PRELIMINARY DRAINAGE STUDY

CEDAR AVENUE TECHNOLOGY PARK
APN # 0253-211-56, 0253-211-57

Bloomington, San Bernardino County, California
September 2, 2016

Prepared for:

Howard Industrial Partners, LLC
155 N. Riverview Drive
Anaheim Hills, CA 92808
714-769-9155 ph.

Revision History	
09/2016	1ST SUBMITTAL – County of San Bernardino

Report Prepared By:

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Engineer of Work/ Contact Person:
Francisco Martinez Jr., P.E.
Xochitl Lozano

Additional Review Required
9-28-16

REGISTERED PROFESSIONAL ENGINEER
FRANCISCO MARTINEZ JR
No. 84640
CIVIL
STATE OF CALIFORNIA

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San Bernardino County
Land Development Division

JN 154882

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Sign & date (upon final submittal for Approval)

REGISTERED PROFESSIONAL ENGINEER
FRANCISCO MARTINEZ JR
No. 84640
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STATE OF CALIFORNIA

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Table of Contents

I. INTRODUCTION

1.1 BACKGROUND

Michael Baker International has been retained by Howard Industrial Partners, LLC to prepare an onsite drainage study for Cedar Avenue Technology Park. The project site is located in Bloomington, a census designated place (CDP), in San Bernardino County. The project site is bounded by Interstate 10 to the north, Vine Street to the East, Orange Street to the south, and Cedar Avenue to the west (see Figure 1).

The site is currently vacant and undeveloped. Flows drain south towards Orange Street where flows collect in the gutter and travel east onto Larch Avenue. Afterwards, flows travel south on Larch Ave then east on Slover Ave for approximately 1,400 feet until flows enter a concrete drainage ditch where they ultimately merge with the Rialto Channel, and ultimately to the Santa Ana River.

1.2 OBJECTIVE

The objectives of this drainage study are the following:

- Determine points of flow concentration and delineate the onsite drainage watershed areas.
- Based on the proposed drainage patterns, ground slope, land use and soil type, and following the criteria and procedures described in the San Bernardino County Hydrology Manual, perform hydrologic calculations to determine the 100-year Developed Condition discharges.
- Comply with the NPDES requirements that all impervious areas drain to an appropriate Best Management Practice (BMP) or equally effective alternative. Identify and size the BMP in order to meet the NPDES requirements. This will be addressed in a separate Preliminary Project Specific Water Quality management Plan (PWQMP).
- Preparation of hydrology report, which consist of hydrological and analytical results and exhibits.

II. HYDROLOGIC METHODOLOGY

The methodology presented in this study is in compliance with the San Bernardino County Hydrology Manual, Dated August 1986 (Reference 1), hereinafter referred to as the Manual.

Model Descriptions - The CivilCADD/CivilDesign Engineering Software Rational Method Hydrology System Model Version 9.0, (Reference 6) was used to generate the peak 100-year and 10-year onsite flows.

Soil Type - The Manual utilizes the Soil Conservation Service (SCS) soil classification system, which classifies soils into four (4) hydrological soil groups (HSG): A through D, with D being the least impervious. Figure C-14 of the Manual are included in Appendix C. According to this figure, this project is located within HSG 'A'. Additionally, per the San Bernardino County Hydrology Manual Addendum the site soil data was obtained from Web Soil Survey website and the soil type for the site is 'A', which is consistent with SCS.

Development Type- The proposed development model was based on commercial for areas with higher impervious areas.

Intensity- Standard intensity-duration curve data were initially taken from the Hydrology Manual figure B-4 Valley Area Isohyetal Map (100 Year, 1 Hour). However, per County of San Bernardino Hydrology Manual Addendum, NOAA Atlas 14 was used to obtain the intensity. For the 100-year analysis, NOAA Atlas 14 specifies a 100-year 1-hour rainfall intensity of 1.34 inches/hour (see Appendix C).

Drainage Areas and Flow Patterns - The drainage areas and flow patterns for existing and proposed conditions were mapped using the aerial topography (Cadd) and the design data per the Grading Plan, respectively. The areas were measured using the computer capabilities of AutoCAD.

III. HYDROLOGY/HYDRAULIC ANALYSIS RESULTS

3.1 HYDROLOGY RESULTS

A hydrologic analysis was performed for the developed conditions using the rational method. The CivilDesign hydrology software was used to generate the 100-year and 10-year peak discharges. Table 1.1 and 1.2 summarize the result of the existing and post condition hydrologic analysis. The detailed rational method calculations are included in Appendix A & B.

