Hydrology & Hydraulics Preliminary Report

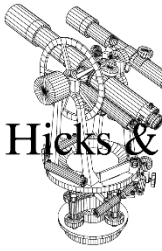
City of Redlands
County of San Bernardino

Prepared: JANUARY 2022 (Preliminary Report)
Updated: JULY 2022 (Preliminary Report)

FOR:
CUP #xxx
Redlands Self-Storage
(APN 0298-051-07)

Prepared For:
Mr. Dave Bird
Madison Capital Group
450 Newport Center Drive – Suite 250
Newport Beach, CA 92660
909-215-4650

Prepared by:
Hicks & Hartwick, Inc.
37 E Olive Ave. STE C
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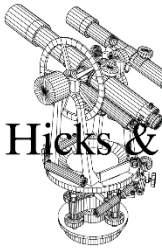
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City of Redlands

Redlands Self Storage

Hydrology & Hydraulics
Preliminary Report

GENERAL

The subject property of this report is approximately 6.5 acres of undeveloped barren land at the southeast corner of Wabash Avenue and Naples Avenue. The property is zoned C-4 commercial. On the north is a mixture of C-4 commercial zoning and the unincorporated area of Mentone. On the west is a shopping center (C-4 commercial) and R-1 residential development. On the south is an RV storage facility (zoned M-1 light industrial). On the east is an RV storage facility (zoned M-1 light industrial).

This report covers both the existing and proposed drainage conditions. The watershed runoff rates are determined using San Bernardino County standards and computer calculations. Rational Method Hydrology Computer Program Package, developed by Advanced Engineering Software (AES), is used to calculate the storm runoff rates.

The hydrologic soil type, ground cover and development type are user specified. The hydrologic soil type is as provided in the County Manual and attached hereto. The ground cover and development type are based on observation and experience. The runoff rates are as provided in the County Manual and attached hereto. Rational Hydrology analysis was performed for the theoretical 2-year, 10-year and 100-year storm events. The detailed summary computer output for each analysis is attached as Exhibits. The existing conditions, proposed conditions, and details maps are provided, illustrating the layout for, and as referenced by, the computer models.

EXISTING CONDITIONS

This drainage study watershed includes the subject property, the RV storage facility on the east and a portion of the RV storage on the south. The watershed consists of the vacant subject property and the existing commercial development (RV storage). The 2-year, 10-year and 100-year rational hydrology runoff analysis is calculated for the entire relevant watershed. The 2-year rational hydrology runoff analysis is also separately calculated for just the project site. The 2-year unit hydrology is calculated for just the project site.

The existing hydrology is calculated based on the existing coverage and configuration as illustrated on the accompanying map. The calculated 2-year, 10-year and 100-year rational hydrology runoff for the existing conditions is included

in this report. The 2-year rational hydrology and unit hydrology calculations for the project site are also included. The existing conditions and small area unit hydrograph reference maps are also attached.

PROPOSED CONDITIONS

The proposed development is a self-storage facility, as shown on the attached proposed conditions map and small area unit hydrograph reference map.

The proposed development will include drainage structures, as specified herein below, to convey the runoff through a basin and outletting onto Wabash Avenue. The change from barren land to a commercial facility will increase to peak runoff flowrate and reduce the time of concentration.

The proposed basin will mitigate increases in peak run-off generated from the project development to less than or equal to 90% of the pre-development peak flow rate from the site. Preliminary basin routing for the 100-year storm event is included in this report. The following table summarizes the pre- and post-condition 100-year run-off from the project site.

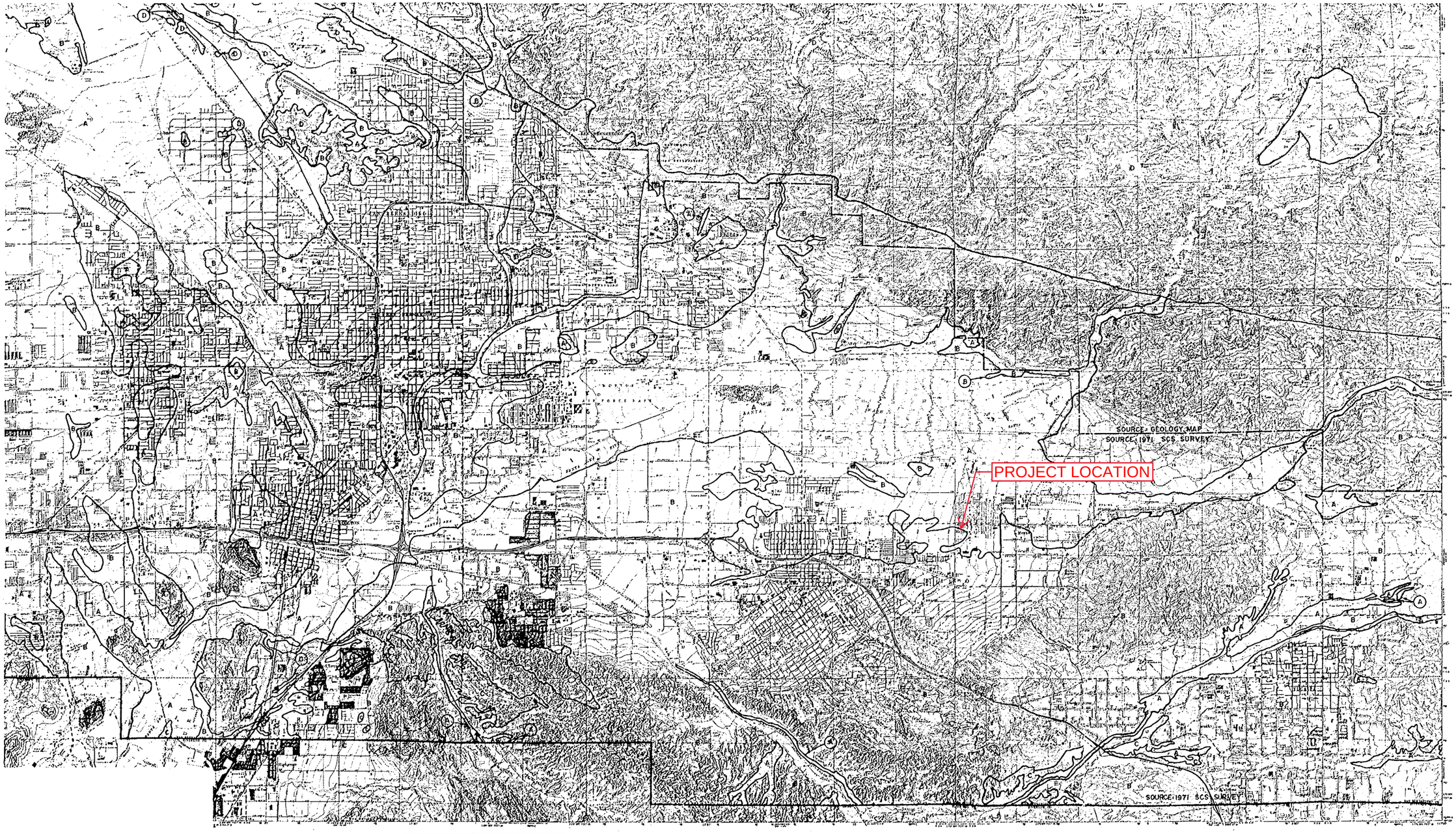
Table 1: Peak Run-off Discharge Summary

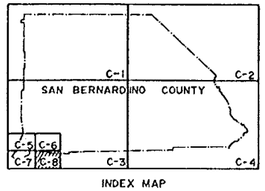
Node	Location	Event Frequency	Existing Runoff (CFS)	Proposed Runoff (CFS)	Net Difference (CFS)
$A12_{Exist.}$ $A16_{Prop.}$	Wabash Ave./Naples Ave. Intersection	100-YR	47.4	45.4	-2.0

The proposed hydrology is calculated based on the proposed coverage and configuration as illustrated on the accompanying map. The calculated 2-year, 10-year and 100-year rational hydrology runoff for the proposed conditions is included in this report. The 2-year rational hydrology and unit hydrology calculations for the project site are also included. The proposed conditions and small area unit hydrograph reference maps are also attached.

PRELIMINARY REPORT LIMITATIONS

This is a preliminary report. The project will include storm drains. Hydraulic analysis of the storm drain and storm drain elements is not included in this preliminary report, but will be included in the final report.





INDEX MAP

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

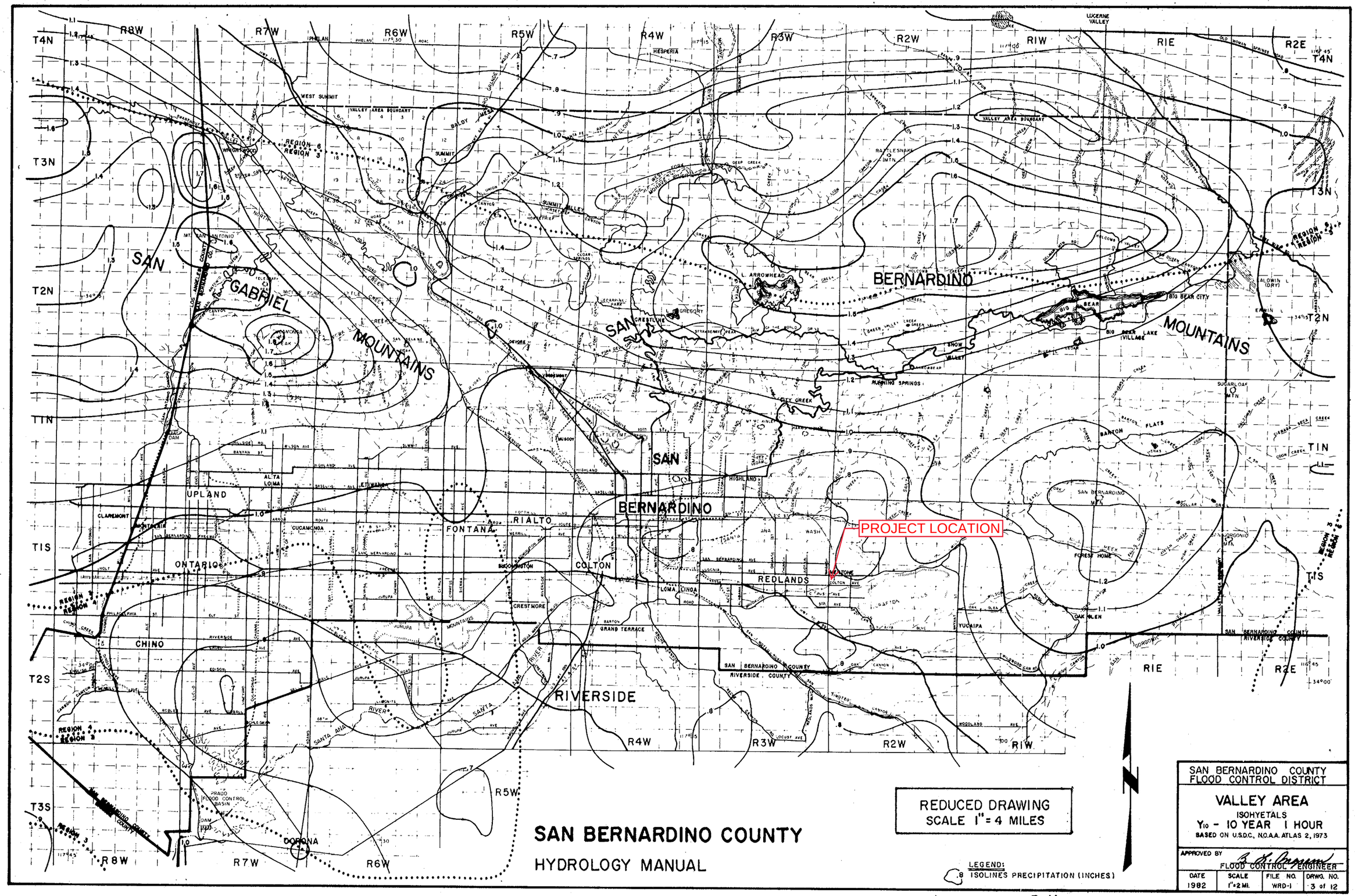
SCALE 1:48,000

SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP FOR SOUTHWEST-D AREA

FIGURE C-16



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

REDUCED DRAWING
SCALE 1" = 4 MILES

LEGEND:
.8 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

VALLEY AREA
ISOHYETALS
Y_{10} - 10 YEAR 1 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY _____ FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1"=2 MI.	WRD-1	3 of 12

FIGURE B-3

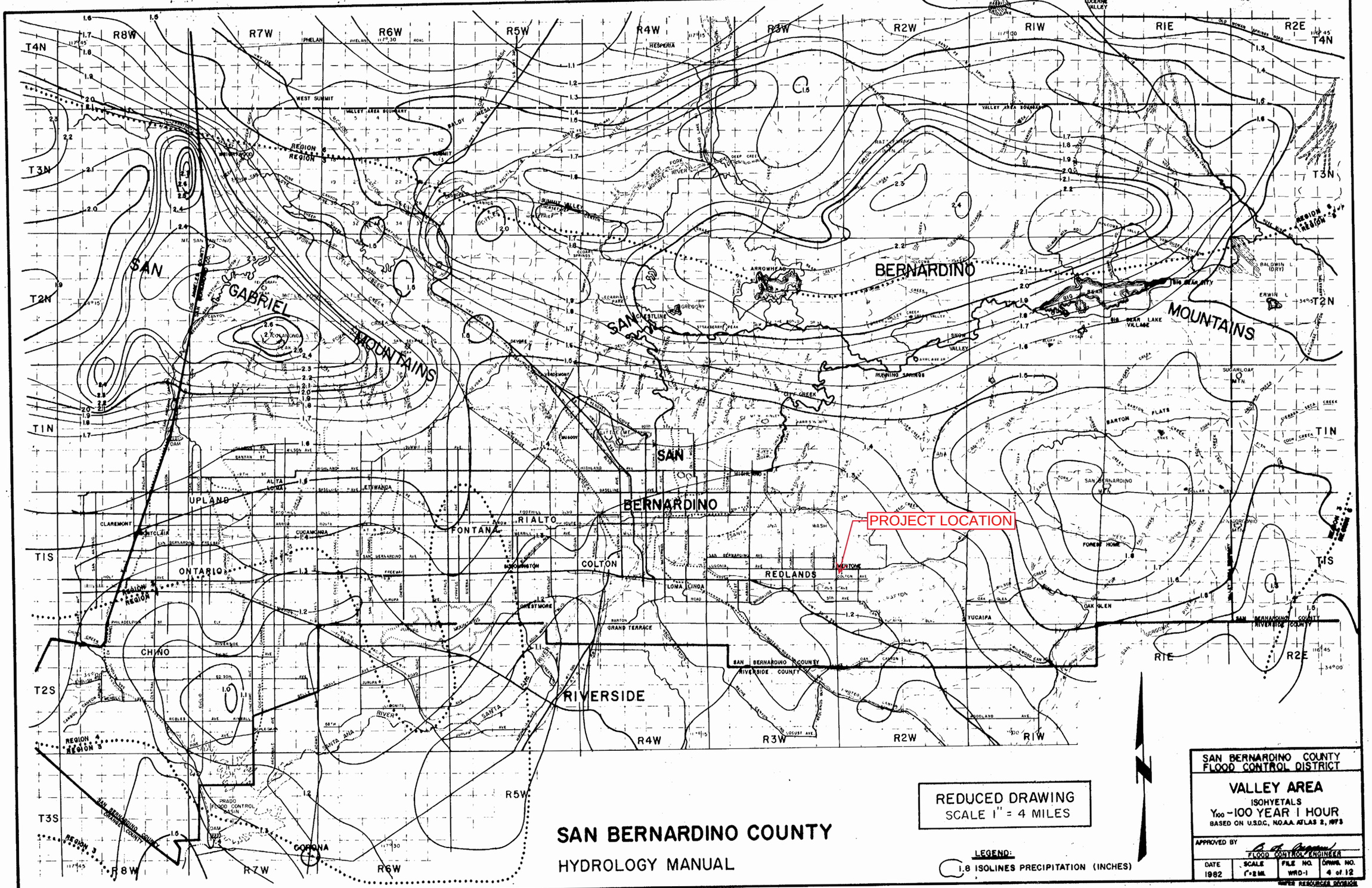
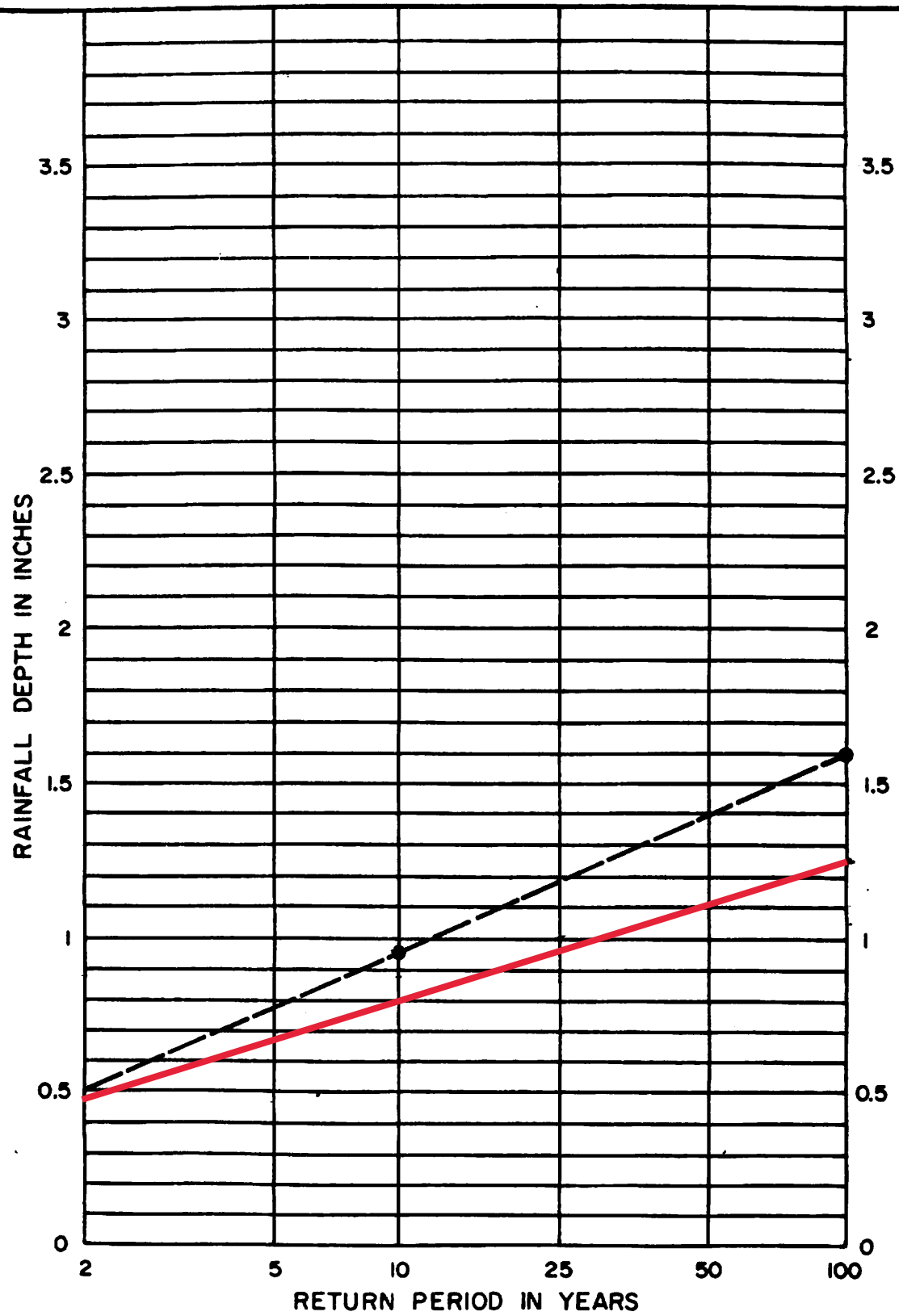

PROJECT LOCATION
SAN BERNARDINO MOUNTAINS
SAN GABRIEL MOUNTAINS
SAN BERNARDINO
RIVERSIDE
R8W
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E
T4N
T3N
T2N
T1N
T1S
T2S
T3S
REGION 6
REGION 5
REGION 4
REGION 3
REGION 2
REGION 1
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
1.8 ISOLINES PRECIPITATION (INCHES)
SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
Y100 - 100 YEAR 1 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973
APPROVED BY
FLOOD CONTROL ENGINEER
DATE 1982
SCALE 1"=2 MI.
FILE NO. WRD-1
DRWG. NO. 4 of 12
WATER RESOURCES DIVISION

FIGURE B-4



NOTE:

1. FOR INTERMEDIATE RETURN PERIODS PLOT 10-YEAR AND 100-YEAR ONE HOUR VALUES FROM MAPS, THEN CONNECT POINTS AND READ VALUE FOR DESIRED RETURN PERIOD. FOR EXAMPLE GIVEN 10-YEAR ONE HOUR = 0.95" AND 100-YEAR ONE HOUR = 1.60", 25-YEAR ONE HOUR = 1.18".

