.63)	**5.14** (4.16-6.47)	**5.72** (4.51-7.41)	**6.52** (4.93-8.79)	**7.14** (5.22-9.95)
2-day	**2.04** (1.80-2.35)	**2.66** (2.35-3.07)	**3.49** (3.08-4.04)	**4.17** (3.65-4.87)	**5.11** (4.33-6.16)	**5.84** (4.85-7.18)	**6.59** (5.34-8.30)	**7.37** (5.81-9.54)	**8.44** (6.39-11.4)	**9.28** (6.79-12.9)
3-day	**2.18** (1.93-2.51)	**2.88** (2.55-3.33)	**3.83** (3.38-4.43)	**4.61** (4.03-5.37)	**5.69** (4.82-6.86)	**6.54** (5.43-8.04)	**7.42** (6.01-9.34)	**8.33** (6.57-10.8)	**9.60** (7.27-12.9)	**10.6** (7.76-14.8)
4-day	**2.35** (2.08-2.70)	**3.13** (2.77-3.61)	**4.18** (3.69-4.84)	**5.06** (4.42-5.90)	**6.27** (5.31-7.56)	**7.23** (6.00-8.89)	**8.22** (6.66-10.4)	**9.26** (7.30-12.0)	**10.7** (8.10-14.4)	**11.9** (8.67-16.5)
7-day	**2.70** (2.39-3.11)	**3.65** (3.23-4.21)	**4.93** (4.35-5.71)	**6.00** (5.25-6.99)	**7.48** (6.33-9.01)	**8.64** (7.17-10.6)	**9.85** (7.98-12.4)	**11.1** (8.77-14.4)	**12.9** (9.75-17.4)	**14.3** (10.4-19.9)
10-day	**2.92** (2.59-3.37)	**3.98** (3.52-4.59)	**5.41** (4.77-6.26)	**6.60** (5.77-7.69)	**8.25** (6.99-9.94)	**9.56** (7.93-11.8)	**10.9** (8.84-13.7)	**12.3** (9.72-16.0)	**14.3** (10.8-19.3)	**15.9** (11.6-22.1)
20-day	**3.64** (3.22-4.19)	**5.01** (4.43-5.78)	**6.86** (6.05-7.94)	**8.41** (7.36-9.80)	**10.6** (8.95-12.7)	**12.3** (10.2-15.1)	**14.0** (11.4-17.7)	**15.9** (12.5-20.6)	**18.5** (14.0-24.9)	**20.5** (15.0-28.6)
30-day	**4.33** (3.83-4.99)	**5.96** (5.27-6.88)	**8.16** (7.20-9.44)	**10.0** (8.76-11.7)	**12.6** (10.7-15.2)	**14.6** (12.1-18.0)	**16.7** (13.6-21.1)	**19.0** (15.0-24.6)	**22.1** (16.7-29.8)	**24.5** (18.0-34.2)
45-day	**5.23** (4.63-6.03)	**7.14** (6.32-8.24)	**9.73** (8.58-11.3)	**11.9** (10.4-13.9)	**14.9** (12.6-18.0)	**17.3** (14.4-21.3)	**19.8** (16.1-25.0)	**22.5** (17.7-29.1)	**26.1** (19.8-35.3)	**29.1** (21.3-40.5)
60-day	**6.21** (5.50-7.15)	**8.37** (7.40-9.65)	**11.3** (9.96-13.1)	**13.7** (12.0-16.0)	**17.2** (14.6-20.7)	**19.9** (16.5-24.5)	**22.8** (18.4-28.7)	**25.8** (20.3-33.4)	**30.0** (22.7-40.4)	**33.3** (24.4-46.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