Table 1.1 Existing Condition Hydrology Summary Table

Node Number	Location	Area (ac)	100-Year Discharge (cfs)	10-Year Discharge (cfs)
12	Discharge location into Orange Street gutter	4.10	6.66	2.80
22	Discharge location into Orange Street gutter	1.56	2.47	0.99
32	Discharge location into Orange Street gutter	4.88	8.77	3.89

Table 1.2 Developed Conditions Hydrology Summary Table

Node Number	Location	Area (ac)	100-Year Discharge (cfs)	10-Year Discharge (cfs)
13	Underground chamber discharge location for infiltration	3.81	12.54	7.53
22	Underground chamber discharge location for infiltration	4.31	15.78	9.77

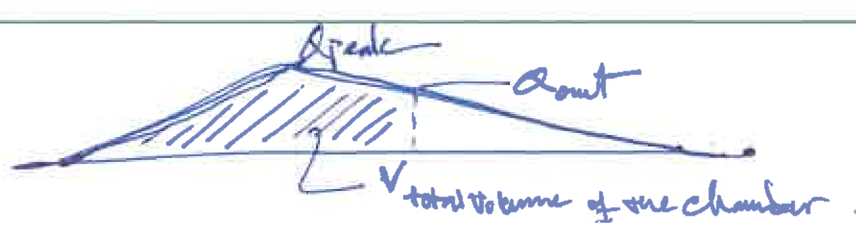
Figures 2 and 3 in appendixes A and B respectively show the drainage patterns for this project.

IV. CONCLUSIONS

1. Methodology used in this report is in compliance with San Bernardino County.

2. An increase of 10.42 cfs is expected for the proposed development due to the increase of the imperviousness ratio from vacant-undeveloped to industrial/commercial development. Due to the location of the site, the project is exempt from HCOC requirements. Therefore, the primary focus is to comply with the NPDES requirements that all impervious areas drain to an appropriate Best Management Practice (BMP) or equally effective alternative. Since the site's soil class provides satisfactory infiltration flows, the proposed BMP will be an underground chamber that will ultimately allow the treated flows to infiltrate. The BMP will be sized in order to meet the NPDES requirements. This will be addressed in a separate Preliminary Project Specific Water Quality management Plan (PWQMP).