REFERENCE: NOAA ATLAS 2, VOLUME XI - CAL., 1973

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

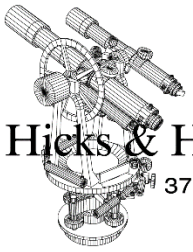
FIGURE D-2

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

EXISTING HYDROLOGY
2-YEAR RUNOFF



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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 1302

                              Analysis prepared by:

                              Hicks & Hartwick, Inc.
                          37 East Olive Avenue, Suite C
                                Redlands, CA 92373
                                  (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301HEA2.DAT
  TIME/DATE OF STUDY: 09:55 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.4700

  *ANTECEDENT MOISTURE CONDITION (AMC) I 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
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0313 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   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) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.105
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.727
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        1.74      0.94     0.100    36    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.56
  TOTAL AREA(ACRES) =      1.74   PEAK FLOW RATE(CFS) =      2.56

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.50
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.56
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    8.21
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =     662.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      6.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1613.50  DOWNSTREAM(FEET) =   1613.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   117.00   CHANNEL SLOPE =  0.0026
  CHANNEL BASE(FEET) =    8.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = -.970   MAXIMUM DEPTH(FEET) =   3.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.710
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.74      0.94     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.82
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 166.86
  AVERAGE FLOW DEPTH(FEET) =   0.00   TRAVEL TIME(MIN.) =   0.01
  Tc(MIN.) =    8.22
  SUBAREA AREA(ACRES) =     1.74       SUBAREA RUNOFF(CFS) =    2.53
  EFFECTIVE AREA(ACRES) =      3.48     AREA-AVERAGED Fm(INCH/HR) =   0.09
  AREA-AVERAGED Fp(INCH/HR) =   0.94  AREA-AVERAGED Ap =   0.10
```

```
  TOTAL AREA(ACRES) =        3.5         PEAK FLOW RATE(CFS) =       5.06

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.00   FLOW VELOCITY(FEET/SEC.) = 220.99
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  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.) =    8.22
  RAINFALL INTENSITY(INCH/HR) =   1.71
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       3.48
  TOTAL STREAM AREA(ACRES) =       3.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.06

****************************************************************************
  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) =   620.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.097
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.728
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        1.22      0.94     0.100    36    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.79
  TOTAL AREA(ACRES) =      1.22   PEAK FLOW RATE(CFS) =      1.79

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.20
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.28
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       1.79
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    8.21
  LONGEST FLOWPATH FROM NODE      4.00 TO NODE      6.00 =     662.00 FEET.

****************************************************************************
  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.) =    8.21
  RAINFALL INTENSITY(INCH/HR) =   1.71
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.22
  TOTAL STREAM AREA(ACRES) =       1.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.79

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.06    8.22    1.710  0.94( 0.09) 0.10       3.5       1.00
      2        1.79    8.21    1.712  0.94( 0.09) 0.10       1.2       4.00

  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        6.85    8.21    1.712  0.94( 0.09) 0.10       4.7       4.00
      2        6.85    8.22    1.710  0.94( 0.09) 0.10       4.7       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.85    Tc(MIN.) =     8.22
  EFFECTIVE AREA(ACRES) =       4.70   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.7
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1615.30  DOWNSTREAM(FEET) =  1614.60
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.23
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.85
```

```
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =    8.41
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =     849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      9.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1614.60  DOWNSTREAM ELEVATION(FEET) = 1613.70
  STREET LENGTH(FEET) =   183.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.03
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.50
    HALFSTREET FLOOD WIDTH(FEET) =   17.61
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.19
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.10
  STREET FLOW TRAVEL TIME(MIN.) =   1.39   Tc(MIN.) =    9.81
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.526
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.28      0.94     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.28      SUBAREA RUNOFF(CFS) =    0.36
  EFFECTIVE AREA(ACRES) =      4.98    AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.0        PEAK FLOW RATE(CFS) =       6.85
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  17.42
  FLOW VELOCITY(FEET/SEC.) =  2.18   DEPTH*VELOCITY(FT*FT/SEC.) =   1.09
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =    1032.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.81
```

```
 RAINFALL INTENSITY(INCH/HR) =   1.53
 AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       4.98
 TOTAL STREAM AREA(ACRES) =       4.98
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.85

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   776.00
 ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1613.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.384
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.138
 SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL POOR COVER
 "BARREN"                    B        3.92      0.50     1.000    72   15.38
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.50
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      2.24
 TOTAL AREA(ACRES) =      3.92   PEAK FLOW RATE(CFS) =      2.24

****************************************************************************
 FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   15.38
 RAINFALL INTENSITY(INCH/HR) =   1.14
 AREA-AVERAGED Fm(INCH/HR) =  0.50
 AREA-AVERAGED Fp(INCH/HR) =  0.50
 AREA-AVERAGED Ap =  1.00
 EFFECTIVE STREAM AREA(ACRES) =       3.92
 TOTAL STREAM AREA(ACRES) =       3.92
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.24

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1        6.85    9.79    1.527  0.94( 0.09) 0.10       5.0       4.00
     1        6.85    9.81    1.526  0.94( 0.09) 0.10       5.0       1.00
     2        2.24   15.38    1.138  0.50( 0.50) 1.00       3.9       8.00

 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        9.09    9.79    1.527  0.58( 0.23) 0.40       7.5       4.00
      2        9.09    9.81    1.526  0.58( 0.23) 0.40       7.5       1.00
      3        7.24   15.38    1.138  0.55( 0.27) 0.50       8.9       8.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       9.09    Tc(MIN.) =     9.81
  EFFECTIVE AREA(ACRES) =       7.48   AREA-AVERAGED Fm(INCH/HR) =  0.23
  AREA-AVERAGED Fp(INCH/HR) =  0.58  AREA-AVERAGED Ap =  0.40
  TOTAL AREA(ACRES) =        8.9
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =    1032.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE     12.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1613.70  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   266.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.81
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.56
    HALFSTREET FLOOD WIDTH(FEET) =   20.42
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.30
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.28
  STREET FLOW TRAVEL TIME(MIN.) =   1.92   Tc(MIN.) =   11.73
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.358
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   B        1.86      0.50     1.000    72
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.50
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    1.86      SUBAREA RUNOFF(CFS) =    1.43
  EFFECTIVE AREA(ACRES) =      9.34    AREA-AVERAGED Fm(INCH/HR) =  0.29
  AREA-AVERAGED Fp(INCH/HR) =  0.55  AREA-AVERAGED Ap =  0.52
  TOTAL AREA(ACRES) =       10.8        PEAK FLOW RATE(CFS) =       9.09
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  19.86
  FLOW VELOCITY(FEET/SEC.) =  2.25   DEPTH*VELOCITY(FT*FT/SEC.) =   1.23
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     12.00 =    1298.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.73
  RAINFALL INTENSITY(INCH/HR) =   1.36
  AREA-AVERAGED Fm(INCH/HR) =  0.29
  AREA-AVERAGED Fp(INCH/HR) =  0.55
  AREA-AVERAGED Ap =  0.52
  EFFECTIVE STREAM AREA(ACRES) =       9.34
  TOTAL STREAM AREA(ACRES) =      10.76
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       9.09

****************************************************************************
  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) =   707.00
  ELEVATION DATA: UPSTREAM(FEET) =   1644.70  DOWNSTREAM(FEET) =   1630.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.100
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.601
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        3.77      0.94     0.100    36    9.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      5.11
  TOTAL AREA(ACRES) =      3.77   PEAK FLOW RATE(CFS) =      5.11

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1630.00  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   692.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
```

```
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.026

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.90
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.40
   HALFSTREET FLOOD WIDTH(FEET) =    9.77
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.20
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.67
 STREET FLOW TRAVEL TIME(MIN.) =   2.75   Tc(MIN.) =   11.85
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.349
 SUBAREA LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 B        1.39      0.94     0.100    36
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    1.57
 EFFECTIVE AREA(ACRES) =      5.16    AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =       5.83

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =   9.73
 FLOW VELOCITY(FEET/SEC.) =  4.18   DEPTH*VELOCITY(FT*FT/SEC.) =   1.66
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1399.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.85
 RAINFALL INTENSITY(INCH/HR) =   1.35
 AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       5.16
 TOTAL STREAM AREA(ACRES) =       5.16
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.83

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1        9.09   11.71    1.359  0.55( 0.29) 0.52       9.3       4.00
     1        9.09   11.73    1.358  0.55( 0.29) 0.52       9.3       1.00
     1        7.24   17.43    1.050  0.54( 0.31) 0.58      10.8       8.00
     2        5.83   11.85    1.349  0.94( 0.09) 0.10       5.2      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       14.90   11.71    1.359  0.59( 0.22) 0.37      14.4       4.00
      2       14.90   11.73    1.358  0.59( 0.22) 0.37      14.4       1.00
      3       14.88   11.85    1.349  0.59( 0.22) 0.37      14.5      10.00
      4       11.68   17.43    1.050  0.57( 0.24) 0.43      15.9       8.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      14.90    Tc(MIN.) =    11.73
  EFFECTIVE AREA(ACRES) =      14.45   AREA-AVERAGED Fm(INCH/HR) =  0.22
  AREA-AVERAGED Fp(INCH/HR) =  0.59  AREA-AVERAGED Ap =  0.37
  TOTAL AREA(ACRES) =       15.9
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1399.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       15.9  TC(MIN.) =     11.73
  EFFECTIVE AREA(ACRES) =     14.45  AREA-AVERAGED Fm(INCH/HR)=  0.22
  AREA-AVERAGED Fp(INCH/HR) =  0.59  AREA-AVERAGED Ap = 0.372
  PEAK FLOW RATE(CFS)   =      14.90

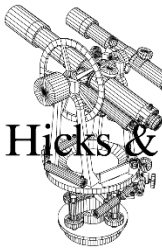
  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       14.90   11.71    1.359  0.59( 0.22) 0.37      14.4       4.00
      2       14.90   11.73    1.358  0.59( 0.22) 0.37      14.4       1.00
      3       14.88   11.85    1.349  0.59( 0.22) 0.37      14.5      10.00
      4       11.68   17.43    1.050  0.57( 0.24) 0.43      15.9       8.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

EXISTING HYDROLOGY
10-YEAR RUNOFF



Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

```
**************************************************************************
            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 1302

                              Analysis prepared by:

                                  Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                    Redlands, CA 92373
                                    (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301HEAT.DAT
  TIME/DATE OF STUDY: 09:55 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.8000

  *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 0.0312 0.167 0.0150
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0312 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   0.67    2.00 0.0312 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) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.105
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.939
  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                 B        1.74      0.75     0.100    56    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      4.49
  TOTAL AREA(ACRES) =      1.74   PEAK FLOW RATE(CFS) =      4.49

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.50
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.41
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.49
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    8.20
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =     662.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      6.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1613.50  DOWNSTREAM(FEET) =   1613.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   117.00   CHANNEL SLOPE =  0.0026
  CHANNEL BASE(FEET) =    8.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = -.970   MAXIMUM DEPTH(FEET) =   3.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.916
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.74      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 292.96
  AVERAGE FLOW DEPTH(FEET) =   0.00   TRAVEL TIME(MIN.) =   0.01
  Tc(MIN.) =    8.20
  SUBAREA AREA(ACRES) =     1.74       SUBAREA RUNOFF(CFS) =    4.45
  EFFECTIVE AREA(ACRES) =      3.48     AREA-AVERAGED Fm(INCH/HR) =   0.07
  AREA-AVERAGED Fp(INCH/HR) =   0.75  AREA-AVERAGED Ap =   0.10
```

```
  TOTAL AREA(ACRES) =        3.5         PEAK FLOW RATE(CFS) =       8.90

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.00   FLOW VELOCITY(FEET/SEC.) = 388.51
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  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.) =    8.20
  RAINFALL INTENSITY(INCH/HR) =   2.92
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       3.48
  TOTAL STREAM AREA(ACRES) =       3.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.90

****************************************************************************
  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) =   620.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.097
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.941
  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                 B        1.22      0.75     0.100    56    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.15
  TOTAL AREA(ACRES) =      1.22   PEAK FLOW RATE(CFS) =      3.15

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.20
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.39
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       3.15
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    8.19
  LONGEST FLOWPATH FROM NODE      4.00 TO NODE      6.00 =     662.00 FEET.

****************************************************************************
  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.) =    8.19
  RAINFALL INTENSITY(INCH/HR) =   2.92
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.22
  TOTAL STREAM AREA(ACRES) =       1.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.15

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        8.90    8.20    2.916  0.75( 0.07) 0.10       3.5       1.00
      2        3.15    8.19    2.919  0.75( 0.07) 0.10       1.2       4.00

  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       12.04    8.19    2.919  0.75( 0.07) 0.10       4.7       4.00
      2       12.04    8.20    2.916  0.75( 0.07) 0.10       4.7       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.04    Tc(MIN.) =     8.20
  EFFECTIVE AREA(ACRES) =       4.70   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.7
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1615.30  DOWNSTREAM(FEET) =  1614.60
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.13
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.04
```

```
  PIPE TRAVEL TIME(MIN.) =   0.16    Tc(MIN.) =    8.37
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =     849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      9.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1614.60  DOWNSTREAM ELEVATION(FEET) = 1613.70
  STREET LENGTH(FEET) =   183.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.37
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.59
    HALFSTREET FLOOD WIDTH(FEET) =   22.02
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.52
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.48
  STREET FLOW TRAVEL TIME(MIN.) =   1.21   Tc(MIN.) =    9.58
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.636
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.28      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.28      SUBAREA RUNOFF(CFS) =    0.65
  EFFECTIVE AREA(ACRES) =      4.98    AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.0        PEAK FLOW RATE(CFS) =      12.04
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.58   HALFSTREET FLOOD WIDTH(FEET) =  21.83
  FLOW VELOCITY(FEET/SEC.) =  2.49   DEPTH*VELOCITY(FT*FT/SEC.) =   1.46
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =    1032.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.58
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 RAINFALL INTENSITY(INCH/HR) =   2.64
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       4.98
 TOTAL STREAM AREA(ACRES) =       4.98
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.04

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   776.00
 ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1613.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.384
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.938
 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.)
 NATURAL POOR COVER
 "BARREN"                    B        3.92      0.27     1.000    86   15.38
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      5.88
 TOTAL AREA(ACRES) =      3.92   PEAK FLOW RATE(CFS) =      5.88

****************************************************************************
 FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   15.38
 RAINFALL INTENSITY(INCH/HR) =   1.94
 AREA-AVERAGED Fm(INCH/HR) =  0.27
 AREA-AVERAGED Fp(INCH/HR) =  0.27
 AREA-AVERAGED Ap =  1.00
 EFFECTIVE STREAM AREA(ACRES) =       3.92
 TOTAL STREAM AREA(ACRES) =       3.92
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.88

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       12.04    9.57    2.638  0.75( 0.07) 0.10        5.0        4.00
     1       12.04    9.58    2.636  0.75( 0.07) 0.10        5.0        1.00
     2        5.88   15.38    1.938  0.27( 0.27) 1.00        3.9        8.00

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
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  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       17.23    9.57    2.638  0.35( 0.14) 0.40       7.4       4.00
      2       17.24    9.58    2.636  0.35( 0.14) 0.40       7.4       1.00
      3       14.63   15.38    1.938  0.33( 0.16) 0.50       8.9       8.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.24    Tc(MIN.) =     9.58
  EFFECTIVE AREA(ACRES) =       7.42   AREA-AVERAGED Fm(INCH/HR) =  0.14
  AREA-AVERAGED Fp(INCH/HR) =  0.35  AREA-AVERAGED Ap =  0.40
  TOTAL AREA(ACRES) =        8.9
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =    1032.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE     12.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1613.70  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   266.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      19.00
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.68
    HALFSTREET FLOOD WIDTH(FEET) =   27.86
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.70
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.82
  STREET FLOW TRAVEL TIME(MIN.) =   1.64   Tc(MIN.) =   11.22
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.378
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                    B        1.86      0.27     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.27
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    1.86      SUBAREA RUNOFF(CFS) =    3.53
  EFFECTIVE AREA(ACRES) =      9.28    AREA-AVERAGED Fm(INCH/HR) =  0.17
  AREA-AVERAGED Fp(INCH/HR) =  0.32  AREA-AVERAGED Ap =  0.52
  TOTAL AREA(ACRES) =       10.8        PEAK FLOW RATE(CFS) =      18.48
```

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 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.67   HALFSTREET FLOOD WIDTH(FEET) =  26.74
 FLOW VELOCITY(FEET/SEC.) =  2.68   DEPTH*VELOCITY(FT*FT/SEC.) =   1.80
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE     12.00 =    1298.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.22
 RAINFALL INTENSITY(INCH/HR) =   2.38
 AREA-AVERAGED Fm(INCH/HR) =  0.17
 AREA-AVERAGED Fp(INCH/HR) =  0.32
 AREA-AVERAGED Ap =  0.52
 EFFECTIVE STREAM AREA(ACRES) =       9.28
 TOTAL STREAM AREA(ACRES) =      10.76
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      18.48

****************************************************************************
 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) =   707.00
 ELEVATION DATA: UPSTREAM(FEET) =   1644.70  DOWNSTREAM(FEET) =   1630.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.100
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.726
 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                 B        3.77      0.75     0.100    56    9.10
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      8.99
 TOTAL AREA(ACRES) =      3.77   PEAK FLOW RATE(CFS) =      8.99

****************************************************************************
 FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1630.00  DOWNSTREAM ELEVATION(FEET) = 1612.50
 STREET LENGTH(FEET) =   692.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.50
 INSIDE STREET CROSSFALL(DECIMAL) =  0.015
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.026
```

```
  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.41
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.47
    HALFSTREET FLOOD WIDTH(FEET) =   12.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.78
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.23
  STREET FLOW TRAVEL TIME(MIN.) =   2.41   Tc(MIN.) =   11.51
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.339
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.39      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    2.83
  EFFECTIVE AREA(ACRES) =      5.16    AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.2         PEAK FLOW RATE(CFS) =      10.52

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.47   HALFSTREET FLOOD WIDTH(FEET) =  12.54
  FLOW VELOCITY(FEET/SEC.) =  4.79   DEPTH*VELOCITY(FT*FT/SEC.) =   2.25
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1399.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.51
  RAINFALL INTENSITY(INCH/HR) =   2.34
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       5.16
  TOTAL STREAM AREA(ACRES) =       5.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.52

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       18.48   11.21    2.380  0.32( 0.17) 0.52       9.3       4.00
      1       18.48   11.22    2.378  0.32( 0.17) 0.52       9.3       1.00
      1       15.77   17.10    1.809  0.31( 0.18) 0.58      10.8       8.00
      2       10.52   11.51    2.339  0.75( 0.07) 0.10       5.2      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       28.90   11.21    2.380  0.36( 0.13) 0.37      14.3       4.00
      2       28.91   11.22    2.378  0.36( 0.13) 0.37      14.3       1.00
      3       28.86   11.51    2.339  0.36( 0.13) 0.37      14.5      10.00
      4       23.82   17.10    1.809  0.34( 0.15) 0.43      15.9       8.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      28.91    Tc(MIN.) =    11.22
  EFFECTIVE AREA(ACRES) =      14.31   AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.36  AREA-AVERAGED Ap =  0.37
  TOTAL AREA(ACRES) =       15.9
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1399.00 FEET.
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       15.9  TC(MIN.) =     11.22
  EFFECTIVE AREA(ACRES) =     14.31  AREA-AVERAGED Fm(INCH/HR)=  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.36  AREA-AVERAGED Ap = 0.370
  PEAK FLOW RATE(CFS)   =      28.91

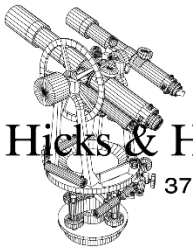
  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       28.90   11.21    2.380  0.36( 0.13) 0.37      14.3       4.00
      2       28.91   11.22    2.378  0.36( 0.13) 0.37      14.3       1.00
      3       28.86   11.51    2.339  0.36( 0.13) 0.37      14.5      10.00
      4       23.82   17.10    1.809  0.34( 0.15) 0.43      15.9       8.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