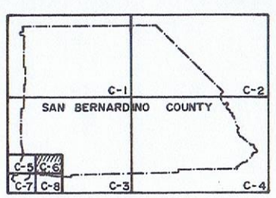
Back to Top

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE



INDEX MAP

SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-B AREA

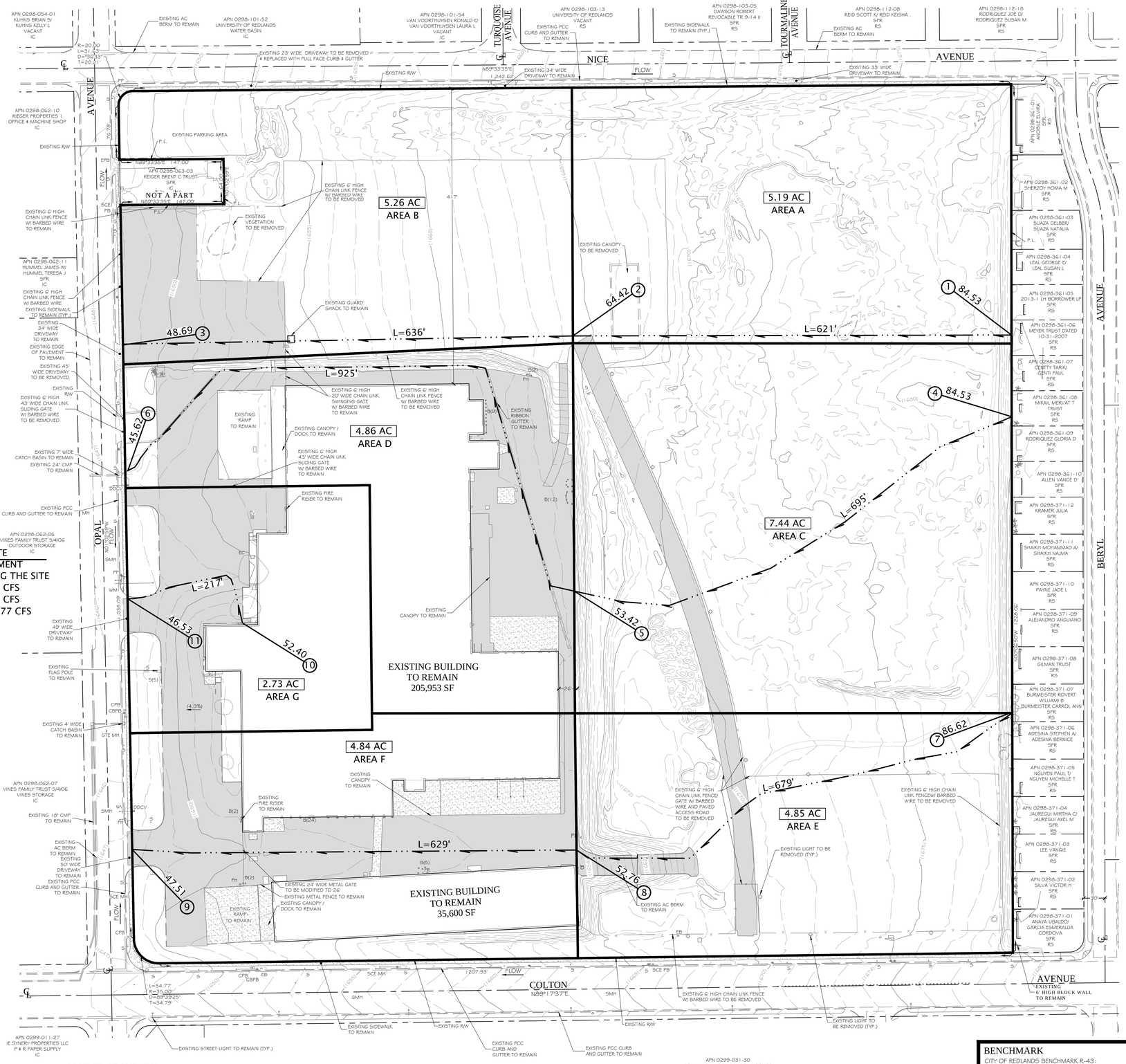
FIGURE C-14

PRE DEVELOPMENT TRIBUTARY AREA MAP

PROPOSED MANUFACTURING/ WAREHOUSING FACILITY

APN 0298-063-07

801 OPAL AVENUE, COUNTY OF SAN BERNARDINO



LEGEND

- EXISTING AC PAVING
- EXISTING PCC PAVING TO REMAIN

AC	ASPHALT CONCRETE
B	EXISTING BOLLARD TO REMAIN
BF	EXISTING BACKFLOW TO REMAIN
CBPB	CABLE PULL BOX
CPB	COMMUNICATIONS PULLBOX
DDCV	DOUBLE DETECTOR CHECK VALVE
EB	ELECTRICAL BOX
EPB	ELECTRICAL PULLBOX
EC	EXISTING ELECTRICAL CABINET TO REMAIN
EX	EXISTING
EV	EXISTING EDISON VAULT
FH	EXISTING FIRE HYDRANT TO REMAIN
FR	EXISTING FIRE RISER TO REMAIN
MB	EXISTING MAILBOX TO REMAIN
MH	EXISTING MANHOLE TO REMAIN
OH	OVERHANG
PB	EXISTING PULLBOX TO REMAIN
PCC	PORTLAND CEMENT CONCRETE
PL	PROPERTY LINE
PP	POWER POLE
RW	RIGHT-OF-WAY
S	EXISTING SIGN TO REMAIN
SMH	EXISTING SEWER MANHOLE TO REMAIN
WM	WATER METER
WV	WATER VALVE

EXISTING VEGETATION TO REMAIN UNLESS OTHERWISE SHOWN TO BE REMOVED

