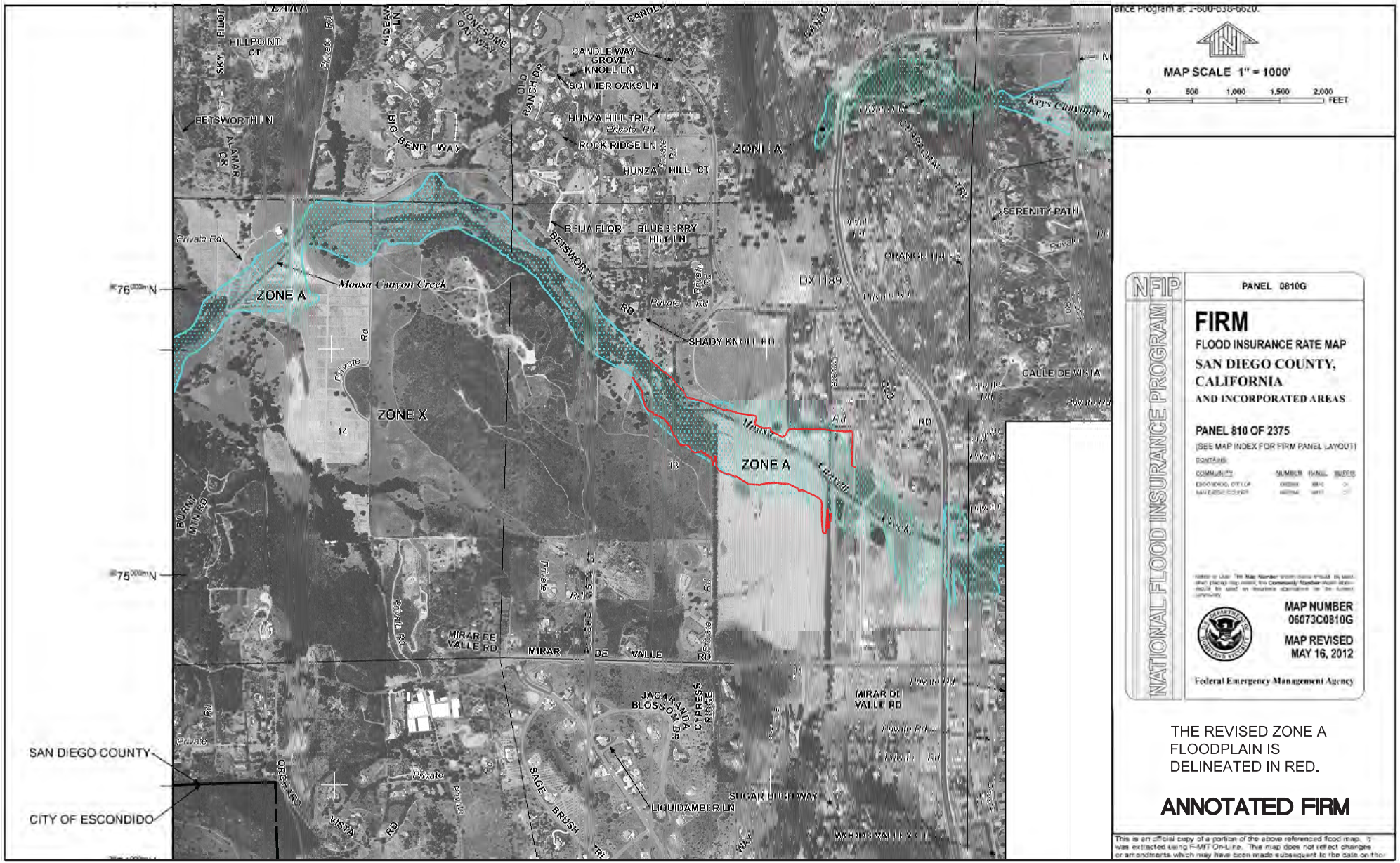
ance Program at 1-800-638-6620.
MAP SCALE 1" = 1000'
0 500 1,000 1,500 2,000 FEET
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0810G
FIRM
FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS
PANEL 810 OF 2375
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
MAP NUMBER
06073C0810G
MAP REVISED
MAY 16, 2012
Federal Emergency Management Agency
ZONE A
ZONE X
Moosa Canyon Creek
HILLPOINT CT
SKY PILOT
BETSWORTH LN
ALAMAR DR
BIG BEND WAY
LONESOME OAK WAY
OLD RANCH DR
CANDLE WAY GROVE
KNOLL LN
SOLDIER OAKS LN
HUNZA HILL TRL
ROCK RIDGE LN
HUNZA HILL CT
BEIJA FLOR
BLUEBERRY HILL LN
SERENITY PATH
ORANGE TRL
SHADY KNOLL RD
CALLE DE VISTA
MIRAR DE VALLE RD
JACARANDA BLOSSOM DR
CYPRESS RIDGE
LIQUIDAMBER LN
SUGAR BUSH WAY
SAGE BRUSH TRL
ORCHARD VISTA RD
BURNT MTN RD
SAN DIEGO COUNTY
CITY OF ESCONDIDO
33°76'00"N
33°75'00"N
THE REVISED ZONE A FLOODPLAIN IS DELINEATED IN RED.
ANNOTATED FIRM
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the