EXISTING HYDROLOGY
100-YEAR RUNOFF



Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

```
**************************************************************************
            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 1302

                              Analysis prepared by:

                              Hicks & Hartwick, Inc.
                          37 East Olive Avenue, Suite C
                                Redlands, CA 92373
                                  (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301HEAH.DAT
  TIME/DATE OF STUDY: 09:56 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

  *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 0.0312 0.167 0.0150
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0312 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   0.67    2.00 0.0312 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) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.105
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.592
  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                 B        1.74      0.42     0.100    76    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      7.13
  TOTAL AREA(ACRES) =      1.74   PEAK FLOW RATE(CFS) =      7.13

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.50
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.13
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    8.19
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =     662.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      6.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1613.50  DOWNSTREAM(FEET) =   1613.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   117.00   CHANNEL SLOPE =  0.0026
  CHANNEL BASE(FEET) =    8.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = -.970   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.561
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.74      0.42     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.66
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 465.55
  AVERAGE FLOW DEPTH(FEET) =   0.00   TRAVEL TIME(MIN.) =   0.00
  Tc(MIN.) =    8.19
  SUBAREA AREA(ACRES) =     1.74       SUBAREA RUNOFF(CFS) =    7.08
  EFFECTIVE AREA(ACRES) =      3.48     AREA-AVERAGED Fm(INCH/HR) =   0.04
  AREA-AVERAGED Fp(INCH/HR) =   0.42  AREA-AVERAGED Ap =   0.10
```

```
 TOTAL AREA(ACRES) =       3.5         PEAK FLOW RATE(CFS) =      14.15

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.00   FLOW VELOCITY(FEET/SEC.) = 617.88
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
 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.) =    8.19
 RAINFALL INTENSITY(INCH/HR) =   4.56
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       3.48
 TOTAL STREAM AREA(ACRES) =       3.48
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      14.15

****************************************************************************
 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) =   620.00
 ELEVATION DATA: UPSTREAM(FEET) =   1635.78  DOWNSTREAM(FEET) =   1618.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.097
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.595
 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                 B        1.22      0.42     0.100    76    8.10
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      5.00
 TOTAL AREA(ACRES) =      1.22   PEAK FLOW RATE(CFS) =      5.00

****************************************************************************
 FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.20
 FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.42
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       5.00
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    8.18
  LONGEST FLOWPATH FROM NODE      4.00 TO NODE      6.00 =     662.00 FEET.

****************************************************************************
  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.) =    8.18
  RAINFALL INTENSITY(INCH/HR) =   4.56
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.22
  TOTAL STREAM AREA(ACRES) =       1.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.00

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       14.15    8.19    4.561  0.42( 0.04) 0.10       3.5       1.00
      2        5.00    8.18    4.565  0.42( 0.04) 0.10       1.2       4.00

  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       19.15    8.18    4.565  0.42( 0.04) 0.10       4.7       4.00
      2       19.15    8.19    4.561  0.42( 0.04) 0.10       4.7       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      19.15    Tc(MIN.) =     8.19
  EFFECTIVE AREA(ACRES) =       4.70   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.7
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1615.30  DOWNSTREAM(FEET) =  1614.60
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.93
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.15
```

```
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    8.34
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =     849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      9.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1614.60  DOWNSTREAM ELEVATION(FEET) = 1613.70
  STREET LENGTH(FEET) =   183.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      19.67
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.68
    HALFSTREET FLOOD WIDTH(FEET) =   27.63
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.80
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.89
  STREET FLOW TRAVEL TIME(MIN.) =   1.09   Tc(MIN.) =    9.43
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.163
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.28      0.42     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.28      SUBAREA RUNOFF(CFS) =    1.04
  EFFECTIVE AREA(ACRES) =      4.98    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.0        PEAK FLOW RATE(CFS) =      19.15
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.67   HALFSTREET FLOOD WIDTH(FEET) =  26.51
  FLOW VELOCITY(FEET/SEC.) =  2.79   DEPTH*VELOCITY(FT*FT/SEC.) =   1.87
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =    1032.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.43
```

```
 RAINFALL INTENSITY(INCH/HR) =   4.16
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       4.98
 TOTAL STREAM AREA(ACRES) =       4.98
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      19.15

****************************************************************************
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   776.00
 ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1613.70

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.384
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.028
 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.)
 NATURAL POOR COVER
 "BARREN"                    B        3.92      0.11     1.000    97   15.38
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.11
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =     10.31
 TOTAL AREA(ACRES) =      3.92   PEAK FLOW RATE(CFS) =     10.31

****************************************************************************
 FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   15.38
 RAINFALL INTENSITY(INCH/HR) =   3.03
 AREA-AVERAGED Fm(INCH/HR) =  0.11
 AREA-AVERAGED Fp(INCH/HR) =  0.11
 AREA-AVERAGED Ap =  1.00
 EFFECTIVE STREAM AREA(ACRES) =       3.92
 TOTAL STREAM AREA(ACRES) =       3.92
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.31

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       19.15    9.42    4.166  0.42( 0.04) 0.10       5.0       4.00
     1       19.15    9.43    4.163  0.42( 0.04) 0.10       5.0       1.00
     2       10.31   15.38    3.028  0.11( 0.11) 1.00       3.9       8.00

 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       27.91    9.42    4.166  0.16( 0.06) 0.39       7.4       4.00
     2       27.92    9.43    4.163  0.16( 0.06) 0.39       7.4       1.00
     3       24.18   15.38    3.028  0.14( 0.07) 0.50       8.9       8.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      27.92    Tc(MIN.) =     9.43
 EFFECTIVE AREA(ACRES) =       7.38   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.16  AREA-AVERAGED Ap =  0.39
 TOTAL AREA(ACRES) =        8.9
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      9.00 =    1032.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      9.00 TO NODE     12.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1613.70  DOWNSTREAM ELEVATION(FEET) = 1612.50
 STREET LENGTH(FEET) =   266.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 36.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.015
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      30.98
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.78
   HALFSTREET FLOOD WIDTH(FEET) =   48.30
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.79
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.18
 STREET FLOW TRAVEL TIME(MIN.) =   1.59   Tc(MIN.) =   11.02
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.762
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL POOR COVER
 "BARREN"                    B        1.86      0.11     1.000    97
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.11
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA AREA(ACRES) =    1.86      SUBAREA RUNOFF(CFS) =    6.12
 EFFECTIVE AREA(ACRES) =      9.24    AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.14  AREA-AVERAGED Ap =  0.52
 TOTAL AREA(ACRES) =       10.8        PEAK FLOW RATE(CFS) =      30.69
```

```
 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.78   HALFSTREET FLOOD WIDTH(FEET) =  47.85
 FLOW VELOCITY(FEET/SEC.) =  2.79   DEPTH*VELOCITY(FT*FT/SEC.) =   2.18
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE     12.00 =    1298.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.02
 RAINFALL INTENSITY(INCH/HR) =   3.76
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.14
 AREA-AVERAGED Ap =  0.52
 EFFECTIVE STREAM AREA(ACRES) =       9.24
 TOTAL STREAM AREA(ACRES) =      10.76
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      30.69

****************************************************************************
 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) =   707.00
 ELEVATION DATA: UPSTREAM(FEET) =   1644.70  DOWNSTREAM(FEET) =   1630.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.100
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.259
 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                 B        3.77      0.42     0.100    76    9.10
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =     14.31
 TOTAL AREA(ACRES) =      3.77   PEAK FLOW RATE(CFS) =     14.31

****************************************************************************
 FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1630.00  DOWNSTREAM ELEVATION(FEET) = 1612.50
 STREET LENGTH(FEET) =   692.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.50
 INSIDE STREET CROSSFALL(DECIMAL) =  0.015
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.026
```

```
 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      16.59
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.54
   HALFSTREET FLOOD WIDTH(FEET) =   17.36
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.07
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.74
 STREET FLOW TRAVEL TIME(MIN.) =   2.28   Tc(MIN.) =   11.38
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.684
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 B        1.39      0.42     0.100    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    4.56
 EFFECTIVE AREA(ACRES) =      5.16    AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =      16.91

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.54   HALFSTREET FLOOD WIDTH(FEET) =  17.53
 FLOW VELOCITY(FEET/SEC.) =  5.10   DEPTH*VELOCITY(FT*FT/SEC.) =   2.77
 LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1399.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.38
 RAINFALL INTENSITY(INCH/HR) =   3.68
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       5.16
 TOTAL STREAM AREA(ACRES) =       5.16
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      16.91

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       30.69   11.01    3.764  0.14( 0.07) 0.52       9.2       4.00
     1       30.69   11.02    3.762  0.14( 0.07) 0.52       9.2       1.00
     1       26.76   16.98    2.840  0.13( 0.08) 0.58      10.8       8.00
     2       16.91   11.38    3.684  0.42( 0.04) 0.10       5.2      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       47.41   11.01    3.764  0.17( 0.06) 0.37      14.2       4.00
      2       47.42   11.02    3.762  0.17( 0.06) 0.37      14.2       1.00
      3       47.37   11.38    3.684  0.17( 0.06) 0.37      14.5      10.00
      4       39.75   16.98    2.840  0.15( 0.07) 0.43      15.9       8.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      47.42    Tc(MIN.) =    11.02
  EFFECTIVE AREA(ACRES) =      14.24   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.17  AREA-AVERAGED Ap =  0.37
  TOTAL AREA(ACRES) =       15.9
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1399.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       15.9  TC(MIN.) =     11.02
  EFFECTIVE AREA(ACRES) =     14.24  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.17  AREA-AVERAGED Ap = 0.369
  PEAK FLOW RATE(CFS)   =      47.42

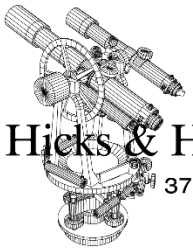
  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       47.41   11.01    3.764  0.17( 0.06) 0.37      14.2       4.00
      2       47.42   11.02    3.762  0.17( 0.06) 0.37      14.2       1.00
      3       47.37   11.38    3.684  0.17( 0.06) 0.37      14.5      10.00
      4       39.75   16.98    2.840  0.15( 0.07) 0.43      15.9       8.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

PROPOSED HYDROLOGY
2-YEAR RUNOFF



Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

```
**************************************************************************
            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 1302

                            Analysis prepared by:

                            Hicks & Hartwick, Inc.
                        37 East Olive Avenue, Suite C
                              Redlands, CA 92373
                                (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301HPA2.DAT
  TIME/DATE OF STUDY: 09:57 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.4700

  *ANTECEDENT MOISTURE CONDITION (AMC) I 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 0.0312 0.167 0.0150
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0312 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   0.67    2.00 0.0312 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) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.105
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.727
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        1.74      0.94     0.100    36    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.56
  TOTAL AREA(ACRES) =      1.74   PEAK FLOW RATE(CFS) =      2.56

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.50
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.32
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.56
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    8.21
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =     662.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      6.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1613.50  DOWNSTREAM(FEET) =   1613.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   117.00   CHANNEL SLOPE =  0.0026
  CHANNEL BASE(FEET) =    8.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.520
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.74      0.94     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.68
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.19
  AVERAGE FLOW DEPTH(FEET) =   0.36   TRAVEL TIME(MIN.) =   1.64
  Tc(MIN.) =    9.86
  SUBAREA AREA(ACRES) =     1.74       SUBAREA RUNOFF(CFS) =    2.23
  EFFECTIVE AREA(ACRES) =      3.48     AREA-AVERAGED Fm(INCH/HR) =   0.09
  AREA-AVERAGED Fp(INCH/HR) =   0.94  AREA-AVERAGED Ap =   0.10
```

```
  TOTAL AREA(ACRES) =        3.5         PEAK FLOW RATE(CFS) =       4.47

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.40   FLOW VELOCITY(FEET/SEC.) =   1.27
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  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.) =    9.86
  RAINFALL INTENSITY(INCH/HR) =   1.52
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       3.48
  TOTAL STREAM AREA(ACRES) =       3.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.47

****************************************************************************
  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) =   620.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.097
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.728
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        1.22      0.94     0.100    36    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.79
  TOTAL AREA(ACRES) =      1.22   PEAK FLOW RATE(CFS) =      1.79

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.20
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.28
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       1.79
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =    8.21
  LONGEST FLOWPATH FROM NODE      4.00 TO NODE      6.00 =     662.00 FEET.

****************************************************************************
  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.) =    8.21
  RAINFALL INTENSITY(INCH/HR) =   1.71
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.22
  TOTAL STREAM AREA(ACRES) =       1.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.79

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.47    9.86    1.520  0.94( 0.09) 0.10       3.5       1.00
      2        1.79    8.21    1.712  0.94( 0.09) 0.10       1.2       4.00

  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        6.01    8.21    1.712  0.94( 0.09) 0.10       4.1       4.00
      2        6.05    9.86    1.520  0.94( 0.09) 0.10       4.7       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.05    Tc(MIN.) =     9.86
  EFFECTIVE AREA(ACRES) =       4.70   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.7
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1615.30  DOWNSTREAM(FEET) =  1614.60
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.05
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       6.05
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =   10.05
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =     849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE     13.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1614.60  DOWNSTREAM ELEVATION(FEET) = 1612.90
  STREET LENGTH(FEET) =   370.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.32
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.49
    HALFSTREET FLOOD WIDTH(FEET) =   17.05
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.09
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.03
  STREET FLOW TRAVEL TIME(MIN.) =   2.95   Tc(MIN.) =   13.00
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.270
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.52      0.94     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    0.55
  EFFECTIVE AREA(ACRES) =      5.22    AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =       6.05
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  16.77
  FLOW VELOCITY(FEET/SEC.) =  2.06   DEPTH*VELOCITY(FT*FT/SEC.) =   1.00
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

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

```
 FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   476.00
 ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1621.18

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.232
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.859
 SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 B        2.44      0.94     0.100    36    7.23
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      3.88
 TOTAL AREA(ACRES) =      2.44   PEAK FLOW RATE(CFS) =      3.88

****************************************************************************
 FLOW PROCESS FROM NODE      9.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
 FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.41
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.88
 PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    7.68
 LONGEST FLOWPATH FROM NODE      8.00 TO NODE     12.00 =     621.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.68
 RAINFALL INTENSITY(INCH/HR) =   1.79
 AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       2.44
 TOTAL STREAM AREA(ACRES) =       2.44
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.88

****************************************************************************
 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) =   459.00
  ELEVATION DATA: UPSTREAM(FEET) =   1631.20  DOWNSTREAM(FEET) =   1621.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.582
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.803
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        2.47      0.94     0.100    36    7.58
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.80
  TOTAL AREA(ACRES) =      2.47   PEAK FLOW RATE(CFS) =      3.80

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.38
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.80
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    8.03
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     604.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.03
  RAINFALL INTENSITY(INCH/HR) =   1.74
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.47
  TOTAL STREAM AREA(ACRES) =       2.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.80

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.88    7.68    1.788  0.94( 0.09) 0.10       2.4       8.00
```

```
     2        3.80    8.03    1.737  0.94( 0.09) 0.10       2.5      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        7.62    7.68    1.788  0.94( 0.09) 0.10        4.8       8.00
      2        7.56    8.03    1.737  0.94( 0.09) 0.10        4.9      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.62    Tc(MIN.) =     7.68
  EFFECTIVE AREA(ACRES) =       4.80   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.9
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     12.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1617.73  DOWNSTREAM(FEET) =  1612.90
  FLOW LENGTH(FEET) =   532.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.13
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.62
  PIPE TRAVEL TIME(MIN.) =   1.45    Tc(MIN.) =    9.13
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     13.00 =    1153.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.13
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.599
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.46      0.94     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.46      SUBAREA RUNOFF(CFS) =    1.98
  EFFECTIVE AREA(ACRES) =      6.26   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.4       PEAK FLOW RATE(CFS) =       8.48

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
```

```
==============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM        Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        8.48    9.13    1.599  0.94( 0.09) 0.10        6.3       8.00
      2        8.40    9.48    1.559  0.94( 0.09) 0.10        6.4      10.00
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     13.00 =    1153.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM        Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        6.01   11.35    1.387  0.94( 0.09) 0.10        4.6       4.00
      2        6.05   13.00    1.270  0.94( 0.09) 0.10        5.2       1.00
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM        Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       14.10    9.13    1.599  0.94( 0.09) 0.10       10.0       8.00
      2       14.09    9.48    1.559  0.94( 0.09) 0.10       10.2      10.00
      3       13.43   11.35    1.387  0.94( 0.09) 0.10       11.0       4.00
      4       12.79   13.00    1.270  0.94( 0.09) 0.10       11.6       1.00
    TOTAL AREA(ACRES) =        11.6

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       14.10  Tc(MIN.) =    9.126
  EFFECTIVE AREA(ACRES) =      9.99  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       11.6
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     16.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) = 1612.90  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =    78.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.16
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.61
    HALFSTREET FLOOD WIDTH(FEET) =   23.05
```

```
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.64
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.60
 STREET FLOW TRAVEL TIME(MIN.) =   0.49   Tc(MIN.) =    9.62
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.545
 SUBAREA LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 B        0.08      0.94     0.100    36
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    0.08      SUBAREA RUNOFF(CFS) =    0.10
 EFFECTIVE AREA(ACRES) =     10.07    AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       11.7        PEAK FLOW RATE(CFS) =      14.10
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.61   HALFSTREET FLOOD WIDTH(FEET) =  23.05
 FLOW VELOCITY(FEET/SEC.) =  2.63   DEPTH*VELOCITY(FT*FT/SEC.) =   1.60
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE     16.00 =    1297.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.62
 RAINFALL INTENSITY(INCH/HR) =   1.54
 AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =      10.07
 TOTAL STREAM AREA(ACRES) =      11.67
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      14.10

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     15.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   707.00
 ELEVATION DATA: UPSTREAM(FEET) =   1644.70  DOWNSTREAM(FEET) =   1630.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.100
 *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.601
 SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 COMMERCIAL                 B        3.77      0.94     0.100    36    9.10
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
```

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  SUBAREA RUNOFF(CFS) =      5.11
  TOTAL AREA(ACRES) =      3.77   PEAK FLOW RATE(CFS) =      5.11

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1630.00  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   698.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.026

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.40
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.39
    HALFSTREET FLOOD WIDTH(FEET) =    9.40
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.10
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.59
  STREET FLOW TRAVEL TIME(MIN.) =   2.83   Tc(MIN.) =   11.93
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.343
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.50      0.94     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    0.56
  EFFECTIVE AREA(ACRES) =      4.27    AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.3        PEAK FLOW RATE(CFS) =       5.11
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =   9.20
  FLOW VELOCITY(FEET/SEC.) =  4.04   DEPTH*VELOCITY(FT*FT/SEC.) =   1.55
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     16.00 =    1405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
 TIME OF CONCENTRATION(MIN.) =   11.93
 RAINFALL INTENSITY(INCH/HR) =   1.34
 AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       4.27
 TOTAL STREAM AREA(ACRES) =       4.27
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.11

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       14.10    9.62    1.545  0.94( 0.09) 0.10      10.1       8.00
     1       14.09    9.97    1.509  0.94( 0.09) 0.10      10.3      10.00
     1       13.43   11.85    1.349  0.94( 0.09) 0.10      11.1       4.00
     1       12.79   13.51    1.239  0.94( 0.09) 0.10      11.7       1.00
     2        5.11   11.93    1.343  0.94( 0.09) 0.10       4.3      14.00

 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       18.89    9.62    1.545  0.94( 0.09) 0.10      13.5       8.00
     2       18.93    9.97    1.509  0.94( 0.09) 0.10      13.9      10.00
     3       18.53   11.85    1.349  0.94( 0.09) 0.10      15.3       4.00
     4       18.51   11.93    1.343  0.94( 0.09) 0.10      15.4      14.00
     5       17.48   13.51    1.239  0.94( 0.09) 0.10      15.9       1.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      18.93    Tc(MIN.) =     9.97
 EFFECTIVE AREA(ACRES) =      13.89   AREA-AVERAGED Fm(INCH/HR) =  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       15.9
 LONGEST FLOWPATH FROM NODE     14.00 TO NODE     16.00 =    1405.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       15.9  TC(MIN.) =      9.97
 EFFECTIVE AREA(ACRES) =     13.89  AREA-AVERAGED Fm(INCH/HR)=  0.09
 AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS)   =      18.93

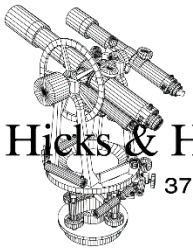
 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       18.89    9.62    1.545  0.94( 0.09) 0.10      13.5       8.00
     2       18.93    9.97    1.509  0.94( 0.09) 0.10      13.9      10.00
     3       18.53   11.85    1.349  0.94( 0.09) 0.10      15.3       4.00
     4       18.51   11.93    1.343  0.94( 0.09) 0.10      15.4      14.00
     5       17.48   13.51    1.239  0.94( 0.09) 0.10      15.9       1.00
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