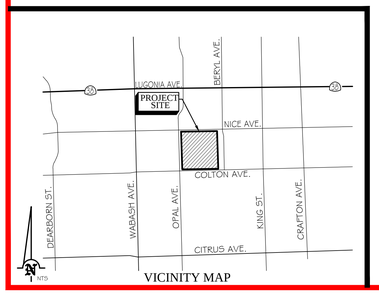
LEGEND

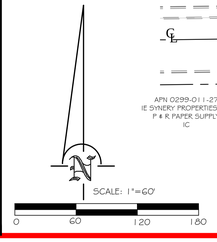
A=4.33 AC — SUB AREA

(#) 60.00 — NODE # & ELEVATIONS

L=655' — FLOWLINE LENGTH

— · · · — FLOWLINE





SOURCE OF SURVEY

TOPOGRAPHIC SURVEY
DATED AUGUST 2013
AS CONDUCTED BY
ONPOINT LAND SURVEYING, INC.
1910 ORANGE TREE LANE, SUITE 344
REDLANDS, CALIFORNIA 92374
PHONE: (909) 792-2221

BENCHMARK

CITY OF REDLANDS BENCHMARK R-43:
BRASS DISK IN THE TOP OF CURB @ NE COR. BERYL AVE. & COLTON AVE. EAST END OF RETURN.
ELEVATION= 1,683.679

BASIS OF BEARING

CENTERLINE OF OPAL AVENUE PER RS 55/28 BEING: NO1°02'59"W.

APN 0298-063-07
PRE DEVELOPMENT TRIBUTARY AREA MAP
PROPOSED MANUFACTURING/ WAREHOUSING FACILITY

PROPERTY OWNER/APPLICANT:
800 OPAL, LLC ATTN: CHARLES WALDEN
2615 SAN MIGUEL #487, NEWPORT BEACH, CA 92660
PHONE: (909) 553-0970

REPRESENTATIVE:
THATCHER ENGINEERING & ASSOCIATES, INC
1461 FORD STREET, STE 105, REDLANDS, CA 92373
PHONE: (909) 748-7777, FAX: (909) 748-7776

• land planning
• civil engineering
• landscape architecture
phone 909.748.7777
fax 909.748.7776
thatcher engineering & associates, inc.
1461 ford street, suite 105, redlands, ca 92373