Appendix B: 100-Year Pre-Project Condition Hydrologic Output

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 01/24/17

Shady Oak
Existing Conditions
Major Drainage Basin 100
100-Year Flow Rate

 *********   Hydrology Study Control Information **********

Program License Serial Number 6289

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.750
24 hour precipitation(inches) = 8.200
P6/P24 =   45.7%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   100.000 to Point/Station   101.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL   ]
(1.0 DU/A or Less   )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance =   75.000(Ft.)
Highest elevation = 1508.000(Ft.)
Lowest elevation = 1502.000(Ft.)
Elevation difference =   6.000(Ft.) Slope = 8.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.00 %, in a development type of
 1.0 DU/A or Less

```
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.66 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3600)*( 100.000^.5)/(   8.000^(1/3)]=   6.66
Rainfall intensity (I) =      8.212(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1502.000(Ft.)
Downstream point elevation =  1330.000(Ft.)
Channel length thru subarea  =   845.000(Ft.)
Channel base width      =   25.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     13.964(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =     13.964(CFS)
Depth of flow =   0.119(Ft.), Average velocity =   4.570(Ft/s)
Channel flow top width =   26.194(Ft.)
Flow Velocity =    4.57(Ft/s)
Travel time  =    3.08 min.
Time of concentration =    9.74 min.
Critical depth =      0.211(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.426(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.997
Decimal fraction soil group D = 0.003
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      6.426(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360  CA =      4.286
Subarea runoff =     27.245(CFS) for     11.800(Ac.)
Total runoff =     27.540(CFS)      Total area =      11.900(Ac.)
Depth of flow =   0.179(Ft.), Average velocity =   5.942(Ft/s)
Critical depth =      0.328(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1330.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =   800.000(Ft.)
```

```
Channel base width      =   37.000(Ft.)
Slope or 'Z' of left channel bank =  58.000
Slope or 'Z' of right channel bank =  58.000
Estimated mean flow rate at midpoint of channel =     34.236(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     34.236(CFS)
Depth of flow =   0.235(Ft.), Average velocity =   2.883(Ft/s)
Channel flow top width =   64.222(Ft.)
Flow Velocity =    2.88(Ft/s)
Travel time  =    4.63 min.
Time of concentration =   14.37 min.
Critical depth =      0.258(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.001(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.115
Decimal fraction soil group D = 0.885
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.404
Rainfall intensity =      5.001(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      8.167
Subarea runoff =     13.305(CFS) for      9.600(Ac.)
Total runoff =     40.845(CFS)      Total area =      21.500(Ac.)
Depth of flow =   0.258(Ft.), Average velocity =   3.042(Ft/s)
Critical depth =      0.287(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     21.500(Ac.)
Runoff from this stream =     40.845(CFS)
Time of concentration =   14.37 min.
Rainfall intensity =     5.001(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  162.000(Ft.)
```

```
Highest elevation = 1486.000(Ft.)
Lowest elevation = 1445.000(Ft.)
Elevation difference =   41.000(Ft.) Slope = 25.309 %
Top of Initial Area Slope adjusted by User to 25.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  25.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.92 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  25.000^(1/3)]=   4.92
Calculated TC of    4.925 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      9.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1445.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =  1405.000(Ft.)
Channel base width      =   19.000(Ft.)
Slope or 'Z' of left channel bank =  30.000
Slope or 'Z' of right channel bank =  30.000
Estimated mean flow rate at midpoint of channel =      8.108(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    0.200(Ft.)
Flow(q) thru subarea =      8.108(CFS)
Depth of flow =   0.118(Ft.), Average velocity =   3.035(Ft/s)
Channel flow top width =   26.108(Ft.)
Flow Velocity =    3.03(Ft/s)
Travel time  =    7.72 min.
Time of concentration =   12.64 min.
Critical depth =      0.162(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.432(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.300
Decimal fraction soil group D = 0.700
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.395
Rainfall intensity =      5.432(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.394  CA =      2.913
Subarea runoff =     15.530(CFS) for      7.300(Ac.)
Total runoff =     15.826(CFS)      Total area =       7.400(Ac.)
Depth of flow =   0.173(Ft.), Average velocity =   3.783(Ft/s)
```

```
Critical depth =      0.238(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      7.400(Ac.)
Runoff from this stream =     15.826(CFS)
Time of concentration =   12.64 min.
Rainfall intensity =     5.432(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       40.845     14.37               5.001
2       15.826     12.64               5.432
Qmax(1) =
         1.000 *    1.000 *    40.845) +
         0.921 *    1.000 *    15.826) + =      55.417
Qmax(2) =
         1.000 *    0.880 *    40.845) +
         1.000 *    1.000 *    15.826) + =      51.763

Total of 2 streams to confluence:
Flow rates before confluence point:
      40.845      15.826
Maximum flow rates at confluence using above data:
       55.417       51.763
Area of streams before confluence:
       21.500        7.400
Results of confluence:
Total flow rate =     55.417(CFS)
Time of concentration =    14.367 min.
Effective stream area after confluence =     28.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1295.000(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =    12.00(Ft.) Slope =   0.0417  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    55.417(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    55.417(CFS)
Normal flow depth in pipe =   25.59(In.)
Flow top width inside pipe =   27.54(In.)
Critical Depth =   29.06(In.)
Pipe flow velocity =     11.20(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    14.39 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     28.900(Ac.)
Runoff from this stream =     55.417(CFS)
Time of concentration =   14.39 min.
Rainfall intensity =     4.997(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      121.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation = 1340.000(Ft.)
Lowest elevation = 1325.000(Ft.)
Elevation difference =   15.000(Ft.) Slope = 15.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  15.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.84 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  15.000^(1/3)]=   5.84
Rainfall intensity (I) =      8.940(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.268(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of street segment elevation =  1325.000(Ft.)
End of street segment elevation =  1298.000(Ft.)
Length of street segment  =  1117.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  32.000(Ft.)
Distance from crown to crossfall grade break  =  31.999(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
```

```
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.000
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  6.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      4.397(CFS)
Depth of flow =   0.575(Ft.), Average velocity =   2.456(Ft/s)
Warning: depth of flow exceeds top of curb
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   3.766(Ft.)
Flow velocity =   2.46(Ft/s)
Travel time =    7.58 min.     TC =   13.42  min.
 Adding area flow to street
Rainfall intensity (I) =      5.227(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.610
Decimal fraction soil group D = 0.390
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.582
Rainfall intensity =      5.227(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.572  CA =      1.659
Subarea runoff =      8.402(CFS) for      2.800(Ac.)
Total runoff =      8.670(CFS)      Total area =       2.900(Ac.)
Street flow at end of street =      8.670(CFS)
Half street flow at end of street =      4.335(CFS)
Depth of flow =   0.610(Ft.), Average velocity =   3.103(Ft/s)
Warning: depth of flow exceeds top of curb
Flow width (from curb towards crown)=   5.482(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1295.200(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =   160.00(Ft.) Slope =   0.0044  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =     8.670(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     3.574(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      3.714(Ft.)
 Minor friction loss =      0.561(Ft.)    K-factor =   1.50
Pipe flow velocity =      4.91(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    13.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.900(Ac.)
Runoff from this stream =      8.670(CFS)
Time of concentration =   13.96 min.
Rainfall intensity =     5.095(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       55.417     14.39               4.997
2        8.670     13.96               5.095
Qmax(1) =
         1.000 *    1.000 *    55.417) +
         0.981 *    1.000 *     8.670) + =      63.922
Qmax(2) =
         1.000 *    0.971 *    55.417) +
         1.000 *    1.000 *     8.670) + =      62.459

Total of 2 streams to confluence:
Flow rates before confluence point:
      55.417       8.670
Maximum flow rates at confluence using above data:
       63.922       62.459
Area of streams before confluence:
       28.900        2.900
Results of confluence:
Total flow rate =     63.922(CFS)
Time of concentration =    14.385 min.
Effective stream area after confluence =     31.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
____________________________________________________________________
Upstream point/station elevation =  1294.500(Ft.)
Downstream point/station elevation =  1288.700(Ft.)
Pipe length  =    96.00(Ft.) Slope =   0.0604  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    63.922(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    63.922(CFS)
Normal flow depth in pipe =   24.66(In.)
Flow top width inside pipe =   28.69(In.)
Critical Depth =   30.40(In.)
Pipe flow velocity =     13.43(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    14.50 min.
End of computations, total study area =          31.800 (Ac.)
```