PROPOSED HYDROLOGY
10-YEAR RUNOFF



Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

```
**************************************************************************
            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 1302

                            Analysis prepared by:

                            Hicks & Hartwick, Inc.
                        37 East Olive Avenue, Suite C
                              Redlands, CA 92373
                                (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301HPAT.DAT
  TIME/DATE OF STUDY: 09:58 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.8000

  *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 0.0312 0.167 0.0150
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0312 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   0.67    2.00 0.0312 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) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.105
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.939
  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                 B        1.74      0.75     0.100    56    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      4.49
  TOTAL AREA(ACRES) =      1.74   PEAK FLOW RATE(CFS) =      4.49

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.50
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.41
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.49
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    8.20
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =     662.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      6.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1613.50  DOWNSTREAM(FEET) =   1613.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   117.00   CHANNEL SLOPE =  0.0026
  CHANNEL BASE(FEET) =    8.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.643
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.74      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.50
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.45
  AVERAGE FLOW DEPTH(FEET) =   0.50   TRAVEL TIME(MIN.) =   1.35
  Tc(MIN.) =    9.54
  SUBAREA AREA(ACRES) =     1.74       SUBAREA RUNOFF(CFS) =    4.02
  EFFECTIVE AREA(ACRES) =      3.48     AREA-AVERAGED Fm(INCH/HR) =   0.07
  AREA-AVERAGED Fp(INCH/HR) =   0.75  AREA-AVERAGED Ap =   0.10
```

```
 TOTAL AREA(ACRES) =        3.5         PEAK FLOW RATE(CFS) =       8.04

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.57   FLOW VELOCITY(FEET/SEC.) =   1.55
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
 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.) =    9.54
 RAINFALL INTENSITY(INCH/HR) =   2.64
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       3.48
 TOTAL STREAM AREA(ACRES) =       3.48
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.04

****************************************************************************
 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) =   620.00
 ELEVATION DATA: UPSTREAM(FEET) =   1635.78  DOWNSTREAM(FEET) =   1618.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.097
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.941
 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                 B        1.22      0.75     0.100    56    8.10
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      3.15
 TOTAL AREA(ACRES) =      1.22   PEAK FLOW RATE(CFS) =      3.15

****************************************************************************
 FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.20
 FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.39
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =       3.15
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =    8.19
  LONGEST FLOWPATH FROM NODE      4.00 TO NODE      6.00 =     662.00 FEET.

****************************************************************************
  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.) =    8.19
  RAINFALL INTENSITY(INCH/HR) =   2.92
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.22
  TOTAL STREAM AREA(ACRES) =       1.22
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.15

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        8.04    9.54    2.643  0.75( 0.07) 0.10       3.5       1.00
      2        3.15    8.19    2.919  0.75( 0.07) 0.10       1.2       4.00

  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       10.79    8.19    2.919  0.75( 0.07) 0.10       4.2       4.00
      2       10.88    9.54    2.643  0.75( 0.07) 0.10       4.7       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.88    Tc(MIN.) =     9.54
  EFFECTIVE AREA(ACRES) =       4.70   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.7
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1615.30  DOWNSTREAM(FEET) =  1614.60
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.98
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.88
```

```
  PIPE TRAVEL TIME(MIN.) =   0.17    Tc(MIN.) =    9.71
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =     849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE     13.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1614.60  DOWNSTREAM ELEVATION(FEET) = 1612.90
  STREET LENGTH(FEET) =   370.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.39
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.58
    HALFSTREET FLOOD WIDTH(FEET) =   21.64
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.39
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.39
  STREET FLOW TRAVEL TIME(MIN.) =   2.57   Tc(MIN.) =   12.29
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.243
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.52      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    1.01
  EFFECTIVE AREA(ACRES) =      5.22    AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =      10.88
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  21.27
  FLOW VELOCITY(FEET/SEC.) =  2.37   DEPTH*VELOCITY(FT*FT/SEC.) =   1.36
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  21
```

```
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   476.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1621.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.232
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.165
  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                 B        2.44      0.75     0.100    56    7.23
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      6.79
  TOTAL AREA(ACRES) =      2.44   PEAK FLOW RATE(CFS) =      6.79

************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE     12.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.22
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.79
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    7.62
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     12.00 =     621.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.62
  RAINFALL INTENSITY(INCH/HR) =   3.06
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.44
  TOTAL STREAM AREA(ACRES) =       2.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.79

************************************************************************
  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) =   459.00
  ELEVATION DATA: UPSTREAM(FEET) =   1631.20  DOWNSTREAM(FEET) =   1621.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.582
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.069
  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                 B        2.47      0.75     0.100    56    7.58
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      6.66
  TOTAL AREA(ACRES) =      2.47   PEAK FLOW RATE(CFS) =      6.66

**************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  31
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.19
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.66
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    7.97
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     604.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.97
  RAINFALL INTENSITY(INCH/HR) =   2.97
  AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.47
  TOTAL STREAM AREA(ACRES) =       2.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.66

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        6.79    7.62    3.059  0.75( 0.07) 0.10       2.4       8.00
      2        6.66    7.97    2.971  0.75( 0.07) 0.10       2.5      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       13.34    7.62    3.059  0.75( 0.07) 0.10       4.8       8.00
      2       13.24    7.97    2.971  0.75( 0.07) 0.10       4.9      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.34    Tc(MIN.) =     7.62
  EFFECTIVE AREA(ACRES) =       4.80   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.9
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     12.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1617.73  DOWNSTREAM(FEET) =  1612.90
  FLOW LENGTH(FEET) =   532.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      13.34
  PIPE TRAVEL TIME(MIN.) =   1.27    Tc(MIN.) =    8.90
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     13.00 =    1153.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.90
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.766
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.46      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.46      SUBAREA RUNOFF(CFS) =    3.54
  EFFECTIVE AREA(ACRES) =      6.26   AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.4       PEAK FLOW RATE(CFS) =      15.17

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
```

```
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       15.17    8.90    2.766  0.75( 0.07) 0.10       6.3       8.00
    2       15.04    9.25    2.697  0.75( 0.07) 0.10       6.4      10.00
LONGEST FLOWPATH FROM NODE      8.00 TO NODE     13.00 =    1153.00 FEET.

** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       10.79   10.92    2.421  0.75( 0.07) 0.10       4.7       4.00
    2       10.88   12.29    2.243  0.75( 0.07) 0.10       5.2       1.00
LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       25.25    8.90    2.766  0.75( 0.07) 0.10      10.1       8.00
    2       25.25    9.25    2.697  0.75( 0.07) 0.10      10.4      10.00
    3       24.24   10.92    2.421  0.75( 0.07) 0.10      11.1       4.00
    4       23.31   12.29    2.243  0.75( 0.07) 0.10      11.6       1.00
  TOTAL AREA(ACRES) =        11.6

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       25.25  Tc(MIN.) =    8.896
EFFECTIVE AREA(ACRES) =     10.11  AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =       11.6
LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     13.00 TO NODE     16.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1612.90  DOWNSTREAM ELEVATION(FEET) = 1612.50
 STREET LENGTH(FEET) =    78.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 36.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.015
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      25.35
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.72
   HALFSTREET FLOOD WIDTH(FEET) =   37.07
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.94
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.13
 STREET FLOW TRAVEL TIME(MIN.) =   0.44   Tc(MIN.) =    9.34
```

```
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.681
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 B        0.08      0.75     0.100    56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA AREA(ACRES) =    0.08      SUBAREA RUNOFF(CFS) =    0.19
 EFFECTIVE AREA(ACRES) =     10.19    AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       11.7        PEAK FLOW RATE(CFS) =      25.25
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.72   HALFSTREET FLOOD WIDTH(FEET) =  37.07
 FLOW VELOCITY(FEET/SEC.) =  2.93   DEPTH*VELOCITY(FT*FT/SEC.) =   2.12
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE     16.00 =    1297.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.34
 RAINFALL INTENSITY(INCH/HR) =   2.68
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =      10.19
 TOTAL STREAM AREA(ACRES) =      11.67
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      25.25

****************************************************************************
 FLOW PROCESS FROM NODE     14.00 TO NODE     15.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   707.00
 ELEVATION DATA: UPSTREAM(FEET) =   1644.70  DOWNSTREAM(FEET) =   1630.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.100
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.726
 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                 B        3.77      0.75     0.100    56    9.10
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
 SUBAREA RUNOFF(CFS) =      8.99
 TOTAL AREA(ACRES) =      3.77   PEAK FLOW RATE(CFS) =      8.99
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1630.00  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   698.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.026

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.50
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   12.03
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.66
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.13
  STREET FLOW TRAVEL TIME(MIN.) =   2.49   Tc(MIN.) =   11.59
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.329
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.50      0.75     0.100    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    1.01
  EFFECTIVE AREA(ACRES) =      4.27    AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.3        PEAK FLOW RATE(CFS) =       8.99
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  11.74
  FLOW VELOCITY(FEET/SEC.) =  4.61   DEPTH*VELOCITY(FT*FT/SEC.) =   2.07
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     16.00 =    1405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.59
  RAINFALL INTENSITY(INCH/HR) =   2.33
  AREA-AVERAGED Fm(INCH/HR) =  0.07
```

```
 AREA-AVERAGED Fp(INCH/HR) =  0.75
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       4.27
 TOTAL STREAM AREA(ACRES) =       4.27
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.99

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       25.25    9.34    2.681  0.75( 0.07) 0.10      10.2       8.00
     1       25.25    9.69    2.617  0.75( 0.07) 0.10      10.5      10.00
     1       24.24   11.37    2.359  0.75( 0.07) 0.10      11.2       4.00
     1       23.31   12.73    2.191  0.75( 0.07) 0.10      11.7       1.00
     2        8.99   11.59    2.329  0.75( 0.07) 0.10       4.3      14.00

 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       33.63    9.34    2.681  0.75( 0.07) 0.10      13.6       8.00
     2       33.73    9.69    2.617  0.75( 0.07) 0.10      14.0      10.00
     3       33.18   11.37    2.359  0.75( 0.07) 0.10      15.4       4.00
     4       33.08   11.59    2.329  0.75( 0.07) 0.10      15.5      14.00
     5       31.76   12.73    2.191  0.75( 0.07) 0.10      15.9       1.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      33.73    Tc(MIN.) =     9.69
 EFFECTIVE AREA(ACRES) =      14.02   AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       15.9
 LONGEST FLOWPATH FROM NODE     14.00 TO NODE     16.00 =    1405.00 FEET.
================================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       15.9  TC(MIN.) =      9.69
 EFFECTIVE AREA(ACRES) =     14.02  AREA-AVERAGED Fm(INCH/HR)=  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS)   =      33.73

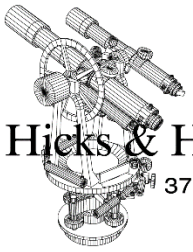
 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       33.63    9.34    2.681  0.75( 0.07) 0.10      13.6       8.00
     2       33.73    9.69    2.617  0.75( 0.07) 0.10      14.0      10.00
     3       33.18   11.37    2.359  0.75( 0.07) 0.10      15.4       4.00
     4       33.08   11.59    2.329  0.75( 0.07) 0.10      15.5      14.00
     5       31.76   12.73    2.191  0.75( 0.07) 0.10      15.9       1.00
================================================================================
================================================================================
 END OF RATIONAL METHOD ANALYSIS
```

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

PROPOSED HYDROLOGY
100-YEAR RUNOFF



Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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             Ver. 22.0  Release Date: 07/01/2015  License ID 1302

                              Analysis prepared by:

                                  Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                    Redlands, CA 92373
                                    (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301HPAH.DAT
  TIME/DATE OF STUDY: 09:58 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

  *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 0.0312 0.167 0.0150
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0312 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   0.67    2.00 0.0312 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) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.105
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.592
  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                 B        1.74      0.42     0.100    76    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      7.13
  TOTAL AREA(ACRES) =      1.74   PEAK FLOW RATE(CFS) =      7.13

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.50
  FLOW LENGTH(FEET) =    41.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.37
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.13
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    8.19
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =     662.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      6.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1613.50  DOWNSTREAM(FEET) =   1613.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   117.00   CHANNEL SLOPE =  0.0026
  CHANNEL BASE(FEET) =    8.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.191
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.74      0.42     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.38
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.71
  AVERAGE FLOW DEPTH(FEET) =   0.65   TRAVEL TIME(MIN.) =   1.14
  Tc(MIN.) =    9.33
  SUBAREA AREA(ACRES) =     1.74       SUBAREA RUNOFF(CFS) =    6.50
  EFFECTIVE AREA(ACRES) =      3.48     AREA-AVERAGED Fm(INCH/HR) =   0.04
  AREA-AVERAGED Fp(INCH/HR) =   0.42  AREA-AVERAGED Ap =   0.10
```

```
  TOTAL AREA(ACRES) =        3.5         PEAK FLOW RATE(CFS) =      12.99

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.74   FLOW VELOCITY(FEET/SEC.) =   1.84
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
  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.) =    9.33
  RAINFALL INTENSITY(INCH/HR) =   4.19
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       3.48
  TOTAL STREAM AREA(ACRES) =       3.48
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.99

****************************************************************************
  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) =   620.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.78  DOWNSTREAM(FEET) =   1618.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.097
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.595
  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                 B        1.22      0.42      0.100    76    8.10
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      5.00
  TOTAL AREA(ACRES) =      1.22   PEAK FLOW RATE(CFS) =      5.00

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1614.37  DOWNSTREAM(FEET) =  1613.20
  FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.42
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =       5.00
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    8.18
 LONGEST FLOWPATH FROM NODE      4.00 TO NODE      6.00 =     662.00 FEET.

****************************************************************************
 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.) =    8.18
 RAINFALL INTENSITY(INCH/HR) =   4.56
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       1.22
 TOTAL STREAM AREA(ACRES) =       1.22
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.00

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       12.99    9.33    4.191  0.42( 0.04) 0.10       3.5       1.00
     2        5.00    8.18    4.565  0.42( 0.04) 0.10       1.2       4.00

 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       17.42    8.18    4.565  0.42( 0.04) 0.10       4.3       4.00
     2       17.58    9.33    4.191  0.42( 0.04) 0.10       4.7       1.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      17.58    Tc(MIN.) =     9.33
 EFFECTIVE AREA(ACRES) =       4.70   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =        4.7
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =     779.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1615.30  DOWNSTREAM(FEET) =  1614.60
 FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.82
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      17.58
```

```
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    9.48
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      7.00 =     849.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE     13.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1614.60  DOWNSTREAM ELEVATION(FEET) = 1612.90
  STREET LENGTH(FEET) =   370.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      18.41
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.67
    HALFSTREET FLOOD WIDTH(FEET) =   26.29
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.70
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.80
  STREET FLOW TRAVEL TIME(MIN.) =   2.29   Tc(MIN.) =   11.76
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.604
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.52      0.42     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    1.67
  EFFECTIVE AREA(ACRES) =      5.22    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.2        PEAK FLOW RATE(CFS) =      17.58
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.66   HALFSTREET FLOOD WIDTH(FEET) =  25.58
  FLOW VELOCITY(FEET/SEC.) =  2.68   DEPTH*VELOCITY(FT*FT/SEC.) =   1.76
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   476.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1621.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.232
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.945
  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                 B        2.44      0.42     0.100    76    7.23
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     10.77
  TOTAL AREA(ACRES) =      2.44   PEAK FLOW RATE(CFS) =     10.77

****************************************************************************
  FLOW PROCESS FROM NODE      9.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.77
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =    7.58
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     12.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.58
  RAINFALL INTENSITY(INCH/HR) =   4.80
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.44
  TOTAL STREAM AREA(ACRES) =       2.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.77

****************************************************************************
  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) =   459.00
  ELEVATION DATA: UPSTREAM(FEET) =   1631.20  DOWNSTREAM(FEET) =   1621.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.582
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.796
  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                 B        2.47      0.42     0.100    76    7.58
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     10.57
  TOTAL AREA(ACRES) =      2.47   PEAK FLOW RATE(CFS) =     10.57

**************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  31
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.57
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =    7.93
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =     604.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.93
  RAINFALL INTENSITY(INCH/HR) =   4.66
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.47
  TOTAL STREAM AREA(ACRES) =       2.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.57

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       10.77    7.58    4.797  0.42( 0.04) 0.10       2.4       8.00
      2       10.57    7.93    4.658  0.42( 0.04) 0.10       2.5      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       21.17    7.58    4.797  0.42( 0.04) 0.10       4.8       8.00
      2       21.02    7.93    4.658  0.42( 0.04) 0.10       4.9      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      21.17    Tc(MIN.) =     7.58
  EFFECTIVE AREA(ACRES) =       4.80   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.9
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     12.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1617.73  DOWNSTREAM(FEET) =  1612.90
  FLOW LENGTH(FEET) =   532.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.94
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.17
  PIPE TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =    8.70
  LONGEST FLOWPATH FROM NODE      8.00 TO NODE     13.00 =    1153.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.70
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.387
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.46      0.42     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.46      SUBAREA RUNOFF(CFS) =    5.71
  EFFECTIVE AREA(ACRES) =      6.26   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.4       PEAK FLOW RATE(CFS) =      24.48

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     13.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
```

```
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       24.48    8.70    4.387  0.42( 0.04) 0.10       6.3       8.00
    2       24.20    9.09    4.263  0.42( 0.04) 0.10       6.4      10.00
LONGEST FLOWPATH FROM NODE      8.00 TO NODE     13.00 =    1153.00 FEET.

** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       17.42   10.62    3.853  0.42( 0.04) 0.10       4.8       4.00
    2       17.58   11.76    3.604  0.42( 0.04) 0.10       5.2       1.00
LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

** PEAK FLOW RATE TABLE **
 STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       40.74    8.70    4.387  0.42( 0.04) 0.10      10.2       8.00
    2       40.71    9.09    4.263  0.42( 0.04) 0.10      10.5      10.00
    3       39.26   10.62    3.853  0.42( 0.04) 0.10      11.2       4.00
    4       38.00   11.76    3.604  0.42( 0.04) 0.10      11.6       1.00
  TOTAL AREA(ACRES) =        11.6

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       40.74  Tc(MIN.) =    8.697
EFFECTIVE AREA(ACRES) =     10.18  AREA-AVERAGED Fm(INCH/HR) =  0.04
AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
TOTAL AREA(ACRES) =       11.6
LONGEST FLOWPATH FROM NODE      1.00 TO NODE     13.00 =    1219.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     13.00 TO NODE     16.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) = 1612.90  DOWNSTREAM ELEVATION(FEET) = 1612.50
STREET LENGTH(FEET) =    78.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 36.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.015
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      40.90
  ***STREET FLOW SPLITS OVER STREET-CROWN***
  FULL DEPTH(FEET) =    0.82   FLOOD WIDTH(FEET) =   54.70
  FULL HALF-STREET VELOCITY(FEET/SEC.) =    2.99
  SPLIT DEPTH(FEET) =    0.38   SPLIT FLOOD WIDTH(FEET) =   11.42
  SPLIT FLOW(CFS) =    2.58   SPLIT VELOCITY(FEET/SEC.) =    1.76
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
```

```
    STREET FLOW DEPTH(FEET) =  0.82
    HALFSTREET FLOOD WIDTH(FEET) =   54.70
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.99
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.44
  STREET FLOW TRAVEL TIME(MIN.) =   0.44   Tc(MIN.) =    9.13
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.250
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.08      0.42     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.08      SUBAREA RUNOFF(CFS) =    0.30
  EFFECTIVE AREA(ACRES) =     10.26    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       11.7        PEAK FLOW RATE(CFS) =      40.74
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.82   HALFSTREET FLOOD WIDTH(FEET) =  54.70
  FLOW VELOCITY(FEET/SEC.) =  2.99   DEPTH*VELOCITY(FT*FT/SEC.) =   2.44
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE     16.00 =    1297.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.13
  RAINFALL INTENSITY(INCH/HR) =   4.25
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =      10.26
  TOTAL STREAM AREA(ACRES) =      11.67
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      40.74

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     15.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   707.00
  ELEVATION DATA: UPSTREAM(FEET) =   1644.70  DOWNSTREAM(FEET) =   1630.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.100
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.259
  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                 B        3.77      0.42     0.100    76    9.10
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     14.31
  TOTAL AREA(ACRES) =      3.77   PEAK FLOW RATE(CFS) =     14.31

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     16.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1630.00  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   698.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.50
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.026

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      15.12
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.53
    HALFSTREET FLOOD WIDTH(FEET) =   16.41
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.99
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.63
  STREET FLOW TRAVEL TIME(MIN.) =   2.33   Tc(MIN.) =   11.43
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.672
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.50      0.42     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    1.63
  EFFECTIVE AREA(ACRES) =      4.27    AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.3        PEAK FLOW RATE(CFS) =      14.31
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  15.81
  FLOW VELOCITY(FEET/SEC.) =  4.95   DEPTH*VELOCITY(FT*FT/SEC.) =   2.56
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     16.00 =    1405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.43
 RAINFALL INTENSITY(INCH/HR) =   3.67
 AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =       4.27
 TOTAL STREAM AREA(ACRES) =       4.27
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      14.31

 ** CONFLUENCE DATA **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       40.74    9.13    4.250  0.42( 0.04) 0.10      10.3       8.00
     1       40.71    9.52    4.135  0.42( 0.04) 0.10      10.6      10.00
     1       39.26   11.05    3.753  0.42( 0.04) 0.10      11.2       4.00
     1       38.00   12.20    3.520  0.42( 0.04) 0.10      11.7       1.00
     2       14.31   11.43    3.672  0.42( 0.04) 0.10       4.3      14.00

 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       53.99    9.13    4.250  0.42( 0.04) 0.10      13.7       8.00
     2       54.15    9.52    4.135  0.42( 0.04) 0.10      14.1      10.00
     3       53.41   11.05    3.753  0.42( 0.04) 0.10      15.4       4.00
     4       53.15   11.43    3.672  0.42( 0.04) 0.10      15.7      14.00
     5       51.71   12.20    3.520  0.42( 0.04) 0.10      15.9       1.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      54.15    Tc(MIN.) =     9.52
 EFFECTIVE AREA(ACRES) =      14.11   AREA-AVERAGED Fm(INCH/HR) =  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =       15.9
 LONGEST FLOWPATH FROM NODE     14.00 TO NODE     16.00 =    1405.00 FEET.
================================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       15.9  TC(MIN.) =      9.52
 EFFECTIVE AREA(ACRES) =     14.11  AREA-AVERAGED Fm(INCH/HR)=  0.04
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS)   =      54.15

 ** PEAK FLOW RATE TABLE **
  STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
  NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
     1       53.99    9.13    4.250  0.42( 0.04) 0.10      13.7       8.00
     2       54.15    9.52    4.135  0.42( 0.04) 0.10      14.1      10.00
     3       53.41   11.05    3.753  0.42( 0.04) 0.10      15.4       4.00
     4       53.15   11.43    3.672  0.42( 0.04) 0.10      15.7      14.00
     5       51.71   12.20    3.520  0.42( 0.04) 0.10      15.9       1.00
================================================================================
================================================================================
```

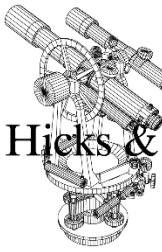
```
END OF RATIONAL METHOD ANALYSIS
```

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

SMALL AREA
UNIT HYDROGRAPH CALCULATIONS



Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

```
**************************************************************************
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             Ver. 22.0  Release Date: 07/01/2015  License ID 1302

                              Analysis prepared by:

                              Hicks & Hartwick, Inc.
                          37 East Olive Avenue, Suite C
                                Redlands, CA 92373
                                  (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301UEA2.DAT
  TIME/DATE OF STUDY: 10:13 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.4700

  *ANTECEDENT MOISTURE CONDITION (AMC) I 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
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0313 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   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) =   776.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1613.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.384
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.138
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                    B        3.87      0.50     1.000    72   15.38
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.50
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.21
  TOTAL AREA(ACRES) =      3.87   PEAK FLOW RATE(CFS) =      2.21

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1613.70  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   237.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.82
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.39
    HALFSTREET FLOOD WIDTH(FEET) =   11.89
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.79
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
  STREET FLOW TRAVEL TIME(MIN.) =   2.20   Tc(MIN.) =   17.59
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.044
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                    B        2.49      0.50     1.000    72
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.50
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    2.49      SUBAREA RUNOFF(CFS) =    1.21
  EFFECTIVE AREA(ACRES) =      6.36    AREA-AVERAGED Fm(INCH/HR) =  0.50
  AREA-AVERAGED Fp(INCH/HR) =  0.50  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        6.4        PEAK FLOW RATE(CFS) =       3.09
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  12.45
  FLOW VELOCITY(FEET/SEC.) =  1.81   DEPTH*VELOCITY(FT*FT/SEC.) =   0.73
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1013.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.4  TC(MIN.) =     17.59
  EFFECTIVE AREA(ACRES) =      6.36  AREA-AVERAGED Fm(INCH/HR)=  0.50
  AREA-AVERAGED Fp(INCH/HR) =  0.50  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =       3.09
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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            Ver. 22.0  Release Date: 07/01/2015  License ID 1302

                              Analysis prepared by:

                                  Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                    Redlands, CA 92373
                                    (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301UPA2.DAT
  TIME/DATE OF STUDY: 10:14 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.4700

  *ANTECEDENT MOISTURE CONDITION (AMC) I 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 0.0312 0.167 0.0150
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0312 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   0.67    2.00 0.0312 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) =   476.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1621.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.232
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.859
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        2.44      0.94     0.100    36    7.23
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.88
  TOTAL AREA(ACRES) =      2.44   PEAK FLOW RATE(CFS) =      3.88

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.41
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.88
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    7.68
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.68
  RAINFALL INTENSITY(INCH/HR) =   1.79
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.44
  TOTAL STREAM AREA(ACRES) =       2.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.88

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   459.00
  ELEVATION DATA: UPSTREAM(FEET) =   1631.20  DOWNSTREAM(FEET) =   1621.18
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.582
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.803
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        2.47      0.94     0.100    36    7.58
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.80
  TOTAL AREA(ACRES) =      2.47   PEAK FLOW RATE(CFS) =      3.80

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.38
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.80
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =    8.03
  LONGEST FLOWPATH FROM NODE      3.00 TO NODE      5.00 =     604.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.03
  RAINFALL INTENSITY(INCH/HR) =   1.74
  AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.47
  TOTAL STREAM AREA(ACRES) =       2.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.80