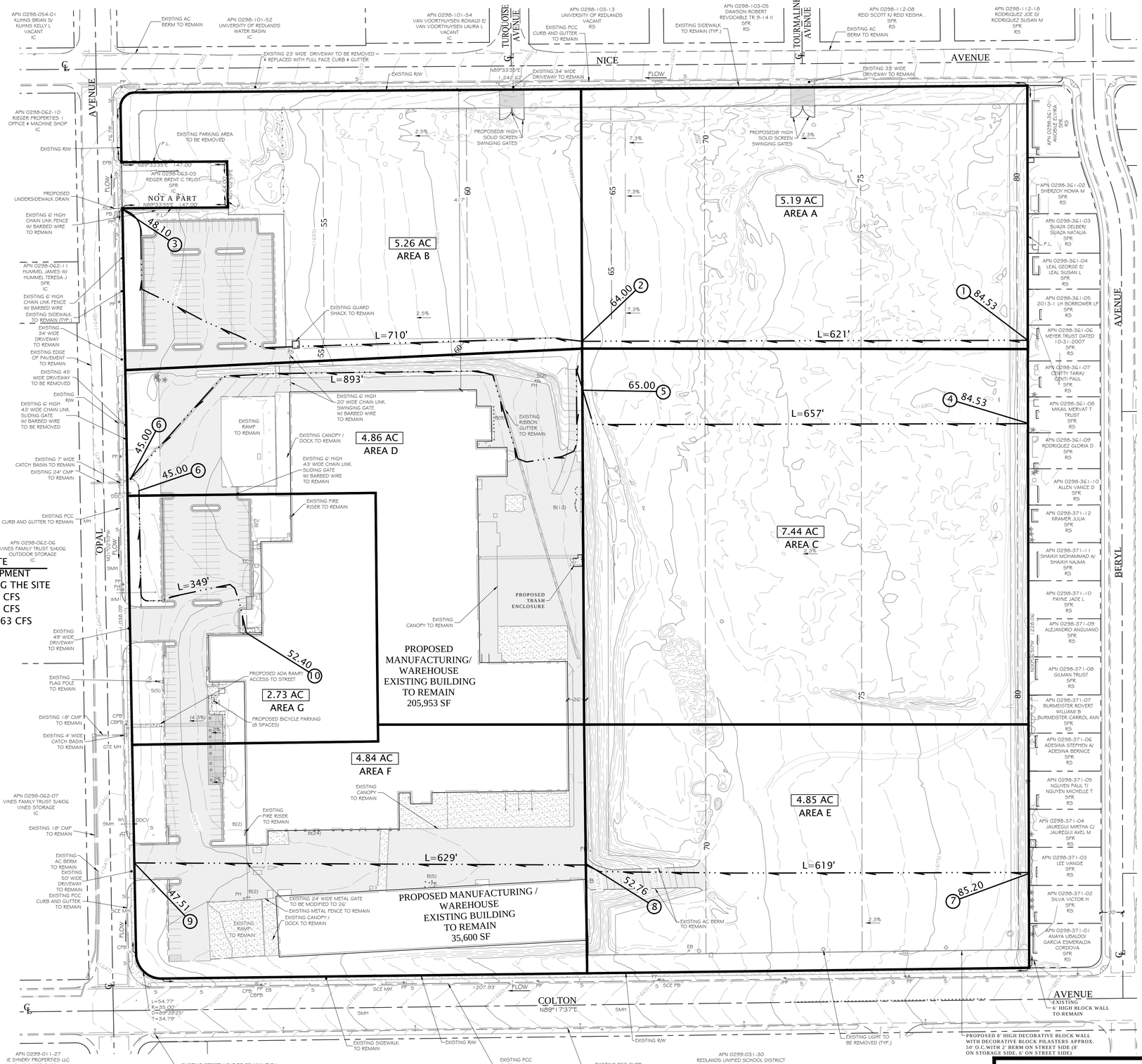
Job Number:	Date Prepared:	Drawn By:	Reference Number:
15480I	8/16/17	PF	15480ITAM2