Appendix C: 100-Year Post-Project Condition Hydrologic Output

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 01/24/17

Shady Oak
Proposed Conditions
Major Drainage Basin 100
100-Year Flow Rate

 *********   Hydrology Study Control Information **********

Program License Serial Number 6289

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.750
24 hour precipitation(inches) = 8.200
P6/P24 =   45.7%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   100.000 to Point/Station   101.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL   ]
(1.0 DU/A or Less   )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Initial subarea total flow distance =   75.000(Ft.)
Highest elevation = 1508.000(Ft.)
Lowest elevation = 1502.000(Ft.)
Elevation difference =   6.000(Ft.) Slope = 8.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.00 %, in a development type of
 1.0 DU/A or Less

```
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.66 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3600)*( 100.000^.5)/(   8.000^(1/3)]=   6.66
Rainfall intensity (I) =      8.212(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.360
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1502.000(Ft.)
Downstream point elevation =  1330.000(Ft.)
Channel length thru subarea  =   845.000(Ft.)
Channel base width      =   25.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     13.964(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =     13.964(CFS)
Depth of flow =   0.119(Ft.), Average velocity =   4.570(Ft/s)
Channel flow top width =   26.194(Ft.)
Flow Velocity =    4.57(Ft/s)
Travel time  =    3.08 min.
Time of concentration =    9.74 min.
Critical depth =      0.211(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      6.426(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.997
Decimal fraction soil group D = 0.003
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.360
Rainfall intensity =      6.426(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.360  CA =      4.286
Subarea runoff =     27.245(CFS) for     11.800(Ac.)
Total runoff =     27.540(CFS)      Total area =      11.900(Ac.)
Depth of flow =   0.179(Ft.), Average velocity =   5.942(Ft/s)
Critical depth =      0.328(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =  1330.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =   800.000(Ft.)
```

```
Channel base width      =   37.000(Ft.)
Slope or 'Z' of left channel bank =  58.000
Slope or 'Z' of right channel bank =  58.000
Estimated mean flow rate at midpoint of channel =     34.236(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     34.236(CFS)
Depth of flow =   0.235(Ft.), Average velocity =   2.883(Ft/s)
Channel flow top width =   64.222(Ft.)
Flow Velocity =    2.88(Ft/s)
Travel time  =    4.63 min.
Time of concentration =   14.37 min.
Critical depth =      0.258(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.001(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.115
Decimal fraction soil group D = 0.885
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.404
Rainfall intensity =      5.001(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      8.167
Subarea runoff =     13.305(CFS) for      9.600(Ac.)
Total runoff =     40.845(CFS)      Total area =      21.500(Ac.)
Depth of flow =   0.258(Ft.), Average velocity =   3.042(Ft/s)
Critical depth =      0.287(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     21.500(Ac.)
Runoff from this stream =     40.845(CFS)
Time of concentration =   14.37 min.
Rainfall intensity =     5.001(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  162.000(Ft.)
```

```
Highest elevation = 1486.000(Ft.)
Lowest elevation = 1445.000(Ft.)
Elevation difference =   41.000(Ft.) Slope = 25.309 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  25.30 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.91 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  25.300^(1/3)]=   4.91
Calculated TC of    4.905 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      9.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.296(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1445.000(Ft.)
Downstream point elevation =  1295.000(Ft.)
Channel length thru subarea  =  1537.000(Ft.)
Channel base width      =   19.000(Ft.)
Slope or 'Z' of left channel bank =  30.000
Slope or 'Z' of right channel bank =  30.000
Estimated mean flow rate at midpoint of channel =      2.456(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    0.200(Ft.)
Flow(q) thru subarea =      2.456(CFS)
Depth of flow =   0.061(Ft.), Average velocity =   1.939(Ft/s)
Channel flow top width =   22.649(Ft.)
Flow Velocity =    1.94(Ft/s)
Travel time  =   13.21 min.
Time of concentration =   18.11 min.
Critical depth =      0.077(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.307(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.593
Decimal fraction soil group D = 0.407
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.380
Rainfall intensity =      4.307(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.377  CA =      1.057
Subarea runoff =      4.256(CFS) for      2.700(Ac.)
Total runoff =      4.552(CFS)      Total area =       2.800(Ac.)
Depth of flow =   0.087(Ft.), Average velocity =   2.416(Ft/s)
Critical depth =      0.113(Ft.)
```

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Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.800(Ac.)
Runoff from this stream =      4.552(CFS)
Time of concentration =   18.11 min.
Rainfall intensity =     4.307(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       40.845     14.37               5.001
2        4.552     18.11               4.307
Qmax(1) =
         1.000 *    1.000 *    40.845) +
         1.000 *    0.793 *     4.552) + =      44.456
Qmax(2) =
         0.861 *    1.000 *    40.845) +
         1.000 *    1.000 *     4.552) + =      39.727

Total of 2 streams to confluence:
Flow rates before confluence point:
      40.845       4.552
Maximum flow rates at confluence using above data:
       44.456       39.727
Area of streams before confluence:
       21.500        2.800
Results of confluence:
Total flow rate =     44.456(CFS)
Time of concentration =    14.367 min.
Effective stream area after confluence =     24.300(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1295.000(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =    12.00(Ft.) Slope =   0.0417  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    44.456(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    44.456(CFS)
Normal flow depth in pipe =   24.09(In.)
Flow top width inside pipe =   23.86(In.)
Critical Depth =   26.60(In.)
Pipe flow velocity =     10.53(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    14.39 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     24.300(Ac.)
Runoff from this stream =     44.456(CFS)
Time of concentration =   14.39 min.
Rainfall intensity =     4.997(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      150.000 to Point/Station      151.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   72.000(Ft.)
Highest elevation = 1299.000(Ft.)
Lowest elevation = 1298.000(Ft.)
Elevation difference =    1.000(Ft.) Slope =  1.389 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of   1.38 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.52 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  65.000^.5)/(   1.380^(1/3)]=   6.52
Rainfall intensity (I) =      8.328(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.500(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      151.000 to Point/Station      152.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Top of street segment elevation =  1298.000(Ft.)
End of street segment elevation =  1297.700(Ft.)
Length of street segment  =    36.500(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  41.000(Ft.)
Distance from crown to crossfall grade break  =  40.990(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.020
Gutter width =   0.000(Ft.)
Gutter hike from flowline =  6.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      2.215(CFS)
Depth of flow =   0.661(Ft.), Average velocity =   1.711(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    8.05(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.045(Ft.)
Flow velocity =   1.71(Ft/s)
Travel time =    0.36 min.     TC =    6.87  min.
 Adding area flow to street
Rainfall intensity (I) =      8.047(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      8.047(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      0.480
Subarea runoff =      3.363(CFS) for      0.700(Ac.)
Total runoff =      3.863(CFS)      Total area =       0.800(Ac.)
Street flow at end of street =      3.863(CFS)
Half street flow at end of street =      3.863(CFS)
Depth of flow =   0.698(Ft.), Average velocity =   1.978(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    9.88(Ft.)
Flow width (from curb towards crown)=   9.881(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      152.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =  1295.200(Ft.)
Downstream point/station elevation =  1294.500(Ft.)
Pipe length  =   160.00(Ft.) Slope =   0.0044  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =     3.863(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.148(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.737(Ft.)
 Minor friction loss =      0.111(Ft.)    K-factor =   1.50
Pipe flow velocity =      2.19(Ft/s)
Travel time through pipe =    1.22 min.
Time of concentration (TC) =     8.09 min.
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.800(Ac.)
Runoff from this stream =      3.863(CFS)
Time of concentration =    8.09 min.
Rainfall intensity =     7.242(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       44.456     14.39               4.997
2        3.863      8.09               7.242
Qmax(1) =
         1.000 *    1.000 *    44.456) +
         0.690 *    1.000 *     3.863) + =      47.121
Qmax(2) =
         1.000 *    0.563 *    44.456) +
         1.000 *    1.000 *     3.863) + =      28.871

Total of 2 streams to confluence:
Flow rates before confluence point:
      44.456       3.863
Maximum flow rates at confluence using above data:
       47.121       28.871
Area of streams before confluence:
       24.300        0.800
Results of confluence:
Total flow rate =     47.121(CFS)
Time of concentration =    14.386 min.
Effective stream area after confluence =     25.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1294.500(Ft.)
Downstream point/station elevation =  1288.700(Ft.)
Pipe length  =    96.00(Ft.) Slope =   0.0604  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    47.121(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    47.121(CFS)
Normal flow depth in pipe =   21.49(In.)
Flow top width inside pipe =   27.04(In.)
Critical Depth =   27.12(In.)
Pipe flow velocity =     12.52(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =    14.51 min.