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.88    7.68    1.788  0.94( 0.09) 0.10       2.4       1.00
      2        3.80    8.03    1.737  0.94( 0.09) 0.10       2.5       3.00

  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        7.62    7.68    1.788  0.94( 0.09) 0.10       4.8       1.00
      2        7.56    8.03    1.737  0.94( 0.09) 0.10       4.9       3.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.62    Tc(MIN.) =     7.68
  EFFECTIVE AREA(ACRES) =       4.80   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.9
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1617.73  DOWNSTREAM(FEET) =  1612.90
  FLOW LENGTH(FEET) =   532.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.13
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.62
  PIPE TRAVEL TIME(MIN.) =   1.45    Tc(MIN.) =    9.13
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =    1153.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.13
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.599
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.46      0.94     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.94
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.46      SUBAREA RUNOFF(CFS) =    1.98
  EFFECTIVE AREA(ACRES) =      6.26   AREA-AVERAGED Fm(INCH/HR) =  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.4       PEAK FLOW RATE(CFS) =       8.48
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.4  TC(MIN.) =      9.13
  EFFECTIVE AREA(ACRES) =      6.26  AREA-AVERAGED Fm(INCH/HR)=  0.09
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       8.48

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
```

```
     1        8.48    9.13    1.599  0.94( 0.09) 0.10       6.3       1.00
     2        8.40    9.48    1.559  0.94( 0.09) 0.10       6.4       3.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==========================================================================
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                            Analysis prepared by:

                                Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                   Redlands, CA 92373
                                    (909) 793-2257

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:



--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.73
    TOTAL CATCHMENT AREA(ACRES) =    6.36
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.500
    LOW LOSS FRACTION = 0.267
    TIME OF CONCENTRATION(MIN.) = 17.59
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.14
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.35
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.50
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.17
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16

--------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.61
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.54

**************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.17      0.0000      0.00  Q         .         .         .         .
  0.46      0.0016      0.14  Q         .         .         .         .
  0.76      0.0050      0.14  Q         .         .         .         .
  1.05      0.0083      0.14  Q         .         .         .         .
  1.34      0.0117      0.14  Q         .         .         .         .
  1.63      0.0151      0.14  Q         .         .         .         .
```

```
 1.93      0.0186      0.14  Q         .         .         .         .
 2.22      0.0221      0.15  Q         .         .         .         .
 2.51      0.0256      0.15  Q         .         .         .         .
 2.81      0.0292      0.15  Q         .         .         .         .
 3.10      0.0328      0.15  Q         .         .         .         .
 3.39      0.0365      0.15  Q         .         .         .         .
 3.69      0.0402      0.15  Q         .         .         .         .
 3.98      0.0440      0.16  Q         .         .         .         .
 4.27      0.0478      0.16  Q         .         .         .         .
 4.57      0.0517      0.16  Q         .         .         .         .
 4.86      0.0556      0.16  Q         .         .         .         .
 5.15      0.0596      0.17  Q         .         .         .         .
 5.45      0.0636      0.17  Q         .         .         .         .
 5.74      0.0677      0.17  Q         .         .         .         .
 6.03      0.0719      0.17  Q         .         .         .         .
 6.33      0.0761      0.18  Q         .         .         .         .
 6.62      0.0804      0.18  Q         .         .         .         .
 6.91      0.0848      0.18  Q         .         .         .         .
 7.20      0.0892      0.18  Q         .         .         .         .
 7.50      0.0938      0.19  Q         .         .         .         .
 7.79      0.0984      0.19  Q         .         .         .         .
 8.08      0.1031      0.20  Q         .         .         .         .
 8.38      0.1079      0.20  Q         .         .         .         .
 8.67      0.1128      0.21  Q         .         .         .         .
 8.96      0.1178      0.21  Q         .         .         .         .
 9.26      0.1230      0.22  Q         .         .         .         .
 9.55      0.1282      0.22  Q         .         .         .         .
 9.84      0.1336      0.23  Q         .         .         .         .
10.14      0.1391      0.23  Q         .         .         .         .
10.43      0.1448      0.24  Q         .         .         .         .
10.72      0.1506      0.24  Q         .         .         .         .
11.02      0.1566      0.25  .Q        .         .         .         .
11.31      0.1628      0.26  .Q        .         .         .         .
11.60      0.1693      0.27  .Q        .         .         .         .
11.90      0.1759      0.28  .Q        .         .         .         .
12.19      0.1829      0.30  .Q        .         .         .         .
12.48      0.1904      0.32  .Q        .         .         .         .
12.78      0.1983      0.34  .Q        .         .         .         .
13.07      0.2065      0.35  .Q        .         .         .         .
13.36      0.2152      0.37  .Q        .         .         .         .
13.65      0.2244      0.39  .Q        .         .         .         .
13.95      0.2342      0.42  .Q        .         .         .         .
14.24      0.2447      0.45  .Q        .         .         .         .
14.53      0.2563      0.51  . Q       .         .         .         .
14.83      0.2691      0.55  . Q       .         .         .         .
15.12      0.2835      0.64  . Q       .         .         .         .
15.41      0.2999      0.71  . Q       .         .         .         .
15.71      0.3202      0.96  .  Q      .         .         .         .
16.00      0.3479      1.32  .    Q    .         .         .         .
16.29      0.4013      3.09  .         . Q       .         .         .
16.59      0.4486      0.81  .  Q      .         .         .         .
16.88      0.4655      0.59  . Q       .         .         .         .
17.17      0.4785      0.48  .Q        .         .         .         .
17.47      0.4893      0.40  .Q        .         .         .         .
```

17.76	0.4985	0.36	.Q	.	.	.	.
18.05	0.5068	0.33	.Q	.	.	.	.
18.35	0.5142	0.28	.Q	.	.	.	.
18.64	0.5208	0.26	.Q	.	.	.	.
18.93	0.5270	0.25	Q	.	.	.	.
19.22	0.5329	0.23	Q	.	.	.	.
19.52	0.5384	0.22	Q	.	.	.	.
19.81	0.5437	0.21	Q	.	.	.	.
20.10	0.5487	0.20	Q	.	.	.	.
20.40	0.5535	0.19	Q	.	.	.	.
20.69	0.5581	0.19	Q	.	.	.	.
20.98	0.5626	0.18	Q	.	.	.	.
21.28	0.5669	0.17	Q	.	.	.	.
21.57	0.5710	0.17	Q	.	.	.	.
21.86	0.5751	0.16	Q	.	.	.	.
22.16	0.5790	0.16	Q	.	.	.	.
22.45	0.5828	0.16	Q	.	.	.	.
22.74	0.5865	0.15	Q	.	.	.	.
23.04	0.5902	0.15	Q	.	.	.	.
23.33	0.5937	0.14	Q	.	.	.	.
23.62	0.5972	0.14	Q	.	.	.	.
23.92	0.6006	0.14	Q	.	.	.	.
24.21	0.6039	0.14	Q	.	.	.	.
24.50	0.6055	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1442.4
10%	351.8
20%	105.5
30%	52.8
40%	35.2
50%	17.6
60%	17.6
70%	17.6
80%	17.6
90%	17.6

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
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             Ver. 22.0  Release Date: 07/01/2015  License ID 1302

                          Analysis prepared by:

                              Hicks & Hartwick, Inc.
                            37 East Olive Avenue, Suite C
                                 Redlands, CA 92373
                                   (909) 793-2257

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:



--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.15
    TOTAL CATCHMENT AREA(ACRES) =    6.37
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.090
    LOW LOSS FRACTION = 0.570
    TIME OF CONCENTRATION(MIN.) =  9.13
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.14
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.35
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.50
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.17
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.16

--------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.69
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.45

**************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.02      0.0000      0.00  Q         .         .         .         .
  0.17      0.0008      0.13  Q         .         .         .         .
  0.33      0.0024      0.13  Q         .         .         .         .
  0.48      0.0040      0.13  Q         .         .         .         .
  0.63      0.0056      0.13  Q         .         .         .         .
  0.78      0.0072      0.13  Q         .         .         .         .
```

0.94	0.0088	0.13	Q	.	.	.	.
1.09	0.0104	0.13	Q	.	.	.	.
1.24	0.0120	0.13	Q	.	.	.	.
1.39	0.0137	0.13	Q	.	.	.	.
1.54	0.0153	0.13	Q	.	.	.	.
1.70	0.0170	0.13	Q	.	.	.	.
1.85	0.0187	0.13	Q	.	.	.	.
2.00	0.0203	0.13	Q	.	.	.	.
2.15	0.0220	0.14	Q	.	.	.	.
2.30	0.0237	0.14	Q	.	.	.	.
2.46	0.0254	0.14	Q	.	.	.	.
2.61	0.0272	0.14	Q	.	.	.	.
2.76	0.0289	0.14	Q	.	.	.	.
2.91	0.0306	0.14	Q	.	.	.	.
3.07	0.0324	0.14	Q	.	.	.	.
3.22	0.0342	0.14	Q	.	.	.	.
3.37	0.0360	0.14	Q	.	.	.	.
3.52	0.0377	0.14	Q	.	.	.	.
3.67	0.0395	0.14	Q	.	.	.	.
3.83	0.0414	0.14	Q	.	.	.	.
3.98	0.0432	0.15	Q	.	.	.	.
4.13	0.0450	0.15	Q	.	.	.	.
4.28	0.0469	0.15	Q	.	.	.	.
4.44	0.0488	0.15	Q	.	.	.	.
4.59	0.0506	0.15	Q	.	.	.	.
4.74	0.0525	0.15	Q	.	.	.	.
4.89	0.0544	0.15	Q	.	.	.	.
5.04	0.0564	0.15	Q	.	.	.	.
5.20	0.0583	0.15	Q	.	.	.	.
5.35	0.0603	0.16	Q	.	.	.	.
5.50	0.0622	0.16	Q	.	.	.	.
5.65	0.0642	0.16	Q	.	.	.	.
5.80	0.0662	0.16	Q	.	.	.	.
5.96	0.0682	0.16	Q	.	.	.	.
6.11	0.0703	0.16	Q	.	.	.	.
6.26	0.0723	0.16	Q	.	.	.	.
6.41	0.0744	0.17	Q	.	.	.	.
6.57	0.0765	0.17	Q	.	.	.	.
6.72	0.0786	0.17	Q	.	.	.	.
6.87	0.0807	0.17	Q	.	.	.	.
7.02	0.0828	0.17	Q	.	.	.	.
7.17	0.0850	0.17	Q	.	.	.	.
7.33	0.0872	0.17	Q	.	.	.	.
7.48	0.0894	0.18	Q	.	.	.	.
7.63	0.0916	0.18	Q	.	.	.	.
7.78	0.0939	0.18	Q	.	.	.	.
7.94	0.0962	0.18	Q	.	.	.	.
8.09	0.0985	0.18	Q	.	.	.	.
8.24	0.1008	0.19	Q	.	.	.	.
8.39	0.1031	0.19	Q	.	.	.	.
8.54	0.1055	0.19	Q	.	.	.	.
8.70	0.1079	0.19	Q	.	.	.	.
8.85	0.1103	0.19	Q	.	.	.	.
9.00	0.1128	0.20	Q	.	.	.	.

```
 9.15      0.1153      0.20  Q          .          .          .          .
 9.30      0.1178      0.20  Q          .          .          .          .
 9.46      0.1203      0.20  Q          .          .          .          .
 9.61      0.1229      0.21  Q          .          .          .          .
 9.76      0.1255      0.21  Q          .          .          .          .
 9.91      0.1282      0.21  Q          .          .          .          .
10.07      0.1309      0.22  Q          .          .          .          .
10.22      0.1336      0.22  Q          .          .          .          .
10.37      0.1363      0.22  Q          .          .          .          .
10.52      0.1391      0.22  Q          .          .          .          .
10.67      0.1420      0.23  Q          .          .          .          .
10.83      0.1449      0.23  Q          .          .          .          .
10.98      0.1478      0.24  Q          .          .          .          .
11.13      0.1508      0.24  Q          .          .          .          .
11.28      0.1538      0.24  Q          .          .          .          .
11.43      0.1569      0.25  Q          .          .          .          .
11.59      0.1601      0.25  .Q         .          .          .          .
11.74      0.1633      0.26  .Q         .          .          .          .
11.89      0.1666      0.26  .Q         .          .          .          .
12.04      0.1699      0.27  .Q         .          .          .          .
12.20      0.1734      0.29  .Q         .          .          .          .
12.35      0.1771      0.29  .Q         .          .          .          .
12.50      0.1808      0.30  .Q         .          .          .          .
12.65      0.1847      0.31  .Q         .          .          .          .
12.80      0.1886      0.32  .Q         .          .          .          .
12.96      0.1926      0.32  .Q         .          .          .          .
13.11      0.1968      0.33  .Q         .          .          .          .
13.26      0.2010      0.34  .Q         .          .          .          .
13.41      0.2054      0.35  .Q         .          .          .          .
13.57      0.2099      0.36  .Q         .          .          .          .
13.72      0.2145      0.38  .Q         .          .          .          .
13.87      0.2193      0.39  .Q         .          .          .          .
14.02      0.2243      0.41  .Q         .          .          .          .
14.17      0.2296      0.43  .Q         .          .          .          .
14.33      0.2352      0.46  .Q         .          .          .          .
14.48      0.2410      0.47  .Q         .          .          .          .
14.63      0.2473      0.52  . Q        .          .          .          .
14.78      0.2541      0.56  . Q        .          .          .          .
14.93      0.2618      0.67  . Q        .          .          .          .
15.09      0.2706      0.73  . Q        .          .          .          .
15.24      0.2808      0.89  .  Q       .          .          .          .
15.39      0.2927      0.99  .  Q       .          .          .          .
15.54      0.3069      1.28  .    Q     .          .          .          .
15.70      0.3243      1.49  .    Q     .          .          .          .
15.85      0.3489      2.42  .         Q.          .          .          .
16.00      0.3849      3.31  .           .  Q       .          .          .
16.15      0.4590      8.48  .           .          .          .  Q       .
16.30      0.5238      1.83  .       Q   .          .          .          .
16.46      0.5423      1.12  .   Q       .          .          .          .
16.61      0.5544      0.80  .  Q        .          .          .          .
16.76      0.5633      0.61  . Q         .          .          .          .
16.91      0.5703      0.49  .Q          .          .          .          .
17.07      0.5762      0.45  .Q          .          .          .          .
17.22      0.5815      0.40  .Q          .          .          .          .
```

```
 17.37      0.5863      0.37  .Q        .         .         .         .
 17.52      0.5908      0.35  .Q        .         .         .         .
 17.67      0.5950      0.33  .Q        .         .         .         .
 17.83      0.5991      0.31  .Q        .         .         .         .
 17.98      0.6029      0.30  .Q        .         .         .         .
 18.13      0.6065      0.28  .Q        .         .         .         .
 18.28      0.6099      0.26  .Q        .         .         .         .
 18.43      0.6131      0.25  .Q        .         .         .         .
 18.59      0.6162      0.24  Q         .         .         .         .
 18.74      0.6192      0.23  Q         .         .         .         .
 18.89      0.6221      0.23  Q         .         .         .         .
 19.04      0.6249      0.22  Q         .         .         .         .
 19.20      0.6276      0.21  Q         .         .         .         .
 19.35      0.6303      0.21  Q         .         .         .         .
 19.50      0.6328      0.20  Q         .         .         .         .
 19.65      0.6354      0.20  Q         .         .         .         .
 19.80      0.6378      0.19  Q         .         .         .         .
 19.96      0.6402      0.19  Q         .         .         .         .
 20.11      0.6426      0.18  Q         .         .         .         .
 20.26      0.6449      0.18  Q         .         .         .         .
 20.41      0.6471      0.18  Q         .         .         .         .
 20.57      0.6493      0.17  Q         .         .         .         .
 20.72      0.6515      0.17  Q         .         .         .         .
 20.87      0.6536      0.17  Q         .         .         .         .
 21.02      0.6557      0.16  Q         .         .         .         .
 21.17      0.6577      0.16  Q         .         .         .         .
 21.33      0.6598      0.16  Q         .         .         .         .
 21.48      0.6617      0.16  Q         .         .         .         .
 21.63      0.6637      0.15  Q         .         .         .         .
 21.78      0.6656      0.15  Q         .         .         .         .
 21.93      0.6675      0.15  Q         .         .         .         .
 22.09      0.6694      0.15  Q         .         .         .         .
 22.24      0.6712      0.15  Q         .         .         .         .
 22.39      0.6730      0.14  Q         .         .         .         .
 22.54      0.6748      0.14  Q         .         .         .         .
 22.70      0.6766      0.14  Q         .         .         .         .
 22.85      0.6783      0.14  Q         .         .         .         .
 23.00      0.6801      0.14  Q         .         .         .         .
 23.15      0.6818      0.13  Q         .         .         .         .
 23.30      0.6835      0.13  Q         .         .         .         .
 23.46      0.6851      0.13  Q         .         .         .         .
 23.61      0.6868      0.13  Q         .         .         .         .
 23.76      0.6884      0.13  Q         .         .         .         .
 23.91      0.6900      0.13  Q         .         .         .         .
 24.06      0.6916      0.13  Q         .         .         .         .
 24.22      0.6924      0.00  Q         .         .         .         .
 ----------------------------------------------------------------------------
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                Duration
        Peak Flow Rate                     (minutes)
```

0%	1442.5
10%	82.2
20%	36.5
30%	18.3
40%	9.1
50%	9.1
60%	9.1
70%	9.1
80%	9.1
90%	9.1

```
**************************************************************************
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             Ver. 22.0  Release Date: 07/01/2015  License ID 1302

                              Analysis prepared by:

                                  Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                    Redlands, CA 92373
                                    (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301UEAH.DAT
  TIME/DATE OF STUDY: 11:47 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                       --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

  *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
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0313 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   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) =   776.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1613.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.384
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.028
  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.)
  NATURAL POOR COVER
  "BARREN"                    B        3.87      0.11     1.000    97   15.38
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.11
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     10.18
  TOTAL AREA(ACRES) =      3.87   PEAK FLOW RATE(CFS) =     10.18

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1613.70  DOWNSTREAM ELEVATION(FEET) = 1612.50
  STREET LENGTH(FEET) =   237.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 36.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  10.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.015
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.008
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.25
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.60
    HALFSTREET FLOOD WIDTH(FEET) =   22.48
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.59
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.55
  STREET FLOW TRAVEL TIME(MIN.) =   1.53   Tc(MIN.) =   16.91
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.847
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                    B        2.49      0.11     1.000    97
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.11
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    2.49      SUBAREA RUNOFF(CFS) =    6.14
  EFFECTIVE AREA(ACRES) =      6.36    AREA-AVERAGED Fm(INCH/HR) =  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.11  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        6.4        PEAK FLOW RATE(CFS) =      15.69
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.63   HALFSTREET FLOOD WIDTH(FEET) =  24.08
  FLOW VELOCITY(FEET/SEC.) =  2.69   DEPTH*VELOCITY(FT*FT/SEC.) =   1.69
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1013.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.4  TC(MIN.) =     16.91
  EFFECTIVE AREA(ACRES) =      6.36  AREA-AVERAGED Fm(INCH/HR)=  0.11
  AREA-AVERAGED Fp(INCH/HR) =  0.11  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      15.69
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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             Ver. 22.0  Release Date: 07/01/2015  License ID 1302

                              Analysis prepared by:

                                  Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                    Redlands, CA 92373
                                    (909) 793-2257

--------------------------------------------------------------------------
  FILE NAME: 0301UPAH.DAT
  TIME/DATE OF STUDY: 11:48 07/07/2022
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                      --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6500
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

  *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 0.0312 0.167 0.0150
  2   18.0      5.5    0.015/0.026/0.008   0.67    2.00 0.0312 0.167 0.0150
  3   36.0     10.0    0.015/0.020/0.008   0.67    2.00 0.0312 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) =   476.00
  ELEVATION DATA: UPSTREAM(FEET) =   1635.33  DOWNSTREAM(FEET) =   1621.18

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.232
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.945
  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                 B        2.44      0.42     0.100    76    7.23
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     10.77
  TOTAL AREA(ACRES) =      2.44   PEAK FLOW RATE(CFS) =     10.77

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.96
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.77
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =    7.58
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.58
  RAINFALL INTENSITY(INCH/HR) =   4.80
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.44
  TOTAL STREAM AREA(ACRES) =       2.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.77

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   459.00
  ELEVATION DATA: UPSTREAM(FEET) =   1631.20  DOWNSTREAM(FEET) =   1621.18
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.582
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.796
  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                 B        2.47      0.42     0.100    76    7.58
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     10.57
  TOTAL AREA(ACRES) =      2.47   PEAK FLOW RATE(CFS) =     10.57

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1619.18  DOWNSTREAM(FEET) =  1617.73
  FLOW LENGTH(FEET) =   145.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.57
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =    7.93
  LONGEST FLOWPATH FROM NODE      3.00 TO NODE      5.00 =     604.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.93
  RAINFALL INTENSITY(INCH/HR) =   4.66
  AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       2.47
  TOTAL STREAM AREA(ACRES) =       2.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.57

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       10.77    7.58    4.797  0.42( 0.04) 0.10       2.4       1.00
      2       10.57    7.93    4.658  0.42( 0.04) 0.10       2.5       3.00

  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       21.17    7.58    4.797  0.42( 0.04) 0.10       4.8       1.00
    2       21.02    7.93    4.658  0.42( 0.04) 0.10       4.9       3.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      21.17    Tc(MIN.) =     7.58
  EFFECTIVE AREA(ACRES) =       4.80   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        4.9
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1617.73  DOWNSTREAM(FEET) =  1612.90
  FLOW LENGTH(FEET) =   532.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.94
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.17
  PIPE TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =    8.70
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =    1153.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.70
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.387
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        1.46      0.42      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.46      SUBAREA RUNOFF(CFS) =    5.71
  EFFECTIVE AREA(ACRES) =      6.26   AREA-AVERAGED Fm(INCH/HR) =  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.4       PEAK FLOW RATE(CFS) =      24.48
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.4  TC(MIN.) =      8.70
  EFFECTIVE AREA(ACRES) =      6.26  AREA-AVERAGED Fm(INCH/HR)=  0.04
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      24.48

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       24.48    8.70    4.387  0.42( 0.04) 0.10       6.3       1.00
      2       24.20    9.09    4.263  0.42( 0.04) 0.10       6.4       3.00
```