POST DEVELOPMENT TRIBUTARY AREA MAP

PROPOSED MANUFACTURING/ WAREHOUSING FACILITY

APN 0298-063-07

801 OPAL AVENUE, COUNTY OF SAN BERNARDINO



LEGEND

	PROPOSED AC PAVING
	EXISTING AC PAVING TO REMAIN
	PROPOSED DUST PROOF MATERIAL / LANDSCAPING
	PROPOSED PCC PAVING
	EXISTING PCC PAVING TO REMAIN

AC	ASPHALT CONCRETE
B	EXISTING BOLLARD TO REMAIN
BF	EXISTING BACKFLOW TO REMAIN
CBPB	CABLE PULL BOX
CPB	COMMUNICATIONS PULLBOX
DDCV	DOUBLE DETECTOR CHECK VALVE
EB	ELECTRICAL BOX
EPB	ELECTRICAL PULLBOX
EC	EXISTING ELECTRICAL CABINET TO REMAIN
EX.	EXISTING
EV	EXISTING EDISON VAULT
FH	EXISTING FIRE HYDRANT TO REMAIN
FR	EXISTING FIRE RISER TO REMAIN
MB	EXISTING MAILBOX TO REMAIN
MH	EXISTING MANHOLE TO REMAIN
OH	OVERHANG
PB	EXISTING PULLBOX TO REMAIN
PCC	PORTLAND CEMENT CONCRETE
PL	PROPERTY LINE
PP	POWER POLE
R/W	RIGHT-OF-WAY
S	EXISTING SIGN TO REMAIN
SMH	EXISTING SEWER MANHOLE TO REMAIN
WM	WATER METER
WV	WATER VALVE
	EXISTING VEGETATION TO REMAIN

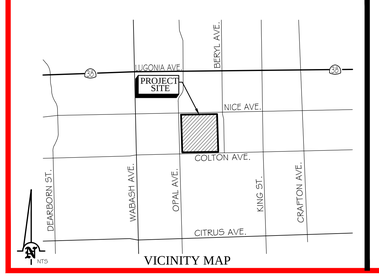
LEGEND

A=4.33 AC — SUB AREA

(#) 60.00 — NODE # & ELEVATIONS

L=655' — FLOWLINE LENGTH

— · · · — FLOWLINE



SOURCE OF SURVEY

TOPOGRAPHIC SURVEY
DATED AUGUST 2013
AS CONDUCTED BY
ONPOINT LAND SURVEYING, INC.
1910 ORANGE TREE LANE, SUITE 344
REDLANDS, CALIFORNIA 92374
PHONE: (909) 792-2221

SCALE: 1"=60'

0 60 120 180

BENCHMARK

CITY OF REDLANDS BENCHMARK R-43:
BRASS DISK IN THE TOP OF CURB @ NE COR. BERYL AVE. & COLTON AVE. EAST END OF RETURN.
ELEVATION= 1,683.679

BASIS OF BEARING

CENTERLINE OF OPAL AVENUE PER RS 55/28 BEING: N01°02'59"W.

APN 0298-063-07

POST DEVELOPMENT TRIBUTARY AREA MAP
PROPOSED MANUFACTURING/
WAREHOUSING FACILITY

PROPERTY OWNER/APPLICANT:
800 OPAL, LLC ATTN: CHARLES WALDEN
2615 SAN MIGUEL #467, NEWPORT BEACH, CA 92660
PHONE: (909) 553-0970

REPRESENTATIVE:
THATCHER ENGINEERING & ASSOCIATES, INC
1461 FORD STREET, STE 105, REDLANDS, CA 92373
PHONE: (909) 748-7777, FAX: (909) 748-7776

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• civil engineering
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phone 909.748.7777
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thatcher engineering & associates, inc.
1461 ford street, suite 105, redlands, ca 92373

Job Number:	Date Prepared:	Drawn By:	Reference Number:
15480I	8/16/17	PF	15480ITAM2