# PRELIMINARY
# DRAINAGE REPORT
## AVION
## City of San Diego, CA
## April 24, 2019
City Project #598173

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## 1. INTRODUCTION

This preliminary drainage report has been prepared in support of a Tentative Map Entitlement submittal for the Avion San Diego Project (the Project), which is located in the City of San Diego, California. The purpose of this report is to determine the hydrologic impact, if any, to the existing storm drain facilities or natural drainage, and to provide peak 100-year discharge values for the project.

The drainage analysis presented herein reflects a Tentative Map level-of-effort, which includes peak 100-year storm event hydrologic analyses using preliminary grades. Hydraulic analyses for inlets, pipe sizes and inverts, and HGL's will be provided during final engineering. Therefore, the purpose of this report submittal is to acquire from the City of San Diego: 1) concept approval of the proposed storm drain layout, 2) approval of the methodology used in the evaluation of the project storm drain system hydrology, and 3) identification of critical path drainage issues that need to be addressed during final engineering.

The Avion Project is a proposed community located in the City of San Diego. The site is approximately 14 acres in size and is located south of Carmel Valley Road, and northeast of Black Mountain Road. Specifically, the site is located to the southeast of the Taburno Way and Winecreek Drive intersection. The property is located in the Black Mountain Ranch Subarea. The surrounding land (except for an adjacent Heritage Bluffs II project area) is designated as open space in the Subarea Plan and is part of the MHPA. The project involves the construction of a residential subdivision with 84 single family residential units and surrounding recreation areas. The vicinity map is shown in Figure 1.

The project proposes to develop 84 single-family units with a maximum 30' height buildings, private streets, and private underground infrastructure. The project is currently vacant and identified as Parcel "C" of BMR Subarea Plan. A RWQCB 401 Certification and an Army Corps of Engineers 404 permit are both not required for this project since the project will not disturb the adjacent creek involved. The project includes a clear span bridge that avoids any special environmental permits.

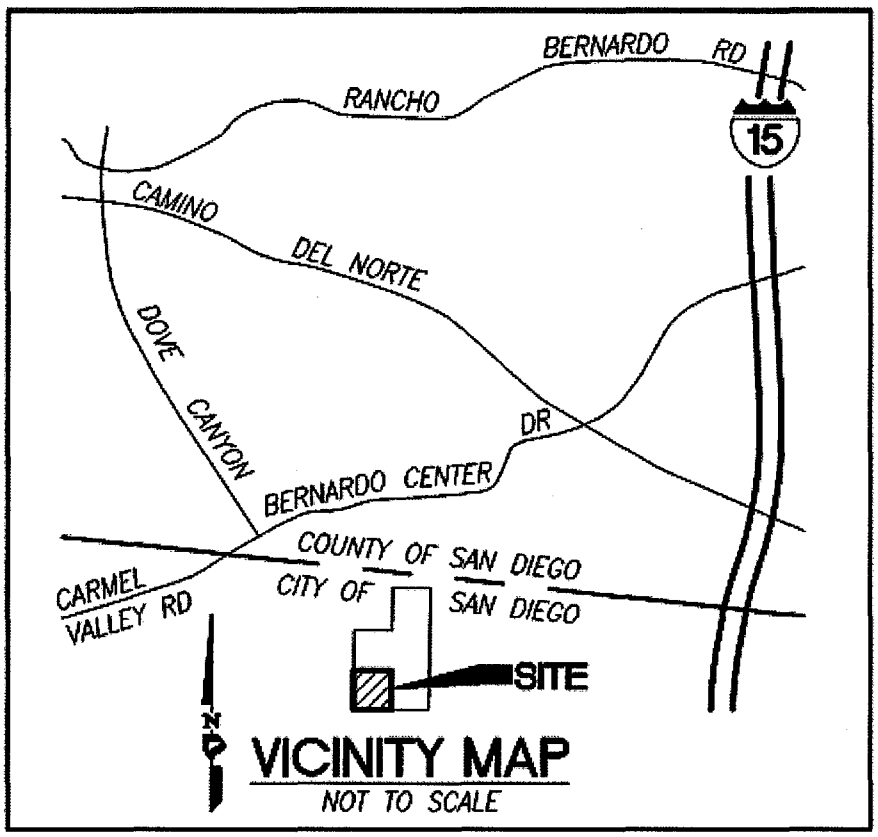


***Figure 1: Project Vicinity Map***

Treatment of storm water prior to discharging into the downstream systems will be facilitated by one biofiltration basin. For a detailed discussion of the project's stormwater quality BMP and hydromodification management approach, refer to the Preliminary Stormwater Quality Management Plan (SWQMP) report. The final post-construction BMP design will be provided during final engineering.

## 2. EXISTING AND PROPOSED DRAINAGE PATTERNS

Under exising conditions, the project area currently consists of terrain sloping in the northerly direction, with natural ground cover. The majority of the site is situated west of a natural drainage course, which conveys stormwater from upstream areas. There are minimal on-site drainage facilities. For this study, existing condition and proposed condition analyses were prepared for comparison.

Under proposed conditions, the drainage system will consist of culverts, brow ditches, curb, gutter, storm drain inlets, and pipes. The drainage analysis system consists of natural canyon areas upstream, downstream, and surrounding the project. Refer to Exhibit B for the drainage areas. For any proposed storm drain discharging to unimproved channels, energy dissipation will minimize erosion potential.

## 3. HYDROLOGY CRITERIA, METHODOLOGY, AND RESULTS

This section of the report summarizes the drainage criteria that were used in the hydrologic analysis and key elements of the methodology.

### 3.1 Hydrology Criteria

Table 1 summarizes the key hydrology assumptions and criteria used for the hydrologic modeling.

***Table 1: Hydrology Criteria***

| | |
|---|---|
| Existing and Proposed Hydrology: | 100-year storm frequency |
| Soil Type: | Hydrologic Soil Group D per Drainage Design Manual requirements |
| Runoff coefficients: | Based on land use in sub-drainage area, from C=0.45 to 0.95. See Rational Method output. |
| Rainfall intensity: | Based on the City of San Diego Intensity Frequency Duration Curves presented in the 2017 City of San Diego Drainage Design Manual. |

### 3.2 Hydrology Methodology

Hydrology calculations were completed for existing and proposed conditions accounting for all areas draining to the onsite storm drain systems. Drainage areas were defined from existing and proposed topographic maps of the area. Hydrologic analysis was completed utilizing the Rational Method, outlined in the 2017 City of San Diego Drainage Design Manual. The goal of the Rational Method analysis was to determine the peak 100-year flow rates for the storm drain

pipes by developing a node link model of the contributing drainage area and applying the intensity-duration-frequency (IDF) curve to the areas. See Appendix 1 for the City of San Diego IDF curve.