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

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**************************************************************************
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==========================================================================
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                            Analysis prepared by:

                                Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                   Redlands, CA 92373
                                    (909) 793-2257

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:



--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.97
    TOTAL CATCHMENT AREA(ACRES) =    6.36
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.110
    LOW LOSS FRACTION = 0.551
    TIME OF CONCENTRATION(MIN.) = 16.91
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.01
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.41
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.17
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.87
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.14

--------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.65
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.07

**************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.22      0.0029      0.25  Q         .         .         .         .
  0.50      0.0087      0.25  Q         .         .         .         .
  0.78      0.0146      0.25  Q         .         .         .         .
  1.06      0.0206      0.26  Q         .         .         .         .
  1.34      0.0266      0.26  Q         .         .         .         .
  1.63      0.0327      0.26  Q         .         .         .         .
```

```
 1.91      0.0388      0.27  Q          .          .          .          .
 2.19      0.0451      0.27  Q          .          .          .          .
 2.47      0.0514      0.27  Q          .          .          .          .
 2.75      0.0577      0.28  Q          .          .          .          .
 3.04      0.0642      0.28  Q          .          .          .          .
 3.32      0.0707      0.28  Q          .          .          .          .
 3.60      0.0773      0.29  Q          .          .          .          .
 3.88      0.0840      0.29  Q          .          .          .          .
 4.16      0.0908      0.29  Q          .          .          .          .
 4.44      0.0977      0.30  Q          .          .          .          .
 4.73      0.1047      0.30  Q          .          .          .          .
 5.01      0.1117      0.31  Q          .          .          .          .
 5.29      0.1189      0.31  Q          .          .          .          .
 5.57      0.1262      0.32  Q          .          .          .          .
 5.85      0.1336      0.32  Q          .          .          .          .
 6.14      0.1411      0.33  Q          .          .          .          .
 6.42      0.1488      0.33  Q          .          .          .          .
 6.70      0.1565      0.34  Q          .          .          .          .
 6.98      0.1644      0.34  Q          .          .          .          .
 7.26      0.1725      0.35  Q          .          .          .          .
 7.55      0.1807      0.35  Q          .          .          .          .
 7.83      0.1890      0.36  Q          .          .          .          .
 8.11      0.1975      0.37  Q          .          .          .          .
 8.39      0.2062      0.38  Q          .          .          .          .
 8.67      0.2151      0.38  Q          .          .          .          .
 8.95      0.2241      0.39  Q          .          .          .          .
 9.24      0.2334      0.40  Q          .          .          .          .
 9.52      0.2429      0.41  Q          .          .          .          .
 9.80      0.2526      0.42  Q          .          .          .          .
10.08      0.2626      0.44  Q          .          .          .          .
10.36      0.2728      0.44  Q          .          .          .          .
10.65      0.2833      0.46  Q          .          .          .          .
10.93      0.2942      0.47  Q          .          .          .          .
11.21      0.3053      0.49  Q          .          .          .          .
11.49      0.3169      0.50  .Q         .          .          .          .
11.77      0.3288      0.53  .Q         .          .          .          .
12.05      0.3412      0.54  .Q         .          .          .          .
12.34      0.3539      0.55  .Q         .          .          .          .
12.62      0.3669      0.58  .Q         .          .          .          .
12.90      0.3813      0.66  .Q         .          .          .          .
13.18      0.3972      0.71  .Q         .          .          .          .
13.46      0.4150      0.82  .Q         .          .          .          .
13.75      0.4348      0.88  .Q         .          .          .          .
14.03      0.4572      1.04  . Q        .          .          .          .
14.31      0.4821      1.10  . Q        .          .          .          .
14.59      0.5105      1.33  . Q        .          .          .          .
14.87      0.5433      1.49  . Q        .          .          .          .
15.15      0.5832      1.94  .  Q       .          .          .          .
15.44      0.6323      2.28  .   Q      .          .          .          .
15.72      0.7097      4.37  .       Q  .          .          .          .
16.00      0.8345      6.35  .          . Q        .          .          .
16.28      1.0912     15.69  .          .          .          .Q         .
16.56      1.3113      3.20  .     Q    .          .          .          .
16.85      1.3682      1.69  .  Q       .          .          .          .
```

```
 17.13      1.4017      1.20  . Q       .         .         .         .
 17.41      1.4268      0.96  .Q        .         .         .         .
 17.69      1.4468      0.76  .Q        .         .         .         .
 17.97      1.4628      0.62  .Q        .         .         .         .
 18.25      1.4763      0.55  .Q        .         .         .         .
 18.54      1.4887      0.51  .Q        .         .         .         .
 18.82      1.5002      0.48  Q         .         .         .         .
 19.10      1.5111      0.45  Q         .         .         .         .
 19.38      1.5213      0.43  Q         .         .         .         .
 19.66      1.5311      0.41  Q         .         .         .         .
 19.95      1.5403      0.39  Q         .         .         .         .
 20.23      1.5492      0.37  Q         .         .         .         .
 20.51      1.5577      0.36  Q         .         .         .         .
 20.79      1.5659      0.35  Q         .         .         .         .
 21.07      1.5738      0.33  Q         .         .         .         .
 21.35      1.5815      0.32  Q         .         .         .         .
 21.64      1.5889      0.31  Q         .         .         .         .
 21.92      1.5960      0.30  Q         .         .         .         .
 22.20      1.6030      0.30  Q         .         .         .         .
 22.48      1.6098      0.29  Q         .         .         .         .
 22.76      1.6164      0.28  Q         .         .         .         .
 23.05      1.6229      0.27  Q         .         .         .         .
 23.33      1.6292      0.27  Q         .         .         .         .
 23.61      1.6353      0.26  Q         .         .         .         .
 23.89      1.6413      0.26  Q         .         .         .         .
 24.17      1.6472      0.25  Q         .         .         .         .
 24.45      1.6501      0.00  Q         .         .         .         .
 ----------------------------------------------------------------------------
----------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated              Duration
        Peak Flow Rate                   (minutes)
    ======================           =========
               0%                      1454.3
              10%                       118.4
              20%                        67.6
              30%                        33.8
              40%                        33.8
              50%                        16.9
              60%                        16.9
              70%                        16.9
              80%                        16.9
              90%                        16.9
```

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

                                Hicks & Hartwick, Inc.
                              37 East Olive Avenue, Suite C
                                   Redlands, CA 92373
                                    (909) 793-2257

**************************************************************************
--------------------------------------------------------------------------

 Problem Descriptions:



--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.07
    TOTAL CATCHMENT AREA(ACRES) =    6.37
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.040
    LOW LOSS FRACTION = 0.780
    TIME OF CONCENTRATION(MIN.) =  8.70
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  1.01
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.41
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.17
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  2.87
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.14

--------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.35
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.38

**************************************************************************
  TIME     VOLUME       Q    0.        7.5      15.0      22.5      30.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.05      0.0000      0.00  Q         .         .         .         .
  0.20      0.0020      0.34  Q         .         .         .         .
  0.34      0.0062      0.34  Q         .         .         .         .
  0.49      0.0103      0.35  Q         .         .         .         .
  0.63      0.0145      0.35  Q         .         .         .         .
  0.78      0.0187      0.36  Q         .         .         .         .
```

0.92	0.0230	0.36	Q	.	.	.	.
1.07	0.0273	0.36	Q	.	.	.	.
1.21	0.0316	0.36	Q	.	.	.	.
1.36	0.0360	0.37	Q	.	.	.	.
1.50	0.0405	0.37	Q	.	.	.	.
1.65	0.0450	0.38	Q	.	.	.	.
1.79	0.0495	0.38	Q	.	.	.	.
1.94	0.0541	0.38	Q	.	.	.	.
2.08	0.0587	0.39	Q	.	.	.	.
2.23	0.0633	0.39	Q	.	.	.	.
2.37	0.0681	0.39	Q	.	.	.	.
2.52	0.0728	0.40	Q	.	.	.	.
2.66	0.0776	0.40	Q	.	.	.	.
2.81	0.0825	0.41	Q	.	.	.	.
2.95	0.0874	0.41	Q	.	.	.	.
3.10	0.0924	0.42	Q	.	.	.	.
3.24	0.0974	0.42	Q	.	.	.	.
3.39	0.1025	0.43	Q	.	.	.	.
3.53	0.1076	0.43	Q	.	.	.	.
3.68	0.1128	0.44	Q	.	.	.	.
3.82	0.1181	0.44	Q	.	.	.	.
3.97	0.1234	0.45	Q	.	.	.	.
4.11	0.1287	0.45	Q	.	.	.	.
4.26	0.1341	0.46	Q	.	.	.	.
4.40	0.1396	0.46	Q	.	.	.	.
4.55	0.1452	0.47	Q	.	.	.	.
4.69	0.1508	0.47	Q	.	.	.	.
4.84	0.1565	0.48	Q	.	.	.	.
4.98	0.1622	0.48	Q	.	.	.	.
5.12	0.1680	0.49	Q	.	.	.	.
5.27	0.1739	0.49	Q	.	.	.	.
5.42	0.1798	0.50	Q	.	.	.	.
5.56	0.1859	0.50	Q	.	.	.	.
5.71	0.1920	0.51	Q	.	.	.	.
5.85	0.1981	0.52	Q	.	.	.	.
6.00	0.2044	0.53	Q	.	.	.	.
6.14	0.2107	0.53	Q	.	.	.	.
6.29	0.2171	0.54	Q	.	.	.	.
6.43	0.2236	0.54	Q	.	.	.	.
6.57	0.2302	0.55	Q	.	.	.	.
6.72	0.2369	0.56	Q	.	.	.	.
6.87	0.2436	0.57	Q	.	.	.	.
7.01	0.2505	0.57	Q	.	.	.	.
7.16	0.2574	0.58	Q	.	.	.	.
7.30	0.2645	0.59	Q	.	.	.	.
7.45	0.2716	0.60	Q	.	.	.	.
7.59	0.2788	0.61	Q	.	.	.	.
7.74	0.2862	0.62	Q	.	.	.	.
7.88	0.2936	0.62	Q	.	.	.	.
8.02	0.3012	0.64	Q	.	.	.	.
8.17	0.3089	0.64	Q	.	.	.	.
8.32	0.3166	0.66	Q	.	.	.	.
8.46	0.3245	0.66	Q	.	.	.	.
8.60	0.3326	0.68	Q	.	.	.	.

8.75	0.3407	0.68	Q . . . .
8.90	0.3490	0.70	Q . . . .
9.04	0.3574	0.71	Q . . . .
9.19	0.3660	0.72	Q . . . .
9.33	0.3747	0.73	Q . . . .
9.48	0.3836	0.75	Q . . . .
9.62	0.3926	0.76	.Q . . . .
9.77	0.4017	0.77	.Q . . . .
9.91	0.4111	0.78	.Q . . . .
10.05	0.4206	0.80	.Q . . . .
10.20	0.4303	0.81	.Q . . . .
10.35	0.4401	0.83	.Q . . . .
10.49	0.4502	0.84	.Q . . . .
10.64	0.4604	0.87	.Q . . . .
10.78	0.4709	0.88	.Q . . . .
10.93	0.4816	0.90	.Q . . . .
11.07	0.4925	0.92	.Q . . . .
11.22	0.5037	0.94	.Q . . . .
11.36	0.5151	0.96	.Q . . . .
11.51	0.5267	0.99	.Q . . . .
11.65	0.5387	1.00	.Q . . . .
11.80	0.5509	1.04	.Q . . . .
11.94	0.5634	1.05	.Q . . . .
12.09	0.5761	1.07	.Q . . . .
12.23	0.5889	1.05	.Q . . . .
12.38	0.6018	1.10	.Q . . . .
12.52	0.6150	1.12	.Q . . . .
12.66	0.6287	1.16	.Q . . . .
12.81	0.6428	1.19	.Q . . . .
12.95	0.6573	1.24	.Q . . . .
13.10	0.6724	1.27	.Q . . . .
13.24	0.6879	1.33	.Q . . . .
13.39	0.7041	1.36	.Q . . . .
13.53	0.7209	1.44	.Q . . . .
13.68	0.7383	1.48	.Q . . . .
13.82	0.7565	1.56	. Q . . . .
13.97	0.7756	1.61	. Q . . . .
14.12	0.7953	1.68	. Q . . . .
14.26	0.8157	1.73	. Q . . . .
14.40	0.8372	1.86	. Q . . . .
14.55	0.8600	1.94	. Q . . . .
14.70	0.8843	2.12	. Q . . . .
14.84	0.9103	2.23	. Q . . . .
14.98	0.9385	2.48	. Q . . . .
15.13	0.9692	2.64	. Q . . . .
15.27	1.0032	3.04	. Q . . . .
15.42	1.0412	3.30	. Q . . . .
15.57	1.0904	4.91	. Q . . . .
15.71	1.1527	5.48	. Q . . . .
15.85	1.2342	8.12	. Q . . .
16.00	1.3460	10.53	. . Q . . .
16.15	1.5558	24.48	. . . . Q .
16.29	1.7417	6.55	. Q . . . .
16.43	1.8072	4.39	. Q . . . .

16.58	1.8505	2.82	. Q	.	.	.	.
16.73	1.8814	2.35	. Q	.	.	.	.
16.87	1.9076	2.02	. Q	.	.	.	.
17.02	1.9305	1.79	. Q	.	.	.	.
17.16	1.9512	1.66	. Q	.	.	.	.
17.31	1.9702	1.52	. Q	.	.	.	.
17.45	1.9877	1.40	.Q	.	.	.	.
17.59	2.0039	1.30	.Q	.	.	.	.
17.74	2.0189	1.21	.Q	.	.	.	.
17.89	2.0330	1.14	.Q	.	.	.	.
18.03	2.0463	1.07	.Q	.	.	.	.
18.17	2.0592	1.07	.Q	.	.	.	.
18.32	2.0717	1.02	.Q	.	.	.	.
18.47	2.0836	0.97	.Q	.	.	.	.
18.61	2.0951	0.93	.Q	.	.	.	.
18.76	2.1060	0.89	.Q	.	.	.	.
18.90	2.1164	0.86	.Q	.	.	.	.
19.05	2.1265	0.82	.Q	.	.	.	.
19.19	2.1362	0.79	.Q	.	.	.	.
19.33	2.1455	0.76	.Q	.	.	.	.
19.48	2.1545	0.74	Q	.	.	.	.
19.62	2.1632	0.71	Q	.	.	.	.
19.77	2.1717	0.69	Q	.	.	.	.
19.92	2.1798	0.67	Q	.	.	.	.
20.06	2.1877	0.65	Q	.	.	.	.
20.20	2.1954	0.63	Q	.	.	.	.
20.35	2.2029	0.61	Q	.	.	.	.
20.49	2.2101	0.60	Q	.	.	.	.
20.64	2.2171	0.58	Q	.	.	.	.
20.78	2.2240	0.56	Q	.	.	.	.
20.93	2.2306	0.55	Q	.	.	.	.
21.08	2.2371	0.54	Q	.	.	.	.
21.22	2.2435	0.52	Q	.	.	.	.
21.36	2.2497	0.51	Q	.	.	.	.
21.51	2.2557	0.50	Q	.	.	.	.
21.66	2.2616	0.48	Q	.	.	.	.
21.80	2.2673	0.47	Q	.	.	.	.
21.94	2.2729	0.46	Q	.	.	.	.
22.09	2.2784	0.45	Q	.	.	.	.
22.23	2.2838	0.44	Q	.	.	.	.
22.38	2.2890	0.43	Q	.	.	.	.
22.52	2.2941	0.42	Q	.	.	.	.
22.67	2.2992	0.41	Q	.	.	.	.
22.82	2.3041	0.41	Q	.	.	.	.
22.96	2.3089	0.40	Q	.	.	.	.
23.11	2.3136	0.39	Q	.	.	.	.
23.25	2.3182	0.38	Q	.	.	.	.
23.39	2.3228	0.37	Q	.	.	.	.
23.54	2.3272	0.37	Q	.	.	.	.
23.68	2.3315	0.36	Q	.	.	.	.
23.83	2.3358	0.35	Q	.	.	.	.
23.98	2.3400	0.35	Q	.	.	.	.
24.12	2.3441	0.34	Q	.	.	.	.
24.26	2.3462	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1444.2
10%	104.4
20%	52.2
30%	26.1
40%	17.4
50%	8.7
60%	8.7
70%	8.7
80%	8.7
90%	8.7

Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

BASIN ROUTING

Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

Pond Report

Pond No. 1 - Basin A/B

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1603.00	n/a	0	0
1.00	1604.00	n/a	1,186	1,186
2.00	1605.00	n/a	3,674	4,860
3.00	1606.00	n/a	2,486	7,346
4.00	1607.00	n/a	2,487	9,833
5.00	1608.00	n/a	2,487	12,320
6.00	1609.00	n/a	2,190	14,510
7.00	1610.00	n/a	1,865	16,375
8.00	1611.00	n/a	1,865	18,240
9.00	1612.00	n/a	4,239	22,479
10.00	1613.00	n/a	7,445	29,924
11.00	1614.00	n/a	8,742	38,666
12.00	1615.00	n/a	10,087	48,753
13.00	1616.00	n/a	11,484	60,237

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	0.00	0.00	0.00
Span (in)	= 8.00	0.00	0.00	0.00
No. Barrels	= 2	0	0	0
Invert El. (ft)	= 1613.50	0.00	0.00	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .009	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

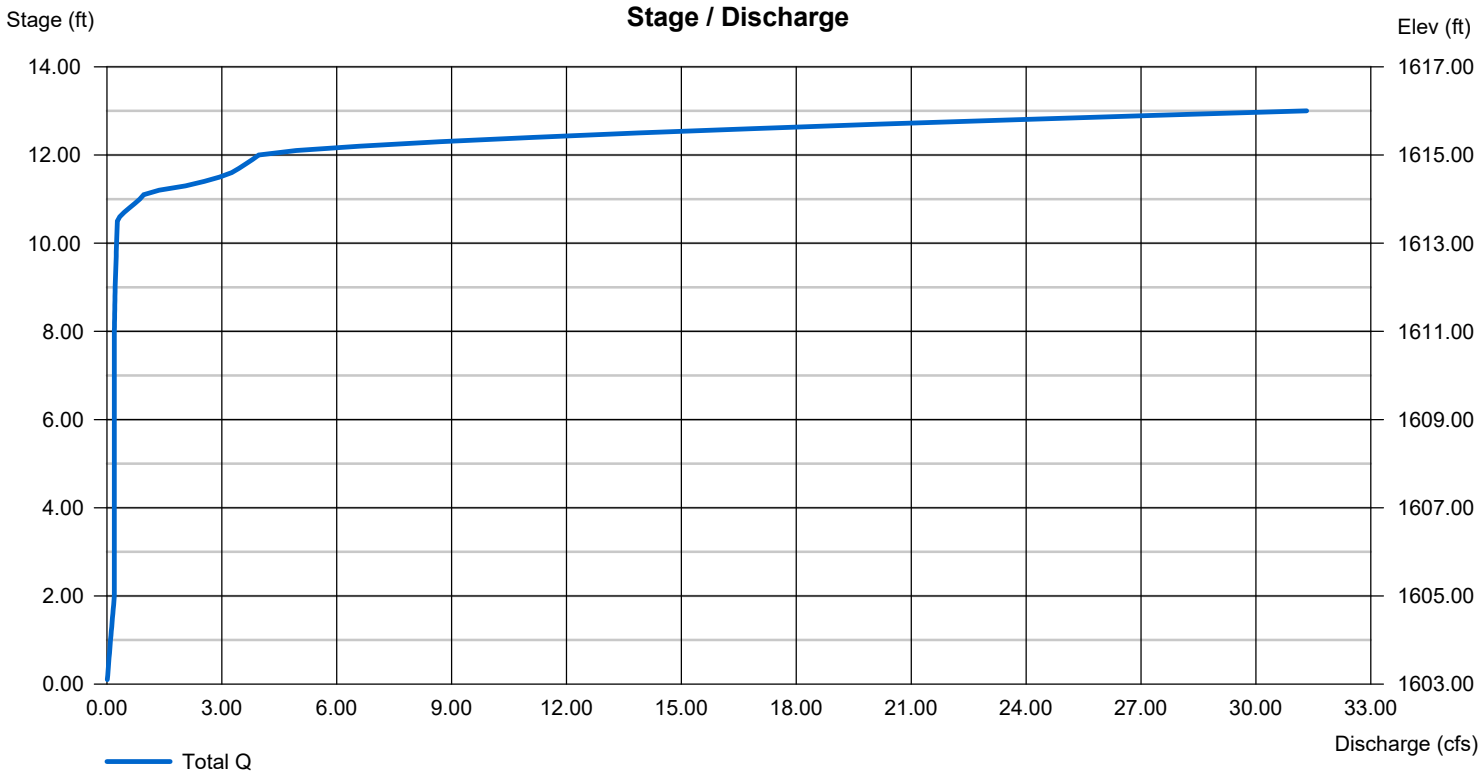
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 1615.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.340 (by Wet area)

TW Elev. (ft) = 0.00

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



Pond Report

Pond No. 1 - Basin A/B

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1603.00	n/a	0	0
1.00	1604.00	n/a	1,186	1,186
2.00	1605.00	n/a	3,674	4,860
3.00	1606.00	n/a	2,486	7,346
4.00	1607.00	n/a	2,487	9,833
5.00	1608.00	n/a	2,487	12,320
6.00	1609.00	n/a	2,190	14,510
7.00	1610.00	n/a	1,865	16,375
8.00	1611.00	n/a	1,865	18,240
9.00	1612.00	n/a	4,239	22,479
10.00	1613.00	n/a	7,445	29,924
11.00	1614.00	n/a	8,742	38,666
12.00	1615.00	n/a	10,087	48,753
13.00	1616.00	n/a	11,484	60,237