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Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     25.100(Ac.)
Runoff from this stream =     47.121(CFS)
Time of concentration =   14.51 min.
Rainfall intensity =     4.969(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      130.000 to Point/Station      131.000
**** INITIAL AREA EVALUATION ****
--------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.570
Initial subarea total flow distance  =   60.000(Ft.)
Highest elevation = 1317.800(Ft.)
Lowest elevation = 1314.000(Ft.)
Elevation difference =    3.800(Ft.) Slope =  6.333 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.33 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.16 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5700)*( 100.000^.5)/(   6.330^(1/3)]=   5.16
Rainfall intensity (I) =      9.685(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff =      0.552(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      131.000 to Point/Station      132.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
--------------------------------------------------------------------------------
Top of street segment elevation =  1314.000(Ft.)
End of street segment elevation =  1297.000(Ft.)
Length of street segment  =   770.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  13.000(Ft.)
Distance from crown to crossfall grade break  =  11.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.015
Slope from grade break to crown (v/hz)  =   0.015
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  11.500(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.015
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  0.270(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      9.295(CFS)
Depth of flow =   0.198(Ft.), Average velocity =   3.558(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.000(Ft.)
Flow velocity =   3.56(Ft/s)
Travel time =    3.61 min.     TC =    8.76  min.
 Adding area flow to street
Rainfall intensity (I) =      6.880(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.756
Decimal fraction soil group D = 0.244
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.577
Rainfall intensity =      6.880(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.577  CA =      2.597
Subarea runoff =     17.316(CFS) for      4.400(Ac.)
Total runoff =     17.868(CFS)      Total area =       4.500(Ac.)
Street flow at end of street =     17.868(CFS)
Half street flow at end of street =      8.934(CFS)
Depth of flow =   0.246(Ft.), Average velocity =   4.613(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  13.000(Ft.)


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Process from Point/Station      132.000 to Point/Station      132.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      4.500(Ac.)
Runoff from this stream =     17.868(CFS)
Time of concentration =    8.76 min.
Rainfall intensity =     6.880(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      140.000 to Point/Station      141.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
```

```
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =  127.000(Ft.)
Highest elevation = 1311.300(Ft.)
Lowest elevation = 1307.560(Ft.)
Elevation difference =    3.740(Ft.) Slope =  2.945 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 90.00 (Ft)
for the top area slope value of   2.94 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.96 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  90.000^.5)/(   2.940^(1/3)]=   5.96
Rainfall intensity (I) =      8.822(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.529(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station      141.000 to Point/Station      132.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =  1307.560(Ft.)
End of street segment elevation =  1297.000(Ft.)
Length of street segment  =   300.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  14.000(Ft.)
Distance from crown to crossfall grade break  =  12.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.004
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.015
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  4.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      1.059(CFS)
Depth of flow =   0.244(Ft.), Average velocity =   3.948(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   1.500(Ft.)
Flow velocity =   3.95(Ft/s)
Travel time =    1.27 min.     TC =    7.23  min.
 Adding area flow to street
Rainfall intensity (I) =      7.791(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
```

```
Rainfall intensity =      7.791(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      0.180
Subarea runoff =      0.873(CFS) for      0.200(Ac.)
Total runoff =      1.402(CFS)      Total area =       0.300(Ac.)
Street flow at end of street =      1.402(CFS)
Half street flow at end of street =      0.701(CFS)
Depth of flow =   0.271(Ft.), Average velocity =   4.236(Ft/s)
Flow width (from curb towards crown)=   1.500(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      132.000 to Point/Station      132.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.300(Ac.)
Runoff from this stream =      1.402(CFS)
Time of concentration =    7.23 min.
Rainfall intensity =     7.791(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       17.868      8.76               6.880
2        1.402      7.23               7.791
Qmax(1) =
         1.000 *    1.000 *    17.868) +
         0.883 *    1.000 *     1.402) + =      19.106
Qmax(2) =
         1.000 *    0.825 *    17.868) +
         1.000 *    1.000 *     1.402) + =      16.136

Total of 2 streams to confluence:
Flow rates before confluence point:
      17.868       1.402
Maximum flow rates at confluence using above data:
       19.106       16.136
Area of streams before confluence:
        4.500        0.300
Results of confluence:
Total flow rate =     19.106(CFS)
Time of concentration =     8.764 min.
Effective stream area after confluence =      4.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      132.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1292.700(Ft.)
Downstream point/station elevation =  1259.600(Ft.)
Pipe length  =    12.66(Ft.) Slope =   2.6145  Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    19.106(CFS)
```

```
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =    19.106(CFS)
Normal flow depth in pipe =    6.22(In.)
Flow top width inside pipe =    8.31(In.)
Critical depth could not be calculated.
Pipe flow velocity =     58.60(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =     8.77 min.


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Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      4.800(Ac.)
Runoff from this stream =     19.106(CFS)
Time of concentration =    8.77 min.
Rainfall intensity =     6.878(In/Hr)


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Process from Point/Station      120.000 to Point/Station      121.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation = 1340.000(Ft.)
Lowest elevation = 1325.000(Ft.)
Elevation difference =   15.000(Ft.) Slope = 15.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  15.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.84 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  15.000^(1/3)]=   5.84
Rainfall intensity (I) =      8.940(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.268(CFS)
Total initial stream area =        0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =  1325.000(Ft.)
```

```
End of street segment elevation =  1298.100(Ft.)
Length of street segment  =  1008.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.100(Ft.)
Distance from crown to crossfall grade break  =  28.600(Ft.)
Slope from gutter to grade break (v/hz) =   0.055
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.500(Ft.)
Slope from curb to property line (v/hz) =   0.500
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  5.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      3.350(CFS)
Depth of flow =   0.466(Ft.), Average velocity =   3.744(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   3.967(Ft.)
Flow velocity =   3.74(Ft/s)
Travel time =    4.49 min.     TC =   10.33  min.
 Adding area flow to street
Rainfall intensity (I) =      6.189(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.930
Decimal fraction soil group D = 0.070
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.572
Rainfall intensity =      6.189(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.558  CA =      1.060
Subarea runoff =      6.290(CFS) for      1.800(Ac.)
Total runoff =      6.559(CFS)      Total area =       1.900(Ac.)
Street flow at end of street =      6.559(CFS)
Half street flow at end of street =      3.279(CFS)
Depth of flow =   0.533(Ft.), Average velocity =   3.959(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    0.07(Ft.)
Flow width (from curb towards crown)=   7.330(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      1.900(Ac.)
Runoff from this stream =      6.559(CFS)
Time of concentration =   10.33 min.
Rainfall intensity =     6.189(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
```