The Civil-D computer program was used to obtain peak flow rates for the offsite and onsite drainage areas in existing and proposed conditions. The Civil-D Modified Rational Method Hydrology Program is a computer-aided design program where the user develops a node link model of the watershed. Developing independent node link models for each interior watershed and linking these sub-models together at confluence points creates the node link model. The intensity-duration-frequency relationships are applied to each of the drainage areas in the model to get the peak flow rates at each point of interest.

For comparison purposes, existing condition drainage areas are similar to the post-project drainage systems. City of San Diego Drainage Design Manual runoff coefficients, based on land use, were assigned for each subarea within CivilD.

### 3.3 Hydrology Results

The results of the Rational Method hydrology modeling are provided in Appendices 2 and 3 and the results are summarized in this section. Development of the project site increases the 100-year runoff from 20.6 cfs to 25.7 cfs, however, the site will detain post-project 100-year flows to less than pre-project 100-year flows with the proposed detention/biofiltration basin. Final detention routing will be provided during final engineering.

For the results of the analysis, see Exhibit A for the existing conditions hydrology map and Exhibit B for the proposed conditions hydrology map in Appendix 5. Refer to the appendices for the hydrology calculations. Table 2 summarizes the hydrology results and compares existing and proposed conditions.

*Table 2: Summary of Hydrology Results*

| *Outfall of Interest* | EXISTING CONDITION | | | | PROPOSED CONDITION (W/ DETENTION) | | | |
|---|---|---|---|---|---|---|---|---|
| | SYSTEM | AREA (ac) | TC (min) | Q100 (cfs) | SYSTEM | AREA (ac) | TC (min) | Q100 (cfs) |
| | 100 | 14.1 | 11.4 | 20.6 | 1000 (W/O DETENTION) | 10.2 | 11.5 | 18.5 |
| | | | | | 1000 (W/ DETENTION) | 10.2 | | <13.4 |
| | | | | | 2000 | 1.9 | 6.7 | 3.3 |
| | | | | | 3000 | 0.05 | 5.7 | 0.1 |
| | | | | | 4000 | 2.0 | 5.7 | 3.8 |
| **# 1** | ***TOTAL*** | ***14.1*** | | ***20.6*** | ***TOTAL W/DETENTION*** | **13.7** | | ***<20.6*** |

Private drive (Winecreek Drive extension) will span over the natural stream east of the site. Due to environmental setback requirements, the crossing is much larger than it needs to be to convey the runon underneath the roadway. The onsite storm drain system will collect site drainage and discharge flows for treatment into the biofiltration basin. Riprap energy dissipators have been provided to mitigate erosive velocities for drainage entering and exiting the basin. Final velocities will be provided during final engineering.

## 4. CONCLUSION

This drainage report has been prepared to support the Tentative Map for the proposed Avion development. This report was prepared to ensure that project development would not adversely affect existing drainage patterns. Hydrology calculations indicate that redevelopment will result in an overall increase in flows from the site, but the site will detain post-project 100-year flows to less than pre-project 100-year flows. Small onsite re-direction of flows does not alter general drainage patterns as onsite storm drain systems ultimately discharge to the same location downstream of the project. As such, the project redevelopment should not have an adverse effect on local or global drainage patterns. The drainage system will be designed appropriately to accommodate the peak-flow conditions for the site.

# APPENDIX 1

## Supporting Documentation

## (IDF Curve, Runoff Coefficients)

**Table A-1. Runoff Coefficients for Rational Method**

| Land Use | Runoff Coefficient (C) |
|---|---|
| | Soil Type [1] |
| **Residential:** | |
| Single Family | 0.55 |
| Multi-Units | 0.70 |
| Mobile Homes | 0.65 |
| Rural (lots greater than ½ acre) | 0.45 |
| **Commercial** [2] | |
| 80% Impervious | 0.85 |
| **Industrial** [2] | |
| 90% Impervious | 0.95 |

**Note:**
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%
Tabulated imperviousness = 80%
Revised C = (50/80) x 0.85 = 0.53

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

## A.1.3. Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the $T_c$ for a selected storm frequency. Once a particular storm frequency has been selected for design and a $T_c$ calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