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	0.00	0.00	0.00
Span (in)	= 8.00	0.00	0.00	0.00
No. Barrels	= 2	0	0	0
Invert El. (ft)	= 1613.50	0.00	0.00	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .009	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 1615.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.340 (by Wet area)

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1603.00	0.00	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	119	1603.10	0.00	---	---	---	0.00	---	---	---	0.000	0.009	0.009
0.20	237	1603.20	0.00	---	---	---	0.00	---	---	---	0.000	0.018	0.018
0.30	356	1603.30	0.00	---	---	---	0.00	---	---	---	0.000	0.028	0.028
0.40	474	1603.40	0.00	---	---	---	0.00	---	---	---	0.000	0.037	0.037
0.50	593	1603.50	0.00	---	---	---	0.00	---	---	---	0.000	0.046	0.046
0.60	712	1603.60	0.00	---	---	---	0.00	---	---	---	0.000	0.055	0.055
0.70	830	1603.70	0.00	---	---	---	0.00	---	---	---	0.000	0.064	0.064
0.80	949	1603.80	0.00	---	---	---	0.00	---	---	---	0.000	0.074	0.074
0.90	1,067	1603.90	0.00	---	---	---	0.00	---	---	---	0.000	0.083	0.083
1.00	1,186	1604.00	0.00	---	---	---	0.00	---	---	---	0.000	0.092	0.092
1.10	1,553	1604.10	0.00	---	---	---	0.00	---	---	---	0.000	0.102	0.102
1.20	1,921	1604.20	0.00	---	---	---	0.00	---	---	---	0.000	0.112	0.112
1.30	2,288	1604.30	0.00	---	---	---	0.00	---	---	---	0.000	0.122	0.122
1.40	2,656	1604.40	0.00	---	---	---	0.00	---	---	---	0.000	0.132	0.132
1.50	3,023	1604.50	0.00	---	---	---	0.00	---	---	---	0.000	0.143	0.143
1.60	3,390	1604.60	0.00	---	---	---	0.00	---	---	---	0.000	0.153	0.153
1.70	3,758	1604.70	0.00	---	---	---	0.00	---	---	---	0.000	0.163	0.163
1.80	4,125	1604.80	0.00	---	---	---	0.00	---	---	---	0.000	0.173	0.173
1.90	4,493	1604.90	0.00	---	---	---	0.00	---	---	---	0.000	0.183	0.183
2.00	4,860	1605.00	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.10	5,109	1605.10	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.20	5,357	1605.20	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.30	5,606	1605.30	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.40	5,854	1605.40	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.50	6,103	1605.50	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.60	6,352	1605.60	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.70	6,600	1605.70	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.80	6,849	1605.80	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
2.90	7,097	1605.90	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193

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Basin A/B

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.00	7,346	1606.00	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.10	7,595	1606.10	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.20	7,843	1606.20	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.30	8,092	1606.30	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.40	8,341	1606.40	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.50	8,590	1606.50	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.60	8,838	1606.60	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.70	9,087	1606.70	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.80	9,336	1606.80	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
3.90	9,584	1606.90	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.00	9,833	1607.00	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.10	10,082	1607.10	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.20	10,330	1607.20	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.30	10,579	1607.30	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.40	10,828	1607.40	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.50	11,077	1607.50	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.60	11,325	1607.60	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.70	11,574	1607.70	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.80	11,823	1607.80	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
4.90	12,071	1607.90	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.00	12,320	1608.00	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.10	12,539	1608.10	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.20	12,758	1608.20	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.30	12,977	1608.30	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.40	13,196	1608.40	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.50	13,415	1608.50	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.60	13,634	1608.60	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.70	13,853	1608.70	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.80	14,072	1608.80	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
5.90	14,291	1608.90	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.00	14,510	1609.00	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.10	14,697	1609.10	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.20	14,883	1609.20	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.30	15,070	1609.30	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.40	15,256	1609.40	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.50	15,443	1609.50	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.60	15,629	1609.60	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.70	15,816	1609.70	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.80	16,002	1609.80	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
6.90	16,189	1609.90	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.00	16,375	1610.00	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.10	16,562	1610.10	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.20	16,748	1610.20	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.30	16,935	1610.30	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.40	17,121	1610.40	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.50	17,308	1610.50	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.60	17,494	1610.60	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.70	17,681	1610.70	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.80	17,867	1610.80	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
7.90	18,054	1610.90	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
8.00	18,240	1611.00	0.00	---	---	---	0.00	---	---	---	0.000	0.193	0.193
8.10	18,664	1611.10	0.00	---	---	---	0.00	---	---	---	0.000	0.195	0.195
8.20	19,088	1611.20	0.00	---	---	---	0.00	---	---	---	0.000	0.197	0.197
8.30	19,512	1611.30	0.00	---	---	---	0.00	---	---	---	0.000	0.199	0.199
8.40	19,936	1611.40	0.00	---	---	---	0.00	---	---	---	0.000	0.201	0.201
8.50	20,360	1611.50	0.00	---	---	---	0.00	---	---	---	0.000	0.203	0.203
8.60	20,783	1611.60	0.00	---	---	---	0.00	---	---	---	0.000	0.204	0.204
8.70	21,207	1611.70	0.00	---	---	---	0.00	---	---	---	0.000	0.206	0.206
8.80	21,631	1611.80	0.00	---	---	---	0.00	---	---	---	0.000	0.208	0.208
8.90	22,055	1611.90	0.00	---	---	---	0.00	---	---	---	0.000	0.210	0.210
9.00	22,479	1612.00	0.00	---	---	---	0.00	---	---	---	0.000	0.212	0.212
9.10	23,224	1612.10	0.00	---	---	---	0.00	---	---	---	0.000	0.216	0.216
9.20	23,968	1612.20	0.00	---	---	---	0.00	---	---	---	0.000	0.220	0.220
9.30	24,713	1612.30	0.00	---	---	---	0.00	---	---	---	0.000	0.224	0.224
9.40	25,457	1612.40	0.00	---	---	---	0.00	---	---	---	0.000	0.228	0.228
9.50	26,202	1612.50	0.00	---	---	---	0.00	---	---	---	0.000	0.231	0.231
9.60	26,946	1612.60	0.00	---	---	---	0.00	---	---	---	0.000	0.235	0.235
9.70	27,691	1612.70	0.00	---	---	---	0.00	---	---	---	0.000	0.239	0.239
9.80	28,435	1612.80	0.00	---	---	---	0.00	---	---	---	0.000	0.243	0.243
9.90	29,180	1612.90	0.00	---	---	---	0.00	---	---	---	0.000	0.247	0.247
10.00	29,924	1613.00	0.00	---	---	---	0.00	---	---	---	0.000	0.251	0.251
10.10	30,798	1613.10	0.00	---	---	---	0.00	---	---	---	0.000	0.255	0.255

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Basin A/B

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
10.20	31,672	1613.20	0.00	---	---	---	0.00	---	---	---	0.000	0.259	0.259
10.30	32,547	1613.30	0.00	---	---	---	0.00	---	---	---	0.000	0.263	0.263
10.40	33,421	1613.40	0.00	---	---	---	0.00	---	---	---	0.000	0.267	0.267
10.50	34,295	1613.50	0.00	---	---	---	0.00	---	---	---	0.000	0.271	0.271
10.60	35,169	1613.60	0.06 oc	---	---	---	0.00	---	---	---	0.000	0.276	0.335
10.70	36,043	1613.70	0.17 oc	---	---	---	0.00	---	---	---	0.000	0.280	0.451
10.80	36,918	1613.80	0.30 oc	---	---	---	0.00	---	---	---	0.000	0.284	0.586
10.90	37,792	1613.90	0.44 oc	---	---	---	0.00	---	---	---	0.000	0.288	0.725
11.00	38,666	1614.00	0.56 oc	---	---	---	0.00	---	---	---	0.000	0.292	0.856
11.10	39,675	1614.10	0.66 oc	---	---	---	0.00	---	---	---	0.000	0.296	0.960
11.20	40,683	1614.20	1.06 oc	---	---	---	0.00	---	---	---	0.000	0.300	1.361
11.30	41,692	1614.30	1.75 oc	---	---	---	0.00	---	---	---	0.000	0.305	2.052
11.40	42,701	1614.40	2.23 oc	---	---	---	0.00	---	---	---	0.000	0.309	2.540
11.50	43,709	1614.50	2.63 oc	---	---	---	0.00	---	---	---	0.000	0.313	2.941
11.60	44,718	1614.60	2.94 ic	---	---	---	0.00	---	---	---	0.000	0.317	3.260
11.70	45,727	1614.70	3.13 ic	---	---	---	0.00	---	---	---	0.000	0.321	3.450
11.80	46,736	1614.80	3.30 ic	---	---	---	0.00	---	---	---	0.000	0.326	3.630
11.90	47,744	1614.90	3.47 ic	---	---	---	0.00	---	---	---	0.000	0.330	3.801
12.00	48,753	1615.00	3.63 ic	---	---	---	0.00	---	---	---	0.000	0.334	3.964
12.10	49,901	1615.10	3.78 ic	---	---	---	0.82	---	---	---	0.000	0.338	4.943
12.20	51,050	1615.20	3.93 ic	---	---	---	2.32	---	---	---	0.000	0.343	6.597
12.30	52,198	1615.30	4.07 ic	---	---	---	4.27	---	---	---	0.000	0.347	8.688
12.40	53,347	1615.40	4.21 ic	---	---	---	6.58	---	---	---	0.000	0.352	11.13
12.50	54,495	1615.50	4.34 ic	---	---	---	9.19	---	---	---	0.000	0.356	13.88
12.60	55,643	1615.60	4.47 ic	---	---	---	12.08	---	---	---	0.000	0.360	16.91
12.70	56,792	1615.70	4.59 ic	---	---	---	15.22	---	---	---	0.000	0.365	20.18
12.80	57,940	1615.80	4.71 ic	---	---	---	18.60	---	---	---	0.000	0.369	23.68
12.90	59,089	1615.90	4.83 ic	---	---	---	22.19	---	---	---	0.000	0.374	27.40
13.00	60,237	1616.00	4.95 ic	---	---	---	26.00	---	---	---	0.000	0.378	31.33

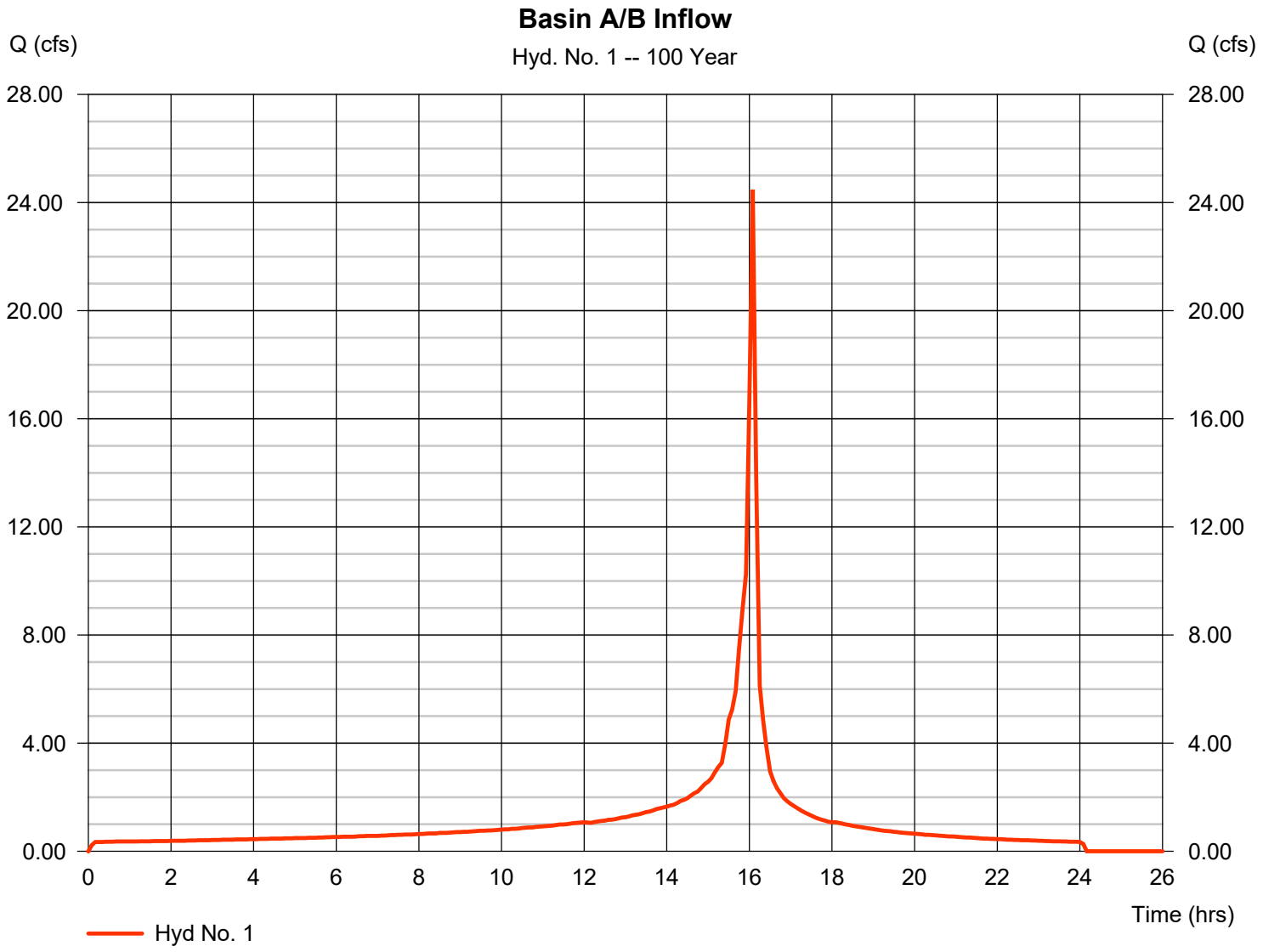
...End

Hydrograph Report

Hyd. No. 1

Basin A/B Inflow

Hydrograph type	= Manual	Peak discharge	= 24.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 16.08 hrs
Time interval	= 5 min	Hyd. volume	= 102,711 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 07 / 19 / 2022

Hyd. No. 1

Basin A/B Inflow

Hydrograph type	= Manual	Peak discharge	= 24.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 965 min
Time interval	= 5 min	Hyd. volume	= 102,711 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
10	0.340	115	0.380	220	0.440	325	0.500
15	0.340	120	0.390	225	0.440	330	0.500
20	0.340	125	0.390	230	0.440	335	0.510
25	0.350	130	0.390	235	0.450	340	0.510
30	0.350	135	0.390	240	0.450	345	0.520
35	0.350	140	0.390	245	0.450	350	0.520
40	0.360	145	0.400	250	0.460	355	0.530
45	0.360	150	0.400	255	0.460	360	0.530
50	0.360	155	0.400	260	0.460	365	0.530
55	0.360	160	0.410	265	0.470	370	0.540
60	0.360	165	0.410	270	0.470	375	0.540
65	0.360	170	0.410	275	0.470	380	0.540
70	0.360	175	0.410	280	0.470	385	0.540
75	0.370	180	0.420	285	0.480	390	0.550
80	0.370	185	0.420	290	0.480	395	0.560
85	0.370	190	0.420	295	0.480	400	0.560
90	0.370	195	0.430	300	0.490	405	0.570
95	0.380	200	0.430	305	0.490	410	0.570
100	0.380	205	0.430	310	0.490	415	0.570
105	0.380	210	0.430	315	0.490	420	0.570
110	0.380	215	0.440	320	0.500	425	0.580

Continues on next page...

Basin A/B Inflow

Hydrograph Discharge Table

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
430	0.580	565	0.750	700	1.020	835	1.620
435	0.590	570	0.760	705	1.040	840	1.650
440	0.600	575	0.760	710	1.050	845	1.690
445	0.600	580	0.770	715	1.060	850	1.720
450	0.610	585	0.770	720	1.070	855	1.780
455	0.610	590	0.780	725	1.060	860	1.860
460	0.620	595	0.790	730	1.050	865	1.900
465	0.620	600	0.800	735	1.080	870	1.960
470	0.620	605	0.810	740	1.100	875	2.060
475	0.630	610	0.810	745	1.120	880	2.150
480	0.640	615	0.830	750	1.130	885	2.210
485	0.640	620	0.830	755	1.160	890	2.340
490	0.650	625	0.840	760	1.170	895	2.480
495	0.660	630	0.860	765	1.190	900	2.570
500	0.660	635	0.870	770	1.220	905	2.700
505	0.660	640	0.880	775	1.250	910	2.930
510	0.680	645	0.880	780	1.260	915	3.120
515	0.680	650	0.900	785	1.290	920	3.270
520	0.680	655	0.910	790	1.330	925	3.980
525	0.690	660	0.920	795	1.350	930	4.870
530	0.700	665	0.930	800	1.370	935	5.240
535	0.710	670	0.940	805	1.410	940	5.920
540	0.710	675	0.950	810	1.450	945	7.490
545	0.720	680	0.970	815	1.470	950	8.920
550	0.720	685	0.990	820	1.510	955	10.26
555	0.730	690	0.990	825	1.560	960	16.73
560	0.740	695	1.000	830	1.590	965	24.48

<<

Basin A/B Inflow

Hydrograph Discharge Table

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
970	13.81	1105	0.970	1240	0.570	1375	0.400
975	6.140	1110	0.940	1245	0.560	1380	0.390
980	4.850	1115	0.920	1250	0.550	1385	0.390
985	3.830	1120	0.900	1255	0.550	1390	0.380
990	2.960	1125	0.880	1260	0.540	1395	0.380
995	2.600	1130	0.860	1265	0.530	1400	0.370
1000	2.340	1135	0.840	1270	0.520	1405	0.370
1005	2.150	1140	0.820	1275	0.510	1410	0.370
1010	1.970	1145	0.800	1280	0.510	1415	0.360
1015	1.850	1150	0.780	1285	0.500	1420	0.360
1020	1.750	1155	0.760	1290	0.490	1425	0.350
1025	1.670	1160	0.750	1295	0.480	1430	0.350
1030	1.590	1165	0.740	1300	0.470	1435	0.350
1035	1.510	1170	0.720	1305	0.470	1440	0.340
1040	1.440	1175	0.710	1310	0.460	1445	0.270
1045	1.380	1180	0.690	1315	0.460		
1050	1.320	1185	0.680	1320	0.450	*...End*	
1055	1.260	1190	0.670	1325	0.450		
1060	1.210	1195	0.660	1330	0.440		
1065	1.170	1200	0.650	1335	0.430		
1070	1.130	1205	0.640	1340	0.430		
1075	1.090	1210	0.630	1345	0.420		
1080	1.070	1215	0.610	1350	0.420		
1085	1.070	1220	0.610	1355	0.410		
1090	1.050	1225	0.600	1360	0.410		
1095	1.020	1230	0.590	1365	0.410		
1100	0.990	1235	0.580	1370	0.400		

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	24.48	5	965	102,711	------	------	------	Basin A/B Inflow
2	Reservoir	14.38	5	970	102,698	1	1615.52	54,684	Basin Routing (100-YR)

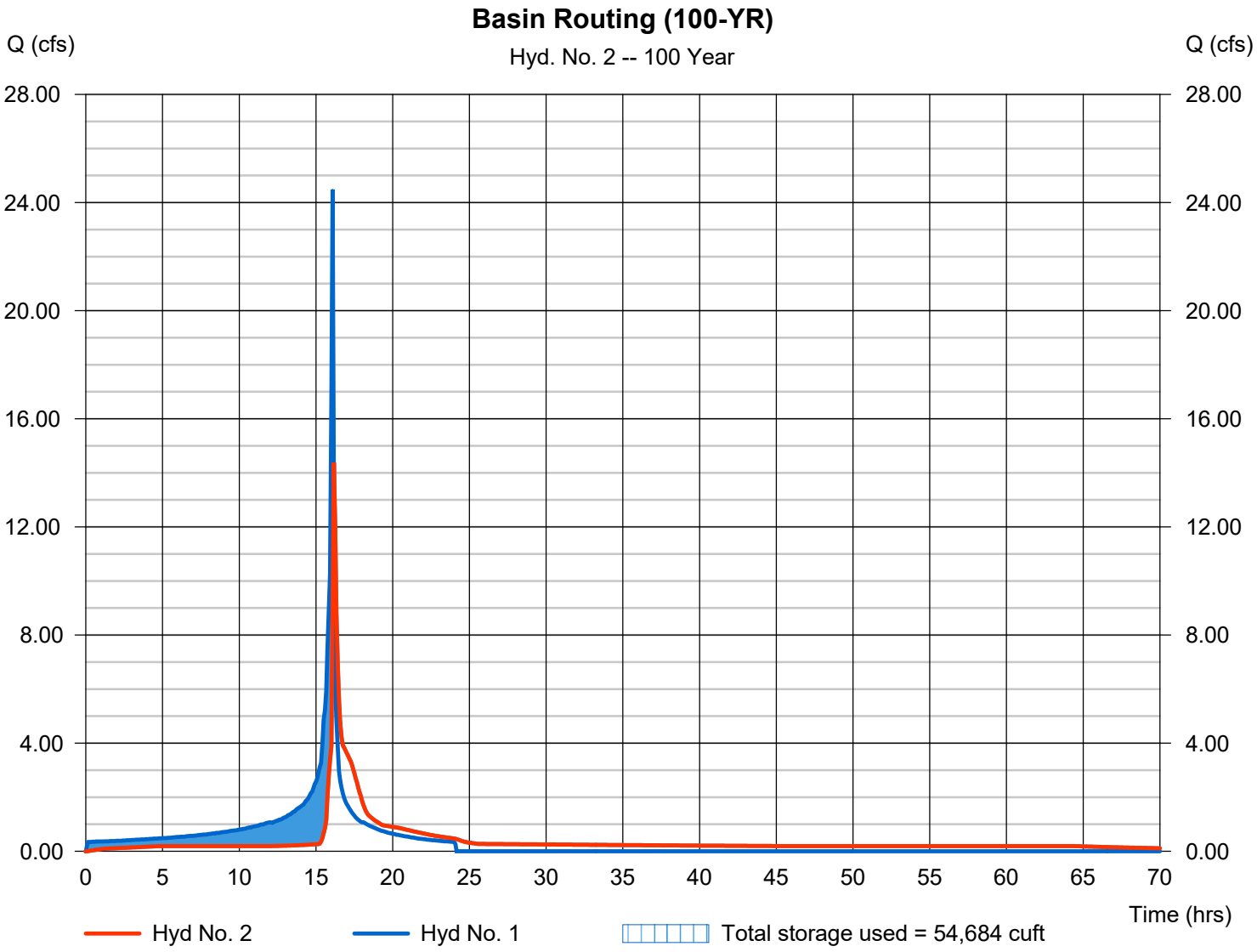
Hydrograph Report

Hyd. No. 2

Basin Routing (100-YR)

Hydrograph type	=	Reservoir	Peak discharge	=	14.38 cfs
Storm frequency	=	100 yrs	Time to peak	=	16.17 hrs
Time interval	=	5 min	Hyd. volume	=	102,698 cuft
Inflow hyd. No.	=	1 - Basin A/B Inflow	Max. Elevation	=	1615.52 ft
Reservoir name	=	Basin A/B	Max. Storage	=	54,684 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 07 / 19 / 2022

Hyd. No. 2

Basin Routing (100-YR)

Hydrograph type	= Reservoir	Peak discharge	= 14.38 cfs
Storm frequency	= 100 yrs	Time to peak	= 16.17 hrs
Time interval	= 5 min	Hyd. volume	= 102,698 cuft
Inflow hyd. No.	= 1 - Basin A/B Inflow	Reservoir name	= Basin A/B
Max. Elevation	= 1615.52 ft	Max. Storage	= 54,684 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 5.00% of Qp.)