```
 No.       (CFS)       (min)                 (In/Hr)


1       19.106      8.77               6.878
2        6.559     10.33               6.189
Qmax(1) =
         1.000 *    1.000 *    19.106) +
         1.000 *    0.849 *     6.559) + =      24.675
Qmax(2) =
         0.900 *    1.000 *    19.106) +
         1.000 *    1.000 *     6.559) + =      23.751

Total of 2 streams to confluence:
Flow rates before confluence point:
      19.106       6.559
Maximum flow rates at confluence using above data:
       24.675       23.751
Area of streams before confluence:
        4.800        1.900
Results of confluence:
Total flow rate =     24.675(CFS)
Time of concentration =     8.767 min.
Effective stream area after confluence =      6.700(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1292.500(Ft.)
Downstream point/station elevation =  1291.000(Ft.)
Pipe length  =   317.66(Ft.) Slope =   0.0047  Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    24.675(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    24.675(CFS)
Normal flow depth in pipe =   21.98(In.)
Flow top width inside pipe =   31.12(In.)
Critical Depth =   19.72(In.)
Pipe flow velocity =      5.87(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =     9.67 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.700(Ac.)
Runoff from this stream =     24.675(CFS)
Time of concentration =    9.67 min.
Rainfall intensity =     6.457(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
```

```
 No.       (CFS)       (min)                 (In/Hr)


1       47.121     14.51               4.969
2       24.675      9.67               6.457
Qmax(1) =
         1.000 *    1.000 *    47.121) +
         0.770 *    1.000 *    24.675) + =      66.109
Qmax(2) =
         1.000 *    0.666 *    47.121) +
         1.000 *    1.000 *    24.675) + =      56.068

Total of 2 main streams to confluence:
Flow rates before confluence point:
      47.121      24.675
Maximum flow rates at confluence using above data:
       66.109       56.068
Area of streams before confluence:
       25.100        6.700


Results of confluence:
Total flow rate =     66.109(CFS)
Time of concentration =    14.514 min.
Effective stream area after confluence  =     31.800(Ac.)
End of computations, total study area =          31.800 (Ac.)
```

Appendix D: HEC-1 Detention Calculations

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   18APR17  TIME  17:17:04  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
                        *DIAGRAM
*** FREE ***
             1          ID   SHADY OAK
             2          ID   PRELIMINARY 100-YEAR DETENTION ANALYSIS
             3          IT       2 01JAN90    1200     200

             4          KK   BASIN
             5          KM   RATIONAL METHOD HYDROGRAPH PROGRAM
             6          KM   100-YEAR, 6-HOUR RAINFALL IS 3.75 INCHES
             7          KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.418
             8          KM   RATIONAL METHOD TIME OF CONCENTRATION IS 14.514 MINUTES
             9          KM   DRAINAGE AREA IS 31.8 ACRES
            10          BA  0.0497
            11          IN       1S 01JAN90    1153
            12          QI        0        3     3.1     3.3     3.4     3.6     3.8     4.1     4.3     4.8
            13          QI        5      5.8     6.3     7.7     8.7    12.8    16.6    66.1    10.3     6.9
            14          QI      5.4      4.5     3.9     3.5     3.2       0       0       0       0       0
            15          QI        0        0       0       0       0       0

            16          KK  DETAIN
            17          RS        1    STOR      -1
            18          SV        0    0.06
            19          SQ        0    63.9
            20          SE      100     101
            21          ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     4       BASIN
              V
              V
    16      DETAIN

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```


```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   18APR17  TIME  17:17:04  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```


SHADY OAK
PRELIMINARY 100-YEAR DETENTION ANALYSIS

```
 IT          HYDROGRAPH TIME DATA
                   NMIN           2  MINUTES IN COMPUTATION INTERVAL
                  IDATE      1JAN90  STARTING DATE
                  ITIME        1200  STARTING TIME
                     NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      1JAN90  ENDING DATE
                 NDTIME        1838  ENDING TIME
                 ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL     .03 HOURS
                TOTAL TIME BASE    6.63 HOURS

       ENGLISH UNITS
            DRAINAGE AREA         SQUARE MILES
            PRECIPITATION DEPTH   INCHES
            LENGTH, ELEVATION     FEET
            FLOW                  CUBIC FEET PER SECOND
            STORAGE VOLUME        ACRE-FEET
            SURFACE AREA          ACRES
```

TEMPERATURE DEGREES FAHRENHEIT

*** ***

```
          **************
          *            *
  4 KK    *   BASIN    *
          *            *
          **************
```

RATIONAL METHOD HYDROGRAPH PROGRAM
100-YEAR, 6-HOUR RAINFALL IS 3.75 INCHES
RATIONAL METHOD RUNOFF COEFFICIENT IS 0.418
RATIONAL METHOD TIME OF CONCENTRATION IS 14.514 MINUTES
DRAINAGE AREA IS 31.8 ACRES

```
 11 IN        TIME DATA FOR INPUT TIME SERIES
                  JXMIN          15  TIME INTERVAL IN MINUTES
                  JXDATE     1JAN90  STARTING DATE
                  JXTIME       1153  STARTING TIME

              SUBBASIN RUNOFF DATA

 10 BA        SUBBASIN CHARACTERISTICS
                  TAREA         .05  SUBBASIN AREA
```