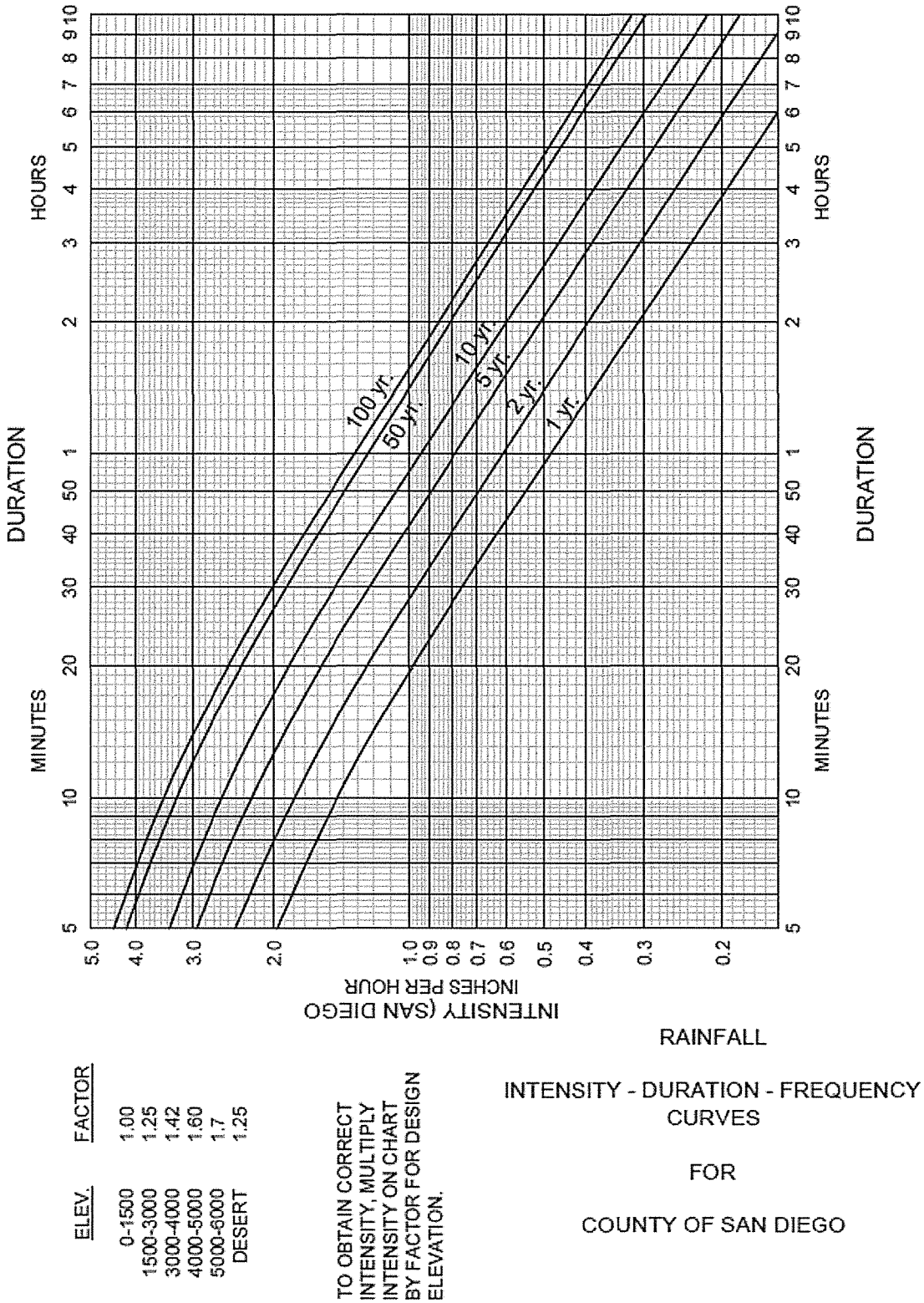


**Figure A-1. Intensity-Duration-Frequency Design Chart**

# APPENDIX 2

## Existing Conditions 100-year Rational Method Computer Output

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 04/18/19
--------------------------------------------------------------------------
3255.4 AVION
EXISTING CONDITIONS
SYSTEM 100
FILE: S100E100
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 4049

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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 = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Initial subarea flow distance  =  446.000(Ft.)
Highest elevation =  921.000(Ft.)
Lowest elevation =  854.000(Ft.)
Elevation difference =   67.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =    10.01 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*( 446.000^.5)/(15.022^(1/3)]=  10.01
Rainfall intensity (I) =      3.372(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      4.462(CFS)
Total initial stream area =        2.940(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
--------------------------------------------------------------------------
Upstream point elevation =   854.000(Ft.)
Downstream point elevation =   684.000(Ft.)
Channel length thru subarea  =   847.000(Ft.)
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Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     10.752(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     10.752(CFS)
Depth of flow =   0.107(Ft.), Average velocity =   9.902(Ft/s)
Channel flow top width =   10.215(Ft.)
Flow Velocity =    9.90(Ft/s)
Travel time  =    1.43 min.
Time of concentration =   11.44 min.
Critical depth =      0.328(Ft.)
 Adding area flow to channel
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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      3.214(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     11.989(CFS) for    8.290(Ac.)
Total runoff =     16.450(CFS)  Total area =       11.23(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
--------------------------------------------------------------------------
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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration =    11.44 min.
Rainfall intensity =      3.214(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      4.150(CFS) for    2.870(Ac.)
Total runoff =     20.601(CFS)  Total area =       14.10(Ac.)
End of computations, total study area =          14.100 (Ac.)
```

# APPENDIX 3

## Proposed Conditions 100-year Rational Method Computer Output

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 04/18/19
--------------------------------------------------------------------------
PROJECT AVION
PROPOSED CONDITIONS
1000P100


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

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


Program License Serial Number 4049

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1000.000 to Point/Station     1001.000
**** 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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Initial subarea flow distance  =   44.000(Ft.)
Highest elevation =  845.000(Ft.)
Lowest elevation =  829.000(Ft.)
Elevation difference =   16.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     2.34 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*(  44.000^.5)/(  36.364^(1/3)]=   2.34
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =       0.079(CFS)
Total initial stream area =        0.040(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1001.000 to Point/Station     1002.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
--------------------------------------------------------------------------
Top of street segment elevation =   829.000(Ft.)
```





```
End of street segment elevation =   820.500(Ft.)
Length of street segment  =   380.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  26.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(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  =  15.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      0.121(CFS)
Depth of flow =   0.102(Ft.), Average velocity =   1.930(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   1.500(Ft.)
Flow velocity =   1.93(Ft/s)
Travel time =    3.28 min.     TC =    8.28  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.613(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.107(CFS) for    1.060(Ac.)
Total runoff =      2.186(CFS)  Total area =        1.10(Ac.)
Street flow at end of street =      2.186(CFS)
Half street flow at end of street =      2.186(CFS)
Depth of flow =   0.270(Ft.), Average velocity =   2.609(Ft/s)
Flow width (from curb towards crown)=   8.754(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1002.000 to Point/Station     1010.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
--------------------------------------------------------------------------
Upstream point/station elevation =   820.000(Ft.)
Downstream point/station elevation =   810.500(Ft.)
Pipe length  =   117.96(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.186(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.186(CFS)
Normal flow depth in pipe =    4.32(In.)
Flow top width inside pipe =    8.99(In.)
Critical Depth =    7.97(In.)
Pipe flow velocity =     10.44(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =     8.47 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1002.000 to Point/Station     1010.000
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.100(Ac.)
Runoff from this stream =      2.186(CFS)
Time of concentration =    8.47 min.
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```
Rainfall intensity =     3.584(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1003.000 to Point/Station     1004.000
**** 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
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =   75.000(Ft.)
Highest elevation =  825.300(Ft.)
Lowest elevation =  824.000(Ft.)
Elevation difference =    1.300(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.14 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  75.000^.5)/( 1.733^(1/3)]=   7.14
Rainfall intensity (I) =      3.818(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.168(CFS)
Total initial stream area =        0.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1004.000 to Point/Station     1006.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Top of street segment elevation =   824.000(Ft.)
End of street segment elevation =   810.000(Ft.)
Length of street segment  =   346.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  26.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(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  =  15.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      0.224(CFS)
Depth of flow =   0.115(Ft.), Average velocity =   2.813(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   1.500(Ft.)
Flow velocity =   2.81(Ft/s)
Travel time =    2.05 min.     TC =    9.19  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =     3.479(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.282(CFS) for    0.670(Ac.)
Total runoff =      1.450(CFS)  Total area =        0.75(Ac.)
Street flow at end of street =      1.450(CFS)
```





```
Half street flow at end of street =      1.450(CFS)
Depth of flow =   0.223(Ft.), Average velocity =   3.012(Ft/s)
Flow width (from curb towards crown)=   6.405(Ft.)


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Process from Point/Station     1005.000 to Point/Station     1006.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
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
[SINGLE FAMILY area type                    ]
Time of concentration =     9.19 min.
Rainfall intensity =      3.479(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      0.708(CFS) for    0.370(Ac.)
Total runoff =      2.158(CFS)  Total area =        1.12(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1006.000 to Point/Station     1009.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   810.000(Ft.)
Downstream point/station elevation =   809.500(Ft.)
Pipe length  =    11.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.158(CFS)
Nearest computed pipe diameter  =     9.00(In.)
Calculated individual pipe flow  =     2.158(CFS)
Normal flow depth in pipe =    5.09(In.)
Flow top width inside pipe =    8.92(In.)
Critical Depth =    7.94(In.)
Pipe flow velocity =      8.38(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     9.21 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1006.000 to Point/Station     1009.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      1.120(Ac.)
Runoff from this stream =      2.158(CFS)
Time of concentration =    9.21 min.
Rainfall intensity =     3.476(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1007.000 to Point/Station     1008.000
**** 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
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =   77.000(Ft.)
Highest elevation =  812.800(Ft.)
Lowest elevation =  812.000(Ft.)
Elevation difference =    0.800(Ft.)
Time of concentration calculated by the urban
```

```
areas overland flow method (App X-C) =      8.58 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  77.000^.5)/( 1.039^(1/3)]=   8.58
Rainfall intensity (I) =      3.567(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.157(CFS)
Total initial stream area =        0.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1008.000 to Point/Station     1009.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Top of street segment elevation =   812.000(Ft.)
End of street segment elevation =   810.000(Ft.)
Length of street segment  =   175.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  26.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(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  =  15.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      0.183(CFS)
Depth of flow =   0.146(Ft.), Average velocity =   1.335(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.563(Ft.)
Flow velocity =   1.34(Ft/s)
Travel time =    2.18 min.     TC =   10.76  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.286(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      0.596(CFS) for    0.330(Ac.)
Total runoff =      0.753(CFS)  Total area =       0.41(Ac.)
Street flow at end of street =      0.753(CFS)
Half street flow at end of street =      0.753(CFS)
Depth of flow =   0.222(Ft.), Average velocity =   1.593(Ft/s)
Flow width (from curb towards crown)=   6.337(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1008.000 to Point/Station     1009.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.410(Ac.)
Runoff from this stream =      0.753(CFS)
Time of concentration =   10.76 min.
Rainfall intensity =     3.286(In/Hr)
Summary of stream data:

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