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
15.58	5.240	1614.01	0.572	-----	-----	-----	-----	-----	-----	-----	-----	0.864
15.67	5.920	1614.14	0.838	-----	-----	-----	-----	-----	-----	-----	-----	1.136
15.75	7.490	1614.30	1.721	-----	-----	-----	-----	-----	-----	-----	-----	2.026
15.83	8.920	1614.47	2.502	-----	-----	-----	-----	-----	-----	-----	-----	2.814
15.92	10.26	1614.66	3.057	-----	-----	-----	-----	-----	-----	-----	-----	3.377
16.00	16.73	1614.95	3.558	-----	-----	-----	-----	-----	-----	-----	-----	3.890
16.08	24.48 <<	1615.33	4.106	-----	-----	-----	4.867	-----	-----	-----	-----	9.322
16.17	13.81	1615.52 <<	4.360	-----	-----	-----	9.665	-----	-----	-----	-----	14.38
16.25	6.140	1615.43	4.249	-----	-----	-----	7.418	-----	-----	-----	-----	12.02
16.33	4.850	1615.30	4.076	-----	-----	-----	4.364	-----	-----	-----	-----	8.786
16.42	3.830	1615.21	3.947	-----	-----	-----	2.577	-----	-----	-----	-----	6.867
16.50	2.960	1615.14	3.840	-----	-----	-----	1.407	-----	-----	-----	-----	5.587
16.58	2.600	1615.08	3.748	-----	-----	-----	0.632	-----	-----	-----	-----	4.718
16.67	2.340	1615.02	3.668	-----	-----	-----	0.205	-----	-----	-----	-----	4.208
16.75	2.150	1614.97	3.589	-----	-----	-----	-----	-----	-----	-----	-----	3.922
16.83	1.970	1614.92	3.503	-----	-----	-----	-----	-----	-----	-----	-----	3.834
16.92	1.850	1614.86	3.412	-----	-----	-----	-----	-----	-----	-----	-----	3.740
17.00	1.750	1614.81	3.318	-----	-----	-----	-----	-----	-----	-----	-----	3.644
17.08	1.670	1614.75	3.220	-----	-----	-----	-----	-----	-----	-----	-----	3.544
17.17	1.590	1614.70	3.122	-----	-----	-----	-----	-----	-----	-----	-----	3.444

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Basin Routing (100-YR)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
17.25	1.510	1614.64	3.021	-----	-----	-----	-----	-----	-----	-----	-----	3.339
17.33	1.440	1614.59	2.905	-----	-----	-----	-----	-----	-----	-----	-----	3.222
17.42	1.380	1614.54	2.744	-----	-----	-----	-----	-----	-----	-----	-----	3.058
17.50	1.320	1614.49	2.582	-----	-----	-----	-----	-----	-----	-----	-----	2.894
17.58	1.260	1614.44	2.404	-----	-----	-----	-----	-----	-----	-----	-----	2.714
17.67	1.210	1614.40	2.239	-----	-----	-----	-----	-----	-----	-----	-----	2.548
17.75	1.170	1614.36	2.058	-----	-----	-----	-----	-----	-----	-----	-----	2.365
17.83	1.130	1614.33	1.894	-----	-----	-----	-----	-----	-----	-----	-----	2.200
17.92	1.090	1614.30	1.748	-----	-----	-----	-----	-----	-----	-----	-----	2.053
18.00	1.070	1614.27	1.568	-----	-----	-----	-----	-----	-----	-----	-----	1.872
18.08	1.070	1614.25	1.420	-----	-----	-----	-----	-----	-----	-----	-----	1.722
18.17	1.050	1614.23	1.297	-----	-----	-----	-----	-----	-----	-----	-----	1.599
18.25	1.020	1614.22	1.193	-----	-----	-----	-----	-----	-----	-----	-----	1.494
18.33	0.990	1614.21	1.102	-----	-----	-----	-----	-----	-----	-----	-----	1.403
18.42	0.970	1614.19	1.039	-----	-----	-----	-----	-----	-----	-----	-----	1.339
18.50	0.940	1614.18	0.996	-----	-----	-----	-----	-----	-----	-----	-----	1.295
18.58	0.920	1614.17	0.955	-----	-----	-----	-----	-----	-----	-----	-----	1.254
18.67	0.900	1614.16	0.917	-----	-----	-----	-----	-----	-----	-----	-----	1.216
18.75	0.880	1614.15	0.880	-----	-----	-----	-----	-----	-----	-----	-----	1.179
18.83	0.860	1614.15	0.846	-----	-----	-----	-----	-----	-----	-----	-----	1.144
18.92	0.840	1614.14	0.814	-----	-----	-----	-----	-----	-----	-----	-----	1.111
19.00	0.820	1614.13	0.782	-----	-----	-----	-----	-----	-----	-----	-----	1.080
19.08	0.800	1614.12	0.752	-----	-----	-----	-----	-----	-----	-----	-----	1.049
19.17	0.780	1614.11	0.723	-----	-----	-----	-----	-----	-----	-----	-----	1.020
19.25	0.760	1614.11	0.696	-----	-----	-----	-----	-----	-----	-----	-----	0.992
19.33	0.750	1614.10	0.669	-----	-----	-----	-----	-----	-----	-----	-----	0.965
19.42	0.740	1614.09	0.659	-----	-----	-----	-----	-----	-----	-----	-----	0.955
19.50	0.720	1614.09	0.652	-----	-----	-----	-----	-----	-----	-----	-----	0.948

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Basin Routing (100-YR)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
19.58	0.710	1614.08	0.646	-----	-----	-----	-----	-----	-----	-----	-----	0.941
19.67	0.690	1614.07	0.639	-----	-----	-----	-----	-----	-----	-----	-----	0.934
19.75	0.680	1614.07	0.631	-----	-----	-----	-----	-----	-----	-----	-----	0.926
19.83	0.670	1614.06	0.624	-----	-----	-----	-----	-----	-----	-----	-----	0.918
19.92	0.660	1614.05	0.616	-----	-----	-----	-----	-----	-----	-----	-----	0.911
20.00	0.650	1614.04	0.609	-----	-----	-----	-----	-----	-----	-----	-----	0.903
20.08	0.640	1614.04	0.601	-----	-----	-----	-----	-----	-----	-----	-----	0.895
20.17	0.630	1614.03	0.594	-----	-----	-----	-----	-----	-----	-----	-----	0.887
20.25	0.610	1614.02	0.586	-----	-----	-----	-----	-----	-----	-----	-----	0.879
20.33	0.610	1614.01	0.578	-----	-----	-----	-----	-----	-----	-----	-----	0.871
20.42	0.600	1614.01	0.570	-----	-----	-----	-----	-----	-----	-----	-----	0.863
20.50	0.590	1614.00	0.562	-----	-----	-----	-----	-----	-----	-----	-----	0.854
20.58	0.580	1613.99	0.550	-----	-----	-----	-----	-----	-----	-----	-----	0.842
20.67	0.570	1613.98	0.539	-----	-----	-----	-----	-----	-----	-----	-----	0.830
20.75	0.560	1613.97	0.528	-----	-----	-----	-----	-----	-----	-----	-----	0.819
20.83	0.550	1613.96	0.516	-----	-----	-----	-----	-----	-----	-----	-----	0.807
20.92	0.550	1613.95	0.505	-----	-----	-----	-----	-----	-----	-----	-----	0.796
21.00	0.540	1613.95	0.495	-----	-----	-----	-----	-----	-----	-----	-----	0.785
21.08	0.530	1613.94	0.484	-----	-----	-----	-----	-----	-----	-----	-----	0.774
21.17	0.520	1613.93	0.474	-----	-----	-----	-----	-----	-----	-----	-----	0.763
21.25	0.510	1613.92	0.463	-----	-----	-----	-----	-----	-----	-----	-----	0.752
21.33	0.510	1613.91	0.453	-----	-----	-----	-----	-----	-----	-----	-----	0.741
21.42	0.500	1613.90	0.443	-----	-----	-----	-----	-----	-----	-----	-----	0.731
21.50	0.490	1613.90	0.432	-----	-----	-----	-----	-----	-----	-----	-----	0.720

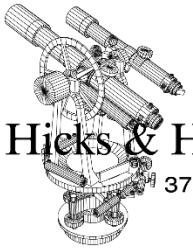
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Hydrology & Hydraulics
Preliminary Report

City of Redlands

County of San Bernardino

HYDROLOGY MAPS



Hicks & Hartwick, Inc.
37 East Olive Ave. Ste C
Redlands, CA. 92373
909.793.2257

NOTE:
Q_2 IS PEAK 2-YEAR FLOWRATE
Q_{10} IS PEAK 10-YEAR FLOWRATE
Q_{100} IS PEAK 100-YEAR FLOWRATE w/o BASIN
QB_{100} IS PEAK 100-YEAR FLOWRATE w/ BASIN

NAPLES AVENUE
OPAL AVENUE
JASPER AVENUE
WABASH AVENUE
NICE AVENUE

A12 1612.5
A11 1630.0
A10 1644.7
A09 1613.7
A08 1635.33
A07 614.60
A06 1613.20 / 1615.30
A05 1618.00 / 1614.37
A04 1635.78
A03 613.50
A02 1618.00 / 1614.37
A01 1635.78

692'
707'
776'
266'
183'
620
621
42'
41'
117'

1.39 ac.
1.86 ac.
3.77 ac.
3.92 ac.
0.28 ac.
1.22 ac.
0.21 ac.
1.74 ac.
0.09 ac.

Q_2 = 5.83 cfs
Q_{10} = 10.52 cfs
Q_{100} = 16.91 cfs

Q_2 = 14.90 cfs
Q_{10} = 28.91 cfs
Q_{100} = 47.42 cfs

Q_2 = 9.09 cfs
Q_{10} = 17.24 cfs
Q_{100} = 27.92 cfs

Q_2 = 6.85 cfs
Q_{10} = 12.04 cfs
Q_{100} = 19.15 cfs

CANOPY - PHASE 1
CANOPY - PHASE 2
RV OFC
SCALE: 1" = 100'
Prepared: JULY 2022

HICKS & HARTWICK, Inc.
CIVIL ENGINEERS · LAND SURVEYORS
37 East Olive Avenue
REDLANDS, CALIFORNIA 92373
909.793.2257

REGISTERED PROFESSIONAL ENGINEER
RILEY CLARK
No. C 40606
exp. 3/31/2023
CIVIL
STATE OF CALIFORNIA

HYDROLOGIC DATA

SCS SOILS GROUP: B
INTENSITY-DURATION SLOPE: 0.65
2-year/1-hour RAINFALL (AMC I): 0.47 in/hr
10-year/1-hour RAINFALL (AMC II): 0.80 in/hr
100-year/1-hour RAINFALL (AMC III): 1.25 in/hr

REDLANDS SELF STORAGE
CITY OF REDLANDS
SAN BERNARDINO COUNTY
EXISTING HYDROLOGY

10301 Hydrology 2022-07.dwg : Existing 2:35pm - Jul 19, 2022 (c) Hicks & Hartwick, Inc.

NOTE:
Q_2 IS PEAK 2-YEAR FLOWRATE
Q_{10} IS PEAK 10-YEAR FLOWRATE
Q_{100} IS PEAK 100-YEAR FLOWRATE w/o BASIN
QB_{100} IS PEAK 100-YEAR FLOWRATE w/ BASIN

Q_2 = 18.93 cfs
Q_{10} = 35.73 cfs
Q_{100} = 54.15 cfs
QB_{100} = 45.37 cfs
0.08 ac.

Q_2 = 14.10 cfs
Q_{10} = 25.25 cfs
Q_{100} = 40.74 cfs
QB_{100} = 31.96 cfs
1.46 ac.

Q_2 = 6.05 cfs
Q_{10} = 10.83 cfs
Q_{100} = 17.58 cfs
0.52 ac.

Q_2 = 5.11 cfs
Q_{10} = 8.99 cfs
Q_{100} = 14.13 cfs
0.50 ac.

NAPLES AVENUE
OPAL AVENUE
WABASH AVENUE
JASPER AVENUE
NICE AVENUE

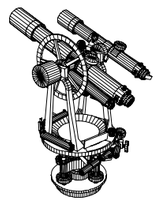
A16 1612.5
A15 1630.0
A13 1612.9
A10 1631.2
A11 1621.18 1619.18
A12 1617.73
A09 1621.18 1619.18
A14 1644.7
A07 614.60
A08 1635.33
A06 1613.20 1615.30
A05 1618.00 1614.37
A04 1635.78
A02 1618.00 1614.37
A01 1635.78
A03 1613.50

2.47 ac.
2.44 ac.
3.77 ac.
1.22 ac.
1.74 ac.
0.21 ac.
0.09 ac.

CANOPY - PHASE 1
CANOPY - PHASE 2
RV/AUTO PARKING SPACE (TYP)
40' ACCESS LANE (TYP)
RV OFC

SCALE: 1" = 100'
Prepared: JULY 2022

HICKS & HARTWICK, Inc.
CIVIL ENGINEERS · LAND SURVEYORS
37 East Olive Avenue
REDLANDS, CALIFORNIA 92373
909.793.2257



REGISTERED PROFESSIONAL ENGINEER
RILEY CLARK
No. C 40606
exp. 3/31/2023
CIVIL
STATE OF CALIFORNIA

HYDROLOGIC DATA

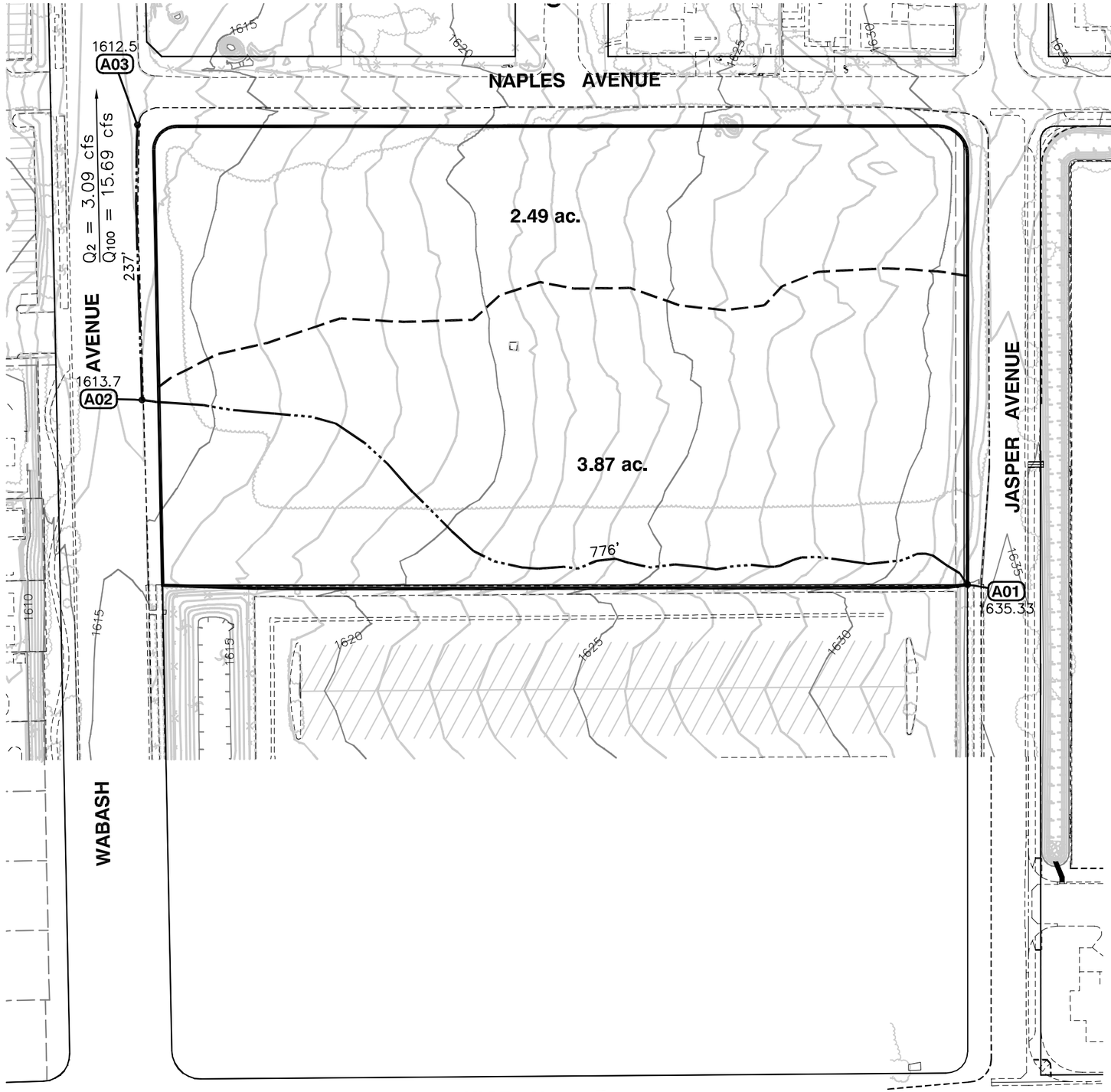
SCS SOILS GROUP: B
INTENSITY-DURATION SLOPE: 0.65
2-year/1-hour RAINFALL (AMC I): 0.47 in/hr
10-year/1-hour RAINFALL (AMC II): 0.80 in/hr
100-year/1-hour RAINFALL (AMC III): 1.25 in/hr

REDLANDS SELF STORAGE
CITY OF REDLANDS
SAN BERNARDINO COUNTY
PROPOSED HYDROLOGY

(c) Hicks & Hartwick, Inc.

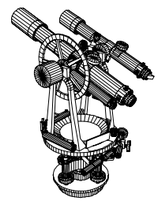
10301 Hydrology 2022-07.dwg : Proposed 2:36pm – Jul 19, 2022

NOTE:
Q_2 IS PEAK 2-YEAR FLOWRATE
Q_{10} IS PEAK 10-YEAR FLOWRATE
Q_{100} IS PEAK 100-YEAR FLOWRATE w/o BASIN
QB_{100} IS PEAK 100-YEAR FLOWRATE w/ BASIN



SCALE: 1" = 100'
Prepared: JULY 2022

HICKS & HARTWICK, Inc.
CIVIL ENGINEERS · LAND SURVEYORS
37 East Olive Avenue
REDLANDS, CALIFORNIA 92373
909.793.2257





HYDROLOGIC DATA

2-year	100-year
Tc = 17.59 min.	Tc = 16.91 min.
Fm = 0.500	Fm = 0.110
Y-bar = 0.267	Y-bar = 0.551

REDLANDS SELF STORAGE
CITY OF REDLANDS
SAN BERNARDINO COUNTY
SAUH EXISTING HYDROLOGY

(c) Hicks & Hartwick, Inc. 2022
10301 Hydrology 2022-07.dwg : SAUH Existing 2:37pm - Jul 19, 2022

NOTE:
Q_2 IS PEAK 2-YEAR FLOWRATE
Q_{10} IS PEAK 10-YEAR FLOWRATE
Q_{100} IS PEAK 100-YEAR FLOWRATE w/o BASIN
QB_{100} IS PEAK 100-YEAR FLOWRATE w/ BASIN

Q_2 = 8.48 cfs
Q_{100} = 24.48 cfs
QB_{100} = 14.38 cfs

NAPLES AVENUE

OPAL AVENUE

AVENUE

JASPER AVENUE

WABASH

NICE AVENUE

1612.9 A06

1631.2 A03

A04 1621.18 1619.18

A05 1617.73

A02 1621.18 1619.18

A01 1635.33

459'

532'

476'

145'

145'

1.46 ac.

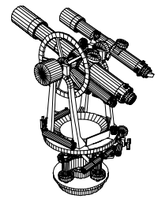
2.47 ac.

2.44 ac.

1610 1615 1620 1625 1630 1635

SCALE: 1" = 100'
Prepared: JULY 2022

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REGISTERED PROFESSIONAL ENGINEER
RILEY CLARK
No. C 40606
exp. 3/31/2023
CIVIL
STATE OF CALIFORNIA

HYDROLOGIC DATA

2-year	100-year
Tc = 9.13 min.	Tc = 8.70 min.
Fm = 0.090	Fm = 0.040
Y-bar = 0.570	Y-bar = 0.780

REDLANDS SELF STORAGE
CITY OF REDLANDS
SAN BERNARDINO COUNTY
SAUH PROPOSED HYDROLOGY

(c) Hicks & Hartwick, Inc.

10301 Hydrology 2022-07.dwg : SAUH Proposed 2:40pm – Jul 19, 2022