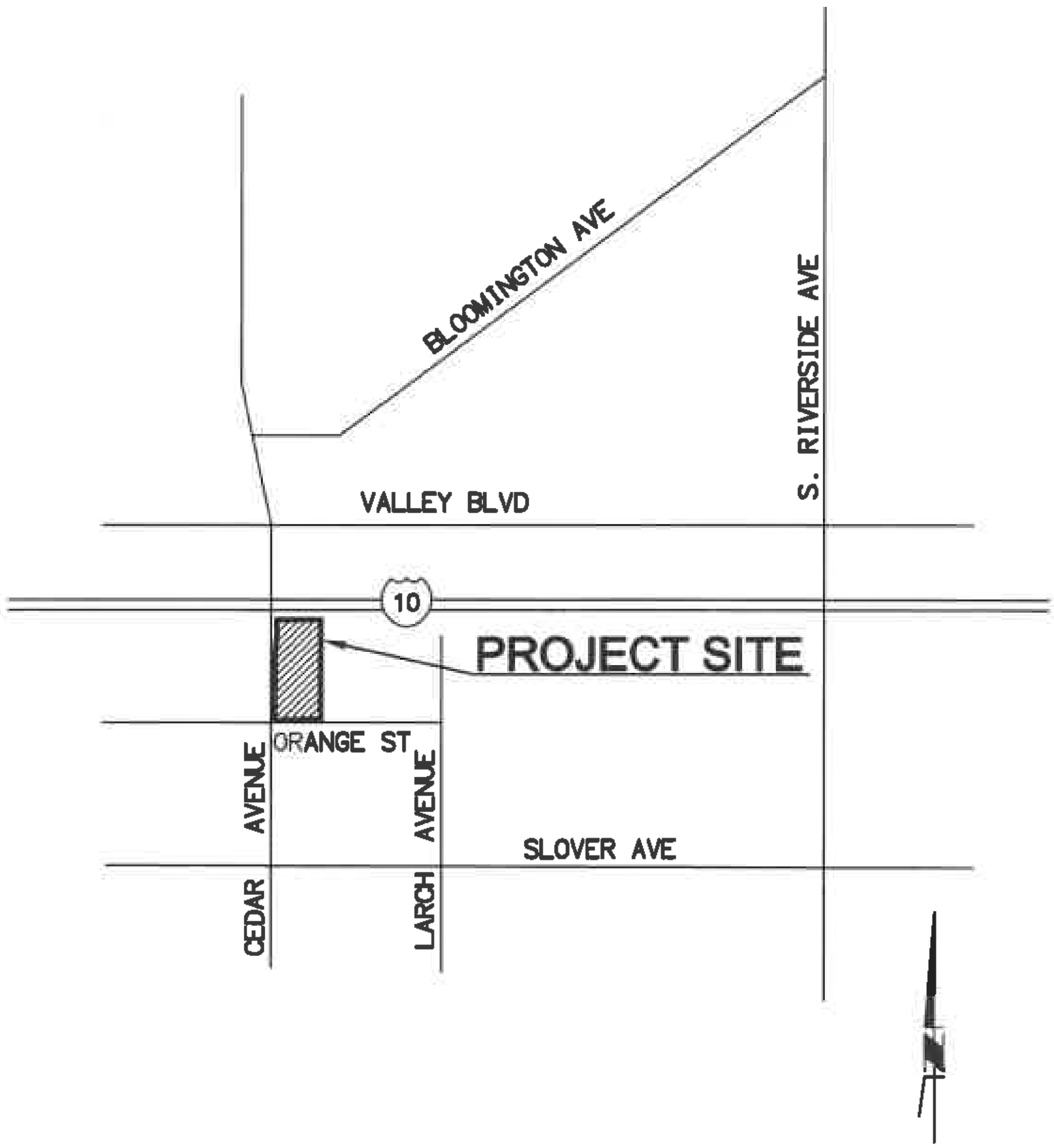
- Hydrologic Calc are ok'd, please address the following:
(1) Show the ΔV (between pre & post)
(2) Show the mitigation for ΔQ & ΔV. (using the volume provided by the underground chamber).



VI. REFERENCES

1. San Bernardino County Flood Control Hydrology Manual, August 1986.

2. CivilDesign Engineering Software, Rational Method Hydrology System Model Version 9.0.



VICINITY MAP

NOT TO SCALE

Michael Baker INTERNATIONAL
40810 COUNTY CENTER DR.,
SUITE 200
TEMECULA, CA 92591
PHONE: (951) 676-8042
MBAKERINTL.COM

CEDAR TECHNOLOGY PARK

FIGURE 1
VICINITY MAP

H:\PDATA\154882\CADD\LAND\DLV\HYDRO\154882-FIG001-VICINITY.DWG DAVID.ZARATE 9/1/16 10:59 am

EXISTING HYDROLOGY ANALYSIS, RATIONAL METHOD

Appendix A

APPENDIX A

HYDROLOGY ANALYSIS, RATIONAL METHOD

A1: Existing Conditions, 100-year storm event

A2: Existing Conditions, 10-year storm event

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              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
      Rational Hydrology Study        Date: 09/01/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
EXISTING CONDITIONS WATERSHED A
100-YR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.842(In.)
  100 Year storm 1 hour rainfall  =      1.340(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.340 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      10.000 to Point/Station      11.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Initial subarea data:
Initial area flow distance =   283.000(Ft.)
Top (of initial area) elevation =    96.000(Ft.)
Bottom (of initial area) elevation =    87.500(Ft.)
Difference in elevation =     8.500(Ft.)
Slope =    0.03004  s(%)=       3.00
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.614 min.
Rainfall intensity =      3.263(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.677
Subarea runoff =      1.987(CFS)
Total initial stream area =        0.900(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.810(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      11.000 to Point/Station      12.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    87.500(Ft.)
Downstream point elevation =    80.700(Ft.)
Channel length thru subarea  =   503.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      4.369(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
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Flow(q) thru subarea =      4.369(CFS)
Depth of flow =   0.171(Ft.), Average velocity =   1.378(Ft/s)
Channel flow top width =   27.096(Ft.)
Flow Velocity =    1.38(Ft/s)
Travel time  =    6.08 min.
Time of concentration =   19.70 min.
Critical depth =      0.143(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Rainfall intensity =      2.614(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.621
Subarea runoff =      4.672(CFS) for    3.200(Ac.)
Total runoff =      6.659(CFS)
Effective area this stream =       4.10(Ac.)
Total Study Area (Main Stream No. 1) =        4.10(Ac.)
Area averaged Fm value =    0.810(In/Hr)
Depth of flow =   0.210(Ft.), Average velocity =   1.545(Ft/s)
Critical depth =      0.178(Ft.)
End of computations, Total Study Area =           4.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
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              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
       Rational Hydrology Study        Date: 09/01/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
EXISTING CONDITION WATERSHED B
100 YEAR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.842(In.)
  100 Year storm 1 hour rainfall  =      1.340(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.340 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Initial subarea data:
Initial area flow distance =   206.000(Ft.)
Top (of initial area) elevation =    94.600(Ft.)
Bottom (of initial area) elevation =    88.500(Ft.)
Difference in elevation =     6.100(Ft.)
Slope =    0.02961  s(%)=       2.96
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.024 min.
Rainfall intensity =      3.515(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.693
Subarea runoff =      1.242(CFS)
Total initial stream area =        0.510(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.810(In/Hr)


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Process from Point/Station       21.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    88.500(Ft.)
Downstream point elevation =    79.900(Ft.)
Channel length thru subarea  =   566.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      1.904(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
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Flow(q) thru subarea =      1.904(CFS)
Depth of flow =   0.109(Ft.), Average velocity =   1.136(Ft/s)
Channel flow top width =   20.857(Ft.)
Flow Velocity =    1.14(Ft/s)
Travel time  =    8.30 min.
Time of concentration =   20.32 min.
Critical depth =      0.089(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Rainfall intensity =      2.566(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.616
Subarea runoff =      1.224(CFS) for    1.050(Ac.)
Total runoff =      2.465(CFS)
Effective area this stream =       1.56(Ac.)
Total Study Area (Main Stream No. 1) =       1.56(Ac.)
Area averaged Fm value =    0.810(In/Hr)
Depth of flow =   0.124(Ft.), Average velocity =   1.224(Ft/s)
Critical depth =      0.104(Ft.)
End of computations, Total Study Area =           1.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
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              San Bernardino County Rational Hydrology Program

                   (Hydrology Manual Date - August 1986)

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       Rational Hydrology Study        Date: 09/01/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
EXISITNG CONDITIONS WATERSHED C
100 YEAR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.842(In.)
  100 Year storm 1 hour rainfall  =      1.340(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.340 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


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Process from Point/Station       30.000 to Point/Station       31.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Initial subarea data:
Initial area flow distance =   285.000(Ft.)
Top (of initial area) elevation =    95.400(Ft.)
Bottom (of initial area) elevation =    83.000(Ft.)
Difference in elevation =    12.400(Ft.)
Slope =    0.04351  s(%)=      4.35
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.677 min.
Rainfall intensity =      3.405(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.686
Subarea runoff =      2.056(CFS)
Total initial stream area =        0.880(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.810(In/Hr)


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Process from Point/Station       31.000 to Point/Station       32.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    83.000(Ft.)
Downstream point elevation =    75.100(Ft.)
Channel length thru subarea  =   462.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      5.462(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
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Flow(q) thru subarea =      5.462(CFS)
Depth of flow =   0.180(Ft.), Average velocity =   1.595(Ft/s)
Channel flow top width =   28.015(Ft.)
Flow Velocity =    1.60(Ft/s)
Travel time  =    4.83 min.
Time of concentration =   17.50 min.
Critical depth =      0.160(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Rainfall intensity =      2.806(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.640
Subarea runoff =      6.713(CFS) for    4.000(Ac.)
Total runoff =      8.769(CFS)
Effective area this stream =        4.88(Ac.)
Total Study Area (Main Stream No. 1) =        4.88(Ac.)
Area averaged Fm value =    0.810(In/Hr)
Depth of flow =   0.227(Ft.), Average velocity =   1.813(Ft/s)
Critical depth =      0.207(Ft.)
End of computations, Total Study Area =           4.88 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
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          San Bernardino County Rational Hydrology Program

               (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
     Rational Hydrology Study        Date: 09/02/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
EXISTING CONDITIONS WATERSHED A
10-YR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.842 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Initial subarea data:
Initial area flow distance =   283.000(Ft.)
Top (of initial area) elevation =    96.000(Ft.)
Bottom (of initial area) elevation =    87.500(Ft.)
Difference in elevation =     