```
1        2.158      9.21                 3.476
2        0.753     10.76                 3.286
Qmax(1) =
          1.000 *    1.000 *     2.158) +
          1.000 *    0.856 *     0.753) + =       2.803
Qmax(2) =
          0.945 *    1.000 *     2.158) +
          1.000 *    1.000 *     0.753) + =       2.793

Total of 2 streams to confluence:
Flow rates before confluence point:
      2.158       0.753
Maximum flow rates at confluence using above data:
      2.803       2.793
Area of streams before confluence:
      1.120       0.410
Results of confluence:
Total flow rate =      2.803(CFS)
Time of concentration =     9.209 min.
Effective stream area after confluence =      1.530(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1009.000 to Point/Station     1010.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   809.500(Ft.)
Downstream point/station elevation =   808.500(Ft.)
Pipe length  =   247.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.803(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.803(CFS)
Normal flow depth in pipe =    9.09(In.)
Flow top width inside pipe =   14.66(In.)
Critical Depth =    8.07(In.)
Pipe flow velocity =      3.60(Ft/s)
Travel time through pipe =    1.14 min.
Time of concentration (TC) =    10.35 min.


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Process from Point/Station     1009.000 to Point/Station     1010.000
**** CONFLUENCE OF MAIN STREAMS ****
----------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.530(Ac.)
Runoff from this stream =      2.803(CFS)
Time of concentration =   10.35 min.
Rainfall intensity =     3.332(In/Hr)
Summary of stream data:

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


1        2.186      8.47                 3.584
2        2.803     10.35                 3.332
Qmax(1) =
          1.000 *    1.000 *     2.186) +
          1.000 *    0.818 *     2.803) + =       4.479
Qmax(2) =
```

```
          0.930 *    1.000 *     2.186) +
          1.000 *    1.000 *     2.803) + =       4.835

Total of 2 main streams to confluence:
Flow rates before confluence point:
      2.186       2.803
Maximum flow rates at confluence using above data:
      4.479       4.835
Area of streams before confluence:
      1.100       1.530


Results of confluence:
Total flow rate =      4.835(CFS)
Time of concentration =    10.351 min.
Effective stream area after confluence  =      2.630(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1010.000 to Point/Station     1015.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   808.500(Ft.)
Downstream point/station elevation =   808.000(Ft.)
Pipe length  =    34.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.835(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.835(CFS)
Normal flow depth in pipe =    8.52(In.)
Flow top width inside pipe =   14.86(In.)
Critical Depth =   10.70(In.)
Pipe flow velocity =      6.71(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    10.44 min.


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Process from Point/Station     1010.000 to Point/Station     1015.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.630(Ac.)
Runoff from this stream =      4.835(CFS)
Time of concentration =   10.44 min.
Rainfall intensity =     3.322(In/Hr)


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Process from Point/Station     1011.000 to Point/Station     1012.000
**** 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
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =   88.000(Ft.)
Highest elevation =  828.700(Ft.)
Lowest elevation =  816.200(Ft.)
Elevation difference =   12.500(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     3.83 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  88.000^.5)/(  14.205^(1/3)]=   3.83
```





```
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.338(CFS)
Total initial stream area =        0.140(Ac.)