***

HYDROGRAPH AT STATION BASIN

DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW
1 JAN 1200	1	1.	1 JAN 1340	51	4.	1 JAN 1520	101	9.	1 JAN 1700	151	5.
1 JAN 1202	2	2.	1 JAN 1342	52	4.	1 JAN 1522	102	9.	1 JAN 1702	152	5.
1 JAN 1204	3	2.	1 JAN 1344	53	4.	1 JAN 1524	103	9.	1 JAN 1704	153	5.
1 JAN 1206	4	3.	1 JAN 1346	54	4.	1 JAN 1526	104	10.	1 JAN 1706	154	5.
1 JAN 1208	5	3.	1 JAN 1348	55	4.	1 JAN 1528	105	10.	1 JAN 1708	155	5.
1 JAN 1210	6	3.	1 JAN 1350	56	4.	1 JAN 1530	106	11.	1 JAN 1710	156	4.
1 JAN 1212	7	3.	1 JAN 1352	57	4.	1 JAN 1532	107	11.	1 JAN 1712	157	4.
1 JAN 1214	8	3.	1 JAN 1354	58	4.	1 JAN 1534	108	12.	1 JAN 1714	158	4.
1 JAN 1216	9	3.	1 JAN 1356	59	4.	1 JAN 1536	109	12.	1 JAN 1716	159	4.
1 JAN 1218	10	3.	1 JAN 1358	60	4.	1 JAN 1538	110	13.	1 JAN 1718	160	4.
1 JAN 1220	11	3.	1 JAN 1400	61	5.	1 JAN 1540	111	13.	1 JAN 1720	161	4.
1 JAN 1222	12	3.	1 JAN 1402	62	5.	1 JAN 1542	112	14.	1 JAN 1722	162	4.
1 JAN 1224	13	3.	1 JAN 1404	63	5.	1 JAN 1544	113	14.	1 JAN 1724	163	4.
1 JAN 1226	14	3.	1 JAN 1406	64	5.	1 JAN 1546	114	15.	1 JAN 1726	164	4.
1 JAN 1228	15	3.	1 JAN 1408	65	5.	1 JAN 1548	115	15.	1 JAN 1728	165	4.
1 JAN 1230	16	3.	1 JAN 1410	66	5.	1 JAN 1550	116	16.	1 JAN 1730	166	4.
1 JAN 1232	17	3.	1 JAN 1412	67	5.	1 JAN 1552	117	16.	1 JAN 1732	167	4.
1 JAN 1234	18	3.	1 JAN 1414	68	5.	1 JAN 1554	118	20.	1 JAN 1734	168	4.
1 JAN 1236	19	3.	1 JAN 1416	69	5.	1 JAN 1556	119	27.	1 JAN 1736	169	4.
1 JAN 1238	20	3.	1 JAN 1418	70	5.	1 JAN 1558	120	33.	1 JAN 1738	170	4.
1 JAN 1240	21	3.	1 JAN 1420	71	5.	1 JAN 1600	121	40.	1 JAN 1740	171	3.
1 JAN 1242	22	3.	1 JAN 1422	72	5.	1 JAN 1602	122	46.	1 JAN 1742	172	3.
1 JAN 1244	23	3.	1 JAN 1424	73	5.	1 JAN 1604	123	53.	1 JAN 1744	173	3.
1 JAN 1246	24	3.	1 JAN 1426	74	5.	1 JAN 1606	124	60.	1 JAN 1746	174	3.
1 JAN 1248	25	3.	1 JAN 1428	75	5.	1 JAN 1608	125	66.	1 JAN 1748	175	3.
1 JAN 1250	26	3.	1 JAN 1430	76	5.	1 JAN 1610	126	59.	1 JAN 1750	176	3.
1 JAN 1252	27	3.	1 JAN 1432	77	5.	1 JAN 1612	127	51.	1 JAN 1752	177	3.
1 JAN 1254	28	3.	1 JAN 1434	78	6.	1 JAN 1614	128	44.	1 JAN 1754	178	3.
1 JAN 1256	29	3.	1 JAN 1436	79	6.	1 JAN 1616	129	36.	1 JAN 1756	179	3.
1 JAN 1258	30	3.	1 JAN 1438	80	6.	1 JAN 1618	130	29.	1 JAN 1758	180	2.
1 JAN 1300	31	3.	1 JAN 1440	81	6.	1 JAN 1620	131	21.	1 JAN 1800	181	2.
1 JAN 1302	32	4.	1 JAN 1442	82	6.	1 JAN 1622	132	14.	1 JAN 1802	182	1.
1 JAN 1304	33	4.	1 JAN 1444	83	6.	1 JAN 1624	133	10.	1 JAN 1804	183	1.
1 JAN 1306	34	4.	1 JAN 1446	84	6.	1 JAN 1626	134	10.	1 JAN 1806	184	0.
1 JAN 1308	35	4.	1 JAN 1448	85	6.	1 JAN 1628	135	9.	1 JAN 1808	185	0.
1 JAN 1310	36	4.	1 JAN 1450	86	6.	1 JAN 1630	136	9.	1 JAN 1810	186	0.
1 JAN 1312	37	4.	1 JAN 1452	87	6.	1 JAN 1632	137	8.	1 JAN 1812	187	0.
1 JAN 1314	38	4.	1 JAN 1454	88	6.	1 JAN 1634	138	8.	1 JAN 1814	188	0.
1 JAN 1316	39	4.	1 JAN 1456	89	7.	1 JAN 1636	139	7.	1 JAN 1816	189	0.
1 JAN 1318	40	4.	1 JAN 1458	90	7.	1 JAN 1638	140	7.	1 JAN 1818	190	0.
1 JAN 1320	41	4.	1 JAN 1500	91	7.	1 JAN 1640	141	7.	1 JAN 1820	191	0.
1 JAN 1322	42	4.	1 JAN 1502	92	7.	1 JAN 1642	142	7.	1 JAN 1822	192	0.
1 JAN 1324	43	4.	1 JAN 1504	93	7.	1 JAN 1644	143	6.	1 JAN 1824	193	0.
1 JAN 1326	44	4.	1 JAN 1506	94	8.	1 JAN 1646	144	6.	1 JAN 1826	194	0.
1 JAN 1328	45	4.	1 JAN 1508	95	8.	1 JAN 1648	145	6.	1 JAN 1828	195	0.
1 JAN 1330	46	4.	1 JAN 1510	96	8.	1 JAN 1650	146	6.	1 JAN 1830	196	0.
1 JAN 1332	47	4.	1 JAN 1512	97	8.	1 JAN 1652	147	6.	1 JAN 1832	197	0.
1 JAN 1334	48	4.	1 JAN 1514	98	8.	1 JAN 1654	148	5.	1 JAN 1834	198	0.
1 JAN 1336	49	4.	1 JAN 1516	99	8.	1 JAN 1656	149	5.	1 JAN 1836	199	0.
1 JAN 1338	50	4.	1 JAN 1518	100	8.	1 JAN 1658	150	5.	1 JAN 1838	200	0.

```
  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR       6.63-HR
+   (CFS)       (HR)
                            (CFS)
+     66.        4.13                  8.           8.           8.           8.
                         (INCHES)    1.555        1.559        1.559        1.559
                          (AC-FT)       4.           4.           4.           4.

                       CUMULATIVE AREA =     .05 SQ MI
```

*** ***

```
          **************
          *            *
 16 KK    *   DETAIN   *
          *            *
          **************
```

HYDROGRAPH ROUTING DATA

```
17 RS          STORAGE ROUTING
                    NSTPS          1  NUMBER OF SUBREACHES
                     ITYP       STOR  TYPE OF INITIAL CONDITION
                   RSVRIC      -1.00  INITIAL CONDITION
                        X        .00 WORKING R AND D COEFFICIENT

18 SV            STORAGE         .0        .1

19 SQ            DISCHARGE       0.       64.

20 SE            ELEVATION     100.00    101.00
```

***

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 0. TO 64.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