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Process from Point/Station     1012.000 to Point/Station     1013.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   816.200(Ft.)
End of street segment elevation =   808.000(Ft.)
Length of street segment  =   262.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  26.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(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  =  15.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.533(CFS)
Depth of flow =   0.234(Ft.), Average velocity =   2.752(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.969(Ft.)
Flow velocity =   2.75(Ft/s)
Travel time =    1.59 min.     TC =    6.59  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.936(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.143(CFS) for    0.990(Ac.)
Total runoff =      2.481(CFS)  Total area =        1.13(Ac.)
Street flow at end of street =      2.481(CFS)
Half street flow at end of street =      2.481(CFS)
Depth of flow =   0.267(Ft.), Average velocity =   3.058(Ft/s)
Flow width (from curb towards crown)=   8.603(Ft.)


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Process from Point/Station     1013.000 to Point/Station     1015.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   808.000(Ft.)
Downstream point/station elevation =   807.500(Ft.)
Pipe length  =    19.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.481(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.481(CFS)
Normal flow depth in pipe =    6.83(In.)
Flow top width inside pipe =    7.70(In.)
Critical Depth =    8.29(In.)
Pipe flow velocity =      6.90(Ft/s)
Travel time through pipe =    0.05 min.
```

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Time of concentration (TC) =      6.63 min.


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Process from Point/Station     1013.000 to Point/Station     1015.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =       1.130(Ac.)
Runoff from this stream =       2.481(CFS)
Time of concentration =     6.63 min.
Rainfall intensity =      3.926(In/Hr)
Summary of stream data:

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


1         4.835     10.44                  3.322
2         2.481      6.63                  3.926
Qmax(1) =
            1.000 *    1.000 *     4.835) +
            0.846 *    1.000 *     2.481) + =       6.935
Qmax(2) =
            1.000 *    0.636 *     4.835) +
            1.000 *    1.000 *     2.481) + =       5.554

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.835       2.481
Maximum flow rates at confluence using above data:
       6.935       5.554
Area of streams before confluence:
       2.630       1.130
Results of confluence:
Total flow rate =       6.935(CFS)
Time of concentration =     10.436 min.
Effective stream area after confluence =       3.760(Ac.)


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Process from Point/Station     1015.000 to Point/Station     1026.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =    807.300(Ft.)
Downstream point/station elevation =    782.000(Ft.)
Pipe length  =    331.23(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      6.935(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =      6.935(CFS)
Normal flow depth in pipe =     7.43(In.)
Flow top width inside pipe =    11.65(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.58(Ft/s)
Travel time through pipe =     0.41 min.
Time of concentration (TC) =     10.84 min.


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Process from Point/Station     1015.000 to Point/Station     1026.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =       3.760(Ac.)
```





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Runoff from this stream =       6.935(CFS)
Time of concentration =    10.84 min.
Rainfall intensity =      3.277(In/Hr)


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Process from Point/Station     1016.000 to Point/Station     1017.000
**** 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
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =    79.000(Ft.)
Highest elevation =  816.000(Ft.)
Lowest elevation =  802.600(Ft.)
Elevation difference =    13.400(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      3.42 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  79.000^.5)/(  16.962^(1/3)]=    3.42
Setting time of concentration to 5 minutes
Rainfall intensity (I) =       4.389(In/Hr) for a    100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =       0.555(CFS)
Total initial stream area =        0.230(Ac.)


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Process from Point/Station     1017.000 to Point/Station     1020.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =    802.600(Ft.)
End of street segment elevation =    783.000(Ft.)
Length of street segment  =    382.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =   26.000(Ft.)
Distance from crown to crossfall grade break  =   10.000(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  =   15.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =    1.500(Ft.)
Gutter hike from flowline =   1.500(In.)
 Manning's N in gutter =   0.0150
 Manning's N from gutter to grade break =   0.0180
 Manning's N from grade break to crown =   0.0180
Estimated mean flow rate at midpoint of street =       2.342(CFS)
Depth of flow =    0.246(Ft.), Average velocity =    3.660(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =    7.540(Ft.)
Flow velocity =    3.66(Ft/s)
Travel time =     1.74 min.      TC =     6.74  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =       3.902(In/Hr) for a    100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =       3.176(CFS) for     1.480(Ac.)
```

```
Total runoff =      3.731(CFS)  Total area =        1.71(Ac.)
Street flow at end of street =      3.731(CFS)
Half street flow at end of street =      3.731(CFS)
Depth of flow =   0.279(Ft.), Average velocity =   4.061(Ft/s)
Flow width (from curb towards crown)=   9.207(Ft.)


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Process from Point/Station     1020.000 to Point/Station     1026.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   783.000(Ft.)
Downstream point/station elevation =   782.500(Ft.)
Pipe length  =    19.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.731(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.731(CFS)
Normal flow depth in pipe =    7.02(In.)
Flow top width inside pipe =   11.83(In.)
Critical Depth =    9.87(In.)
Pipe flow velocity =      7.82(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.78 min.


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Process from Point/Station     1025.000 to Point/Station     1026.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
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
[SINGLE FAMILY area type                    ]
Time of concentration =     6.78 min.
Rainfall intensity =      3.893(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.918(CFS) for    1.830(Ac.)
Total runoff =      7.650(CFS)  Total area =        3.54(Ac.)


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Process from Point/Station     1025.000 to Point/Station     1026.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      3.540(Ac.)
Runoff from this stream =      7.650(CFS)
Time of concentration =    6.78 min.
Rainfall intensity =     3.893(In/Hr)
Summary of stream data:

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


1        6.935     10.84                  3.277
2        7.650      6.78                  3.893
Qmax(1) =
           1.000 *    1.000 *     6.935) +
           0.842 *    1.000 *     7.650) + =      13.374
Qmax(2) =
           1.000 *    0.625 *     6.935) +
           1.000 *    1.000 *     7.650) + =      11.986
```





```
Total of 2 streams to confluence:
Flow rates before confluence point:
       6.935       7.650
Maximum flow rates at confluence using above data:
      13.374      11.986
Area of streams before confluence:
       3.760       3.540
Results of confluence:
Total flow rate =     13.374(CFS)
Time of concentration =    10.842 min.
Effective stream area after confluence =      7.300(Ac.)


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Process from Point/Station     1026.000 to Point/Station     1032.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   782.000(Ft.)
Downstream point/station elevation =   754.000(Ft.)
Pipe length  =   252.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.374(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    13.374(CFS)
Normal flow depth in pipe =    8.55(In.)
Flow top width inside pipe =   14.85(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.49(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =    11.07 min.


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Process from Point/Station     1026.000 to Point/Station     1032.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      7.300(Ac.)
Runoff from this stream =     13.374(CFS)
Time of concentration =   11.07 min.
Rainfall intensity =     3.252(In/Hr)


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Process from Point/Station     1027.000 to Point/Station     1028.000
**** 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
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =   74.000(Ft.)
Highest elevation =  810.000(Ft.)
Lowest elevation =  802.700(Ft.)
Elevation difference =    7.300(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     3.97 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  74.000^.5)/(   9.865^(1/3)]=   3.97
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.193(CFS)
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Total initial stream area =        0.080(Ac.)


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Process from Point/Station     1028.000 to Point/Station     1031.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Top of street segment elevation =   802.700(Ft.)
End of street segment elevation =   784.000(Ft.)
Length of street segment  =   485.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  26.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(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  =  15.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      0.274(CFS)
Depth of flow =   0.129(Ft.), Average velocity =   2.727(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   1.712(Ft.)
Flow velocity =   2.73(Ft/s)
Travel time =    2.96 min.     TC =    7.96  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.666(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.694(CFS) for    0.840(Ac.)
Total runoff =      1.887(CFS)  Total area =        0.92(Ac.)
Street flow at end of street =      1.887(CFS)
Half street flow at end of street =      1.887(CFS)
Depth of flow =   0.241(Ft.), Average velocity =   3.123(Ft/s)
Flow width (from curb towards crown)=   7.299(Ft.)


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Process from Point/Station     1031.000 to Point/Station     1032.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   784.000(Ft.)
Downstream point/station elevation =   754.000(Ft.)
Pipe length  =    80.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.887(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.887(CFS)
Normal flow depth in pipe =    3.17(In.)
Flow top width inside pipe =    5.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.91(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     8.04 min.


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Process from Point/Station     1031.000 to Point/Station     1032.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.920(Ac.)
Runoff from this stream =      1.887(CFS)
Time of concentration =    8.04 min.
Rainfall intensity =     3.653(In/Hr)
Summary of stream data:

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


1       13.374     11.07                 3.252
2        1.887      8.04                 3.653
Qmax(1) =
           1.000 *    1.000 *    13.374) +
           0.890 *    1.000 *     1.887) + =      15.053
Qmax(2) =
           1.000 *    0.726 *    13.374) +
           1.000 *    1.000 *     1.887) + =      11.599

Total of 2 streams to confluence:
Flow rates before confluence point:
      13.374       1.887
Maximum flow rates at confluence using above data:
       15.053      11.599
Area of streams before confluence:
       7.300       0.920
Results of confluence:
Total flow rate =     15.053(CFS)
Time of concentration =    11.069 min.
Effective stream area after confluence =      8.220(Ac.)


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Process from Point/Station     1032.000 to Point/Station     1039.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   754.000(Ft.)
Downstream point/station elevation =   708.000(Ft.)
Pipe length  =   379.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.053(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    15.053(CFS)
Normal flow depth in pipe =    8.98(In.)
Flow top width inside pipe =   14.71(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.65(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =    11.39 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1032.000 to Point/Station     1039.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      8.220(Ac.)
Runoff from this stream =     15.053(CFS)
Time of concentration =   11.39 min.
Rainfall intensity =     3.219(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1033.000 to Point/Station     1034.000
**** 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
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =   69.000(Ft.)
Highest elevation =  786.000(Ft.)
Lowest elevation =  776.000(Ft.)
Elevation difference =   10.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     3.37 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  69.000^.5)/(  14.493^(1/3)]=   3.37
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.362(CFS)
Total initial stream area =        0.150(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1034.000 to Point/Station     1035.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Top of street segment elevation =   776.000(Ft.)
End of street segment elevation =   710.000(Ft.)
Length of street segment  =   657.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  26.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(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  =  15.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.086(CFS)
Depth of flow =   0.182(Ft.), Average velocity =   4.141(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   4.371(Ft.)
Flow velocity =   4.14(Ft/s)
Travel time =    2.64 min.     TC =    7.64  min.
 Adding area flow to street
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
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.722(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.228(CFS) for    0.600(Ac.)
Total runoff =      1.590(CFS)  Total area =        0.75(Ac.)
Street flow at end of street =      1.590(CFS)
Half street flow at end of street =      1.590(CFS)
Depth of flow =   0.202(Ft.), Average velocity =   4.419(Ft/s)
```





```
Flow width (from curb towards crown)=   5.372(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1035.000 to Point/Station     1038.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   710.000(Ft.)
Downstream point/station elevation =   709.500(Ft.)
Pipe length  =    19.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.590(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.590(CFS)
Normal flow depth in pipe =    4.99(In.)
Flow top width inside pipe =    8.95(In.)
Critical Depth =    6.96(In.)
Pipe flow velocity =      6.33(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     7.69 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1037.000 to Point/Station     1038.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
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
[SINGLE FAMILY area type                    ]
Time of concentration =     7.69 min.
Rainfall intensity =      3.713(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.348(CFS) for    0.660(Ac.)
Total runoff =      2.938(CFS)  Total area =        1.41(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1038.000 to Point/Station     1039.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   709.500(Ft.)
Downstream point/station elevation =   708.500(Ft.)
Pipe length  =    79.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.938(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.938(CFS)
Normal flow depth in pipe =    7.63(In.)
Flow top width inside pipe =   11.55(In.)
Critical Depth =    8.82(In.)
Pipe flow velocity =      5.57(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     7.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1038.000 to Point/Station     1039.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.410(Ac.)
Runoff from this stream =      2.938(CFS)
Time of concentration =    7.93 min.
Rainfall intensity =     3.671(In/Hr)
```

```
Summary of stream data:

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


1        15.053      11.39                 3.219
2         2.938       7.93                 3.671
Qmax(1) =
           1.000 *     1.000 *    15.053) +
           0.877 *     1.000 *     2.938) + =      17.629
Qmax(2) =
           1.000 *     0.696 *    15.053) +
           1.000 *     1.000 *     2.938) + =      13.419