HYDROGRAPH AT STATION DETAIN

DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA MON HRMN	ORD	OUTFLOW	STORAGE	STAGE
1 JAN 1200	1	1.	.0	100.0	1 JAN 1414	68	5.	.0	100.1	1 JAN 1628	135	9.	.0	100.1
1 JAN 1202	2	2.	.0	100.0	1 JAN 1416	69	5.	.0	100.1	1 JAN 1630	136	9.	.0	100.1
1 JAN 1204	3	2.	.0	100.0	1 JAN 1418	70	5.	.0	100.1	1 JAN 1632	137	8.	.0	100.1
1 JAN 1206	4	2.	.0	100.0	1 JAN 1420	71	5.	.0	100.1	1 JAN 1634	138	8.	.0	100.1
1 JAN 1208	5	3.	.0	100.0	1 JAN 1422	72	5.	.0	100.1	1 JAN 1636	139	8.	.0	100.1
1 JAN 1210	6	3.	.0	100.0	1 JAN 1424	73	5.	.0	100.1	1 JAN 1638	140	7.	.0	100.1
1 JAN 1212	7	3.	.0	100.0	1 JAN 1426	74	5.	.0	100.1	1 JAN 1640	141	7.	.0	100.1
1 JAN 1214	8	3.	.0	100.0	1 JAN 1428	75	5.	.0	100.1	1 JAN 1642	142	7.	.0	100.1
1 JAN 1216	9	3.	.0	100.0	1 JAN 1430	76	5.	.0	100.1	1 JAN 1644	143	6.	.0	100.1
1 JAN 1218	10	3.	.0	100.0	1 JAN 1432	77	5.	.0	100.1	1 JAN 1646	144	6.	.0	100.1
1 JAN 1220	11	3.	.0	100.0	1 JAN 1434	78	6.	.0	100.1	1 JAN 1648	145	6.	.0	100.1
1 JAN 1222	12	3.	.0	100.0	1 JAN 1436	79	6.	.0	100.1	1 JAN 1650	146	6.	.0	100.1
1 JAN 1224	13	3.	.0	100.0	1 JAN 1438	80	6.	.0	100.1	1 JAN 1652	147	6.	.0	100.1
1 JAN 1226	14	3.	.0	100.0	1 JAN 1440	81	6.	.0	100.1	1 JAN 1654	148	5.	.0	100.1
1 JAN 1228	15	3.	.0	100.0	1 JAN 1442	82	6.	.0	100.1	1 JAN 1656	149	5.	.0	100.1
1 JAN 1230	16	3.	.0	100.0	1 JAN 1444	83	6.	.0	100.1	1 JAN 1658	150	5.	.0	100.1
1 JAN 1232	17	3.	.0	100.1	1 JAN 1446	84	6.	.0	100.1	1 JAN 1700	151	5.	.0	100.1
1 JAN 1234	18	3.	.0	100.1	1 JAN 1448	85	6.	.0	100.1	1 JAN 1702	152	5.	.0	100.1
1 JAN 1236	19	3.	.0	100.1	1 JAN 1450	86	6.	.0	100.1	1 JAN 1704	153	5.	.0	100.1
1 JAN 1238	20	3.	.0	100.1	1 JAN 1452	87	6.	.0	100.1	1 JAN 1706	154	5.	.0	100.1
1 JAN 1240	21	3.	.0	100.1	1 JAN 1454	88	6.	.0	100.1	1 JAN 1708	155	5.	.0	100.1
1 JAN 1242	22	3.	.0	100.1	1 JAN 1456	89	7.	.0	100.1	1 JAN 1710	156	4.	.0	100.1
1 JAN 1244	23	3.	.0	100.1	1 JAN 1458	90	7.	.0	100.1	1 JAN 1712	157	4.	.0	100.1
1 JAN 1246	24	3.	.0	100.1	1 JAN 1500	91	7.	.0	100.1	1 JAN 1714	158	4.	.0	100.1
1 JAN 1248	25	3.	.0	100.1	1 JAN 1502	92	7.	.0	100.1	1 JAN 1716	159	4.	.0	100.1
1 JAN 1250	26	3.	.0	100.1	1 JAN 1504	93	7.	.0	100.1	1 JAN 1718	160	4.	.0	100.1
1 JAN 1252	27	3.	.0	100.1	1 JAN 1506	94	7.	.0	100.1	1 JAN 1720	161	4.	.0	100.1
1 JAN 1254	28	3.	.0	100.1	1 JAN 1508	95	8.	.0	100.1	1 JAN 1722	162	4.	.0	100.1
1 JAN 1256	29	3.	.0	100.1	1 JAN 1510	96	8.	.0	100.1	1 JAN 1724	163	4.	.0	100.1
1 JAN 1258	30	3.	.0	100.1	1 JAN 1512	97	8.	.0	100.1	1 JAN 1726	164	4.	.0	100.1
1 JAN 1300	31	3.	.0	100.1	1 JAN 1514	98	8.	.0	100.1	1 JAN 1728	165	4.	.0	100.1
1 JAN 1302	32	4.	.0	100.1	1 JAN 1516	99	8.	.0	100.1	1 JAN 1730	166	4.	.0	100.1
1 JAN 1304	33	4.	.0	100.1	1 JAN 1518	100	8.	.0	100.1	1 JAN 1732	167	4.	.0	100.1
1 JAN 1306	34	4.	.0	100.1	1 JAN 1520	101	8.	.0	100.1	1 JAN 1734	168	4.	.0	100.1
1 JAN 1308	35	4.	.0	100.1	1 JAN 1522	102	9.	.0	100.1	1 JAN 1736	169	4.	.0	100.1
1 JAN 1310	36	4.	.0	100.1	1 JAN 1524	103	9.	.0	100.1	1 JAN 1738	170	4.	.0	100.1
1 JAN 1312	37	4.	.0	100.1	1 JAN 1526	104	9.	.0	100.1	1 JAN 1740	171	3.	.0	100.1
1 JAN 1314	38	4.	.0	100.1	1 JAN 1528	105	10.	.0	100.2	1 JAN 1742	172	3.	.0	100.1
1 JAN 1316	39	4.	.0	100.1	1 JAN 1530	106	10.	.0	100.2	1 JAN 1744	173	3.	.0	100.1
1 JAN 1318	40	4.	.0	100.1	1 JAN 1532	107	11.	.0	100.2	1 JAN 1746	174	3.	.0	100.1
1 JAN 1320	41	4.	.0	100.1	1 JAN 1534	108	12.	.0	100.2	1 JAN 1748	175	3.	.0	100.1
1 JAN 1322	42	4.	.0	100.1	1 JAN 1536	109	12.	.0	100.2	1 JAN 1750	176	3.	.0	100.1
1 JAN 1324	43	4.	.0	100.1	1 JAN 1538	110	13.	.0	100.2	1 JAN 1752	177	3.	.0	100.1
1 JAN 1326	44	4.	.0	100.1	1 JAN 1540	111	13.	.0	100.2	1 JAN 1754	178	3.	.0	100.0
1 JAN 1328	45	4.	.0	100.1	1 JAN 1542	112	14.	.0	100.2	1 JAN 1756	179	3.	.0	100.0
1 JAN 1330	46	4.	.0	100.1	1 JAN 1544	113	14.	.0	100.2	1 JAN 1758	180	2.	.0	100.0
1 JAN 1332	47	4.	.0	100.1	1 JAN 1546	114	15.	.0	100.2	1 JAN 1800	181	2.	.0	100.0
1 JAN 1334	48	4.	.0	100.1	1 JAN 1548	115	15.	.0	100.2	1 JAN 1802	182	1.	.0	100.0
1 JAN 1336	49	4.	.0	100.1	1 JAN 1550	116	16.	.0	100.2	1 JAN 1804	183	1.	.0	100.0
1 JAN 1338	50	4.	.0	100.1	1 JAN 1552	117	16.	.0	100.3	1 JAN 1806	184	1.	.0	100.0
1 JAN 1340	51	4.	.0	100.1	1 JAN 1554	118	18.	.0	100.3	1 JAN 1808	185	0.	.0	100.0
1 JAN 1342	52	4.	.0	100.1	1 JAN 1556	119	24.	.0	100.4	1 JAN 1810	186	0.	.0	100.0
1 JAN 1344	53	4.	.0	100.1	1 JAN 1558	120	31.	.0	100.5	1 JAN 1812	187	0.	.0	100.0
1 JAN 1346	54	4.	.0	100.1	1 JAN 1600	121	37.	.0	100.6	1 JAN 1814	188	0.	.0	100.0
1 JAN 1348	55	4.	.0	100.1	1 JAN 1602	122	44.	.0	100.7	1 JAN 1816	189	0.	.0	100.0
1 JAN 1350	56	4.	.0	100.1	1 JAN 1604	123	51.	.0	100.8	1 JAN 1818	190	0.	.0	100.0
1 JAN 1352	57	4.	.0	100.1	1 JAN 1606	124	57.	.1	100.9	1 JAN 1820	191	0.	.0	100.0
1 JAN 1354	58	4.	.0	100.1	1 JAN 1608	125	64.	.1	101.0	1 JAN 1822	192	0.	.0	100.0
1 JAN 1356	59	4.	.0	100.1	1 JAN 1610	126	62.	.1	101.0	1 JAN 1824	193	0.	.0	100.0
1 JAN 1358	60	4.	.0	100.1	1 JAN 1612	127	54.	.1	100.8	1 JAN 1826	194	0.	.0	100.0
1 JAN 1400	61	5.	.0	100.1	1 JAN 1614	128	46.	.0	100.7	1 JAN 1828	195	0.	.0	100.0
1 JAN 1402	62	5.	.0	100.1	1 JAN 1616	129	39.	.0	100.6	1 JAN 1830	196	0.	.0	100.0
1 JAN 1404	63	5.	.0	100.1	1 JAN 1618	130	31.	.0	100.5	1 JAN 1832	197	0.	.0	100.0
1 JAN 1406	64	5.	.0	100.1	1 JAN 1620	131	24.	.0	100.4	1 JAN 1834	198	0.	.0	100.0
1 JAN 1408	65	5.	.0	100.1	1 JAN 1622	132	17.	.0	100.3	1 JAN 1836	199	0.	.0	100.0
1 JAN 1410	66	5.	.0	100.1	1 JAN 1624	133	11.	.0	100.2	1 JAN 1838	200	0.	.0	100.0
1 JAN 1412	67	5.	.0	100.1	1 JAN 1626	134	10.	.0	100.2					