Total of 2 streams to confluence:
Flow rates before confluence point:
      15.053       2.938
Maximum flow rates at confluence using above data:
       17.629       13.419
Area of streams before confluence:
        8.220        1.410
Results of confluence:
Total flow rate =      17.629(CFS)
Time of concentration =    11.391 min.
Effective stream area after confluence =       9.630(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1039.000 to Point/Station     1040.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   708.500(Ft.)
Downstream point/station elevation =   706.000(Ft.)
Pipe length  =    36.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.629(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    17.629(CFS)
Normal flow depth in pipe =   10.43(In.)
Flow top width inside pipe =   17.77(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.60(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    11.43 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1040.000 to Point/Station     1040.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration =    11.43 min.
Rainfall intensity =      3.215(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      0.839(CFS) for    0.580(Ac.)
Total runoff =     18.468(CFS)  Total area =       10.21(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1040.000 to Point/Station     1042.000
```





```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   706.000(Ft.)
Downstream point/station elevation =   698.000(Ft.)
Pipe length  =    64.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.468(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    18.468(CFS)
Normal flow depth in pipe =   10.23(In.)
Flow top width inside pipe =   13.97(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.72(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    11.48 min.
End of computations, total study area =          10.210 (Ac.)
```

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 04/18/19
--------------------------------------------------------------------------
PROJECT AVION
PROPOSED CONDITIONS
2000P100


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

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


Program License Serial Number 4049

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2001.000
**** 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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Initial subarea flow distance  =   61.000(Ft.)
Highest elevation =  850.000(Ft.)
Lowest elevation =  830.000(Ft.)
Elevation difference =   20.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     2.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*(  61.000^.5)/(  32.787^(1/3)]=   2.86
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.099(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2001.000 to Point/Station     2002.000
**** IMPROVED CHANNEL TRAVEL TIME ****
--------------------------------------------------------------------------
Upstream point elevation =   830.000(Ft.)
```





```
Downstream point elevation =   824.000(Ft.)
Channel length thru subarea  =   332.000(Ft.)
Channel base width      =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      1.057(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      1.057(CFS)
Depth of flow =   0.218(Ft.), Average velocity =   3.990(Ft/s)
Channel flow top width =    1.435(Ft.)
Flow Velocity =    3.99(Ft/s)
Travel time  =    1.39 min.
Time of concentration =    6.39 min.
Critical depth =      0.293(Ft.)
 Adding area flow to channel
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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      3.983(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      1.739(CFS) for    0.970(Ac.)
Total runoff =      1.837(CFS)  Total area =        1.02(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2002.000 to Point/Station     2005.000
**** IMPROVED CHANNEL TRAVEL TIME ****
--------------------------------------------------------------------------
Upstream point elevation =   824.000(Ft.)
Downstream point elevation =   758.000(Ft.)
Channel length thru subarea  =   214.000(Ft.)
Channel base width      =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      2.405(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.405(CFS)
Depth of flow =   0.153(Ft.), Average velocity =  13.621(Ft/s)
Channel flow top width =    1.306(Ft.)
Flow Velocity =   13.62(Ft/s)
Travel time  =    0.26 min.
Time of concentration =    6.65 min.
Critical depth =      0.477(Ft.)
 Adding area flow to channel
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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      3.922(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      1.112(CFS) for    0.630(Ac.)
Total runoff =      2.949(CFS)  Total area =        1.65(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2003.000 to Point/Station     2005.000
**** SUBAREA FLOW ADDITION ****
--------------------------------------------------------------------------
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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration =     6.65 min.
Rainfall intensity =      3.922(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      0.371(CFS) for    0.210(Ac.)
Total runoff =      3.320(CFS)  Total area =        1.86(Ac.)
End of computations, total study area =          1.860 (Ac.)
```

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 04/18/19
--------------------------------------------------------------------------
PROJECT AVION
PROPOSED CONDITIONS
3000P100


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

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


Program License Serial Number 4049

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     3000.000 to Point/Station     3001.000
**** 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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Initial subarea flow distance  =   80.000(Ft.)
Highest elevation =  923.000(Ft.)
Lowest elevation =  900.000(Ft.)
Elevation difference =   23.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     3.42 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*(  80.000^.5)/(  28.750^(1/3)]=   3.42
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.099(CFS)
Total initial stream area =        0.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     3001.000 to Point/Station     3002.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   900.000(Ft.)
```





```
Downstream point elevation =   844.000(Ft.)
Channel length thru subarea  =   184.000(Ft.)
Channel base width      =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      0.099(CFS)
Depth of flow =   0.023(Ft.), Average velocity =   4.262(Ft/s)
Channel flow top width =    1.045(Ft.)
Flow Velocity =    4.26(Ft/s)
Travel time  =    0.72 min.
Time of concentration =    5.72 min.
Critical depth =      0.065(Ft.)
End of computations, total study area =           0.050 (Ac.)
```

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 08/07/18
--------------------------------------------------------------------------
PROJECT AVION
PROPOSED CONDITIONS
4000P100


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

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


Program License Serial Number 4049

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

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     4000.000 to Point/Station     4001.000
**** 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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Initial subarea flow distance  =   61.000(Ft.)
Highest elevation =  782.000(Ft.)
Lowest elevation =  766.000(Ft.)
Elevation difference =   16.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     3.08 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4500)*(  61.000^.5)/(  26.230^(1/3)]=   3.08
Setting time of concentration to 5 minutes
Rainfall intensity (I) =      4.389(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.217(CFS)
Total initial stream area =        0.110(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     4001.000 to Point/Station     4002.000
**** IMPROVED CHANNEL TRAVEL TIME ****
--------------------------------------------------------------------------
Upstream point elevation =   766.000(Ft.)
```





```
Downstream point elevation =   705.000(Ft.)
Channel length thru subarea  =   437.000(Ft.)
Channel base width      =    1.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      2.103(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.103(CFS)
Depth of flow =   0.179(Ft.), Average velocity =   9.979(Ft/s)
Channel flow top width =    1.358(Ft.)
Flow Velocity =    9.98(Ft/s)
Travel time  =    0.73 min.
Time of concentration =    5.73 min.
Critical depth =      0.441(Ft.)
 Adding area flow to channel
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
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      4.155(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      3.571(CFS) for    1.910(Ac.)
Total runoff =      3.789(CFS)  Total area =        2.02(Ac.)
End of computations, total study area =          2.020 (Ac.)
```

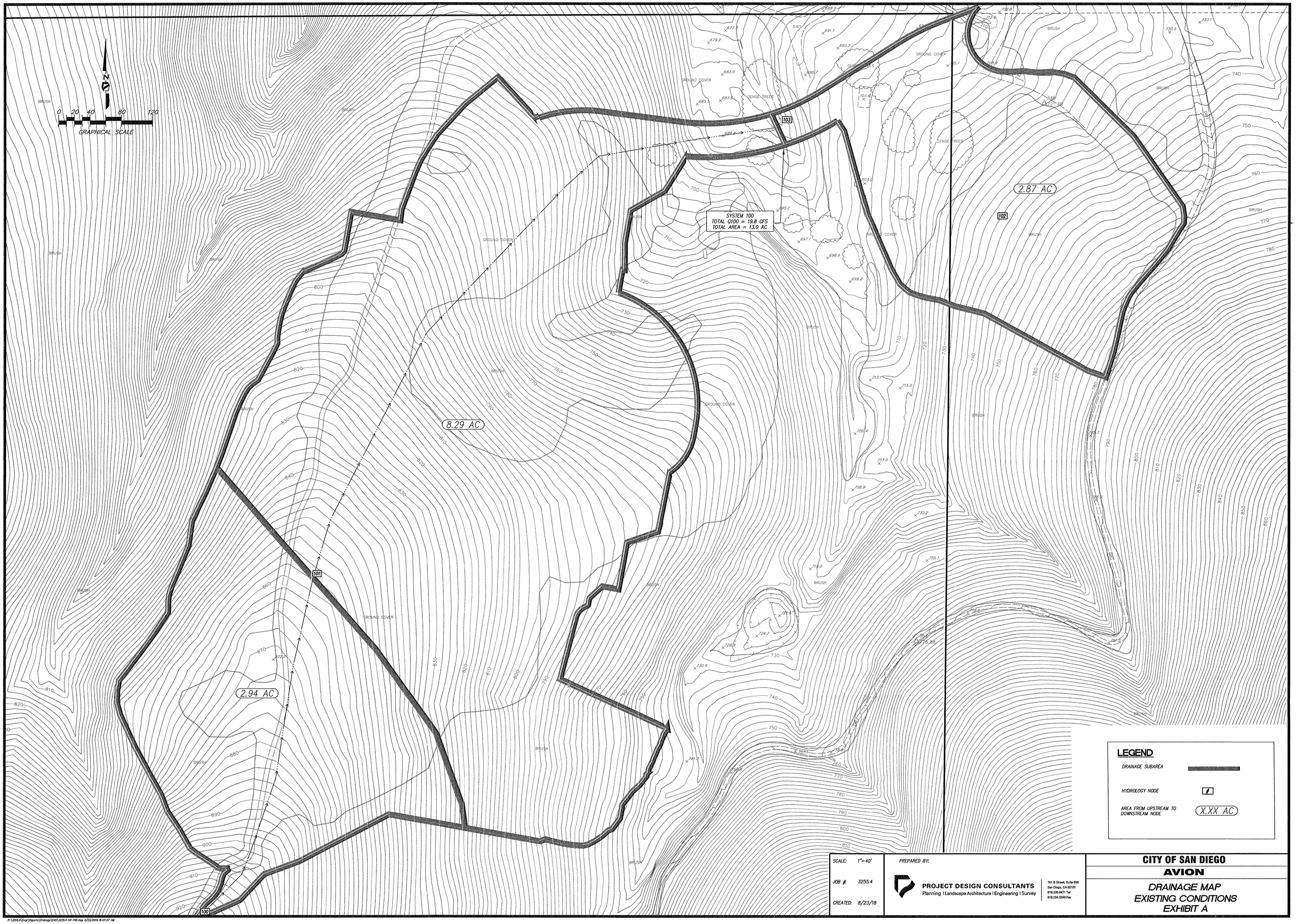
# APPENDIX 4

# Hydraulic Calculations

**To be submitted in Final Engineering**

# APPENDIX 5

## Exhibits




SCALE: 1"=40'

JOB #: 3255.4

CREATED: 8/23/18

PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Engineering | Survey
701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax

**CITY OF SAN DIEGO**

**AVION**

*DRAINAGE MAP*
*EXISTING CONDITIONS*
*EXHIBIT A*

P:\3255.4\Engr\Reports\Drainage\EXH\3255.4 DR EXE.dwg 4/23/2019 8:47:27 AM

N

0 20 40 80 120
GRAPHICAL SCALE

D-40 Riprap

EXISTING WINECREEK DRIVE

WINECREEK DRIVE

PVT. ST 'A'

PVT. ST 'B'

PVT. ST 'C'

PVT. ST 'D'

PVT. ST 'E'

PVT. ST 'F'

0.60 AC
0.66 AC
0.15 AC
1.48 AC
1.83 AC
0.23 AC
0.08 AC
0.84 AC
0.99 AC
0.14 AC
0.33 AC
0.37 AC
1.06 AC
0.04 AC
0.08 AC
0.67 AC
0.05 AC
0.97 AC
0.21 AC
0.63 AC
0.05 AC
0.58 AC
BIOFILTRATION/ HYDROMOD/ DETENTION BASIN
1.91 AC
0.11 AC

SYSTEM 4000
TOTAL Q100 = 3.8 CFS
TOTAL AREA = 2.0 AC

SYSTEM 1000
TOTAL Q100 = 18.2 CFS
TOTAL AREA = 10.1 AC

SYSTEM 3000
TOTAL Q100 = 0.1 CFS
TOTAL AREA = 0.05 AC

SYSTEM 2000
TOTAL Q100 = 2.7 CFS
TOTAL AREA = 1.5 AC

## LEGEND

DRAINAGE SUBAREA

HYDROLOGY NODE

AREA FROM UPSTREAM TO DOWNSTREAM NODE — X.XX AC

SCALE: 1"=40'

JOB #: 3255.4

CREATED: 8/27/18

PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Engineering | Survey
701 B Street, Suite 800
San Diego, CA 92101
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CITY OF SAN DIEGO

AVION

DRAINAGE MAP
PROPOSED CONDITIONS
EXHIBIT B

P:\3255.4\Engr\Reports\Drainage\EXH\3255.4 DR POST.dwg 4/23/2019 8:44:38 AM