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.63-HR
		(CFS)				
64.	4.13		8.	8.	8.	8.
		(INCHES)	1.555	1.559	1.559	1.559
		(AC-FT)	4.	4.	4.	4.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	6.63-HR
0.	4.13	0.	0.	0.	0.

	PEAK STAGE (FEET)	TIME (HR)		MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	6.63-HR
+	101.00	4.13		100.13	100.12	100.12	100.12

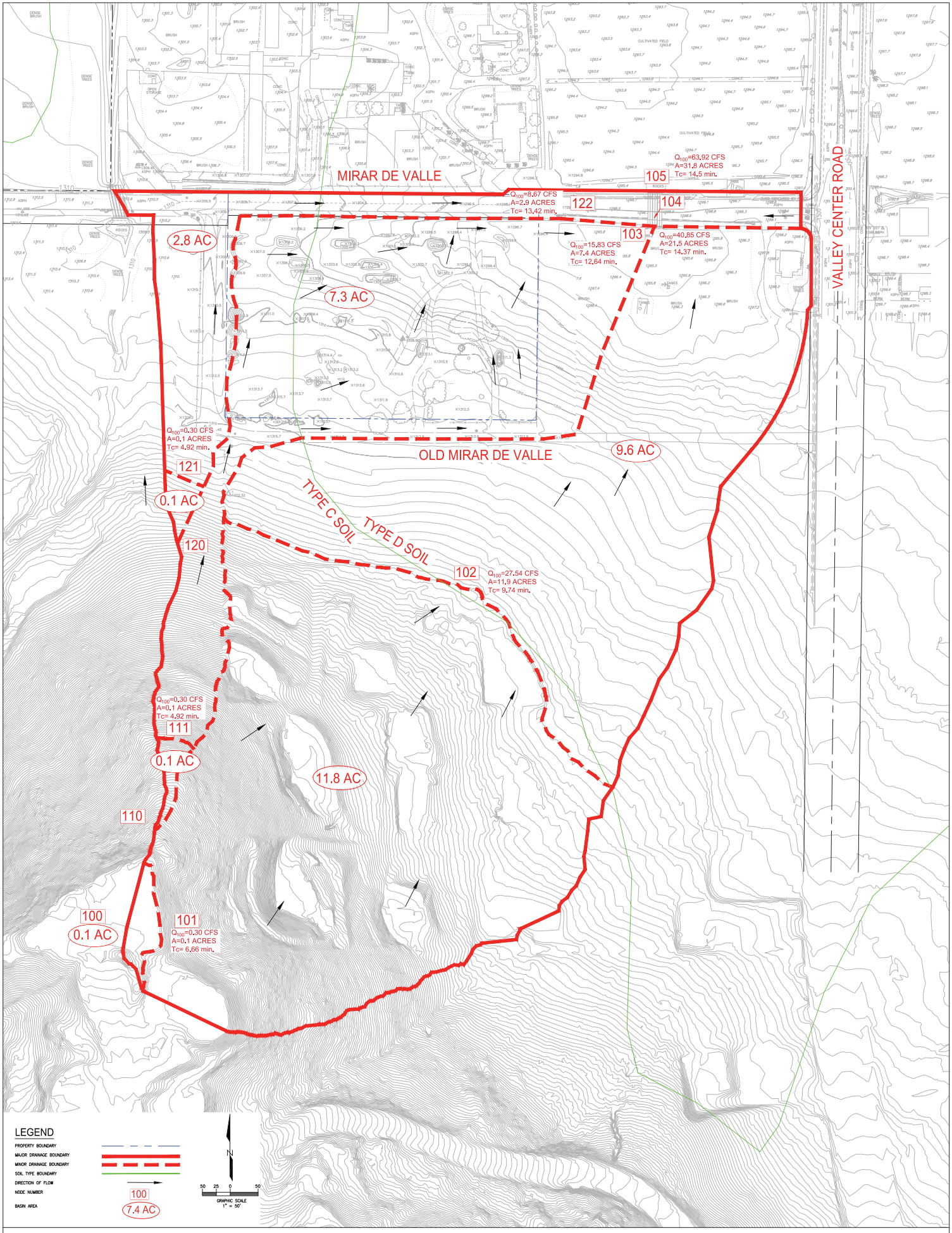
CUMULATIVE AREA = .05 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	BASIN	66.	4.13	8.	8.	8.	.05		
+	ROUTED TO	DETAIN	64.	4.13	8.	8.	8.	.05		
+									101.00	4.13

*** NORMAL END OF HEC-1 ***



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PRE-PROJECT DRAINAGE MAP FOR SHADY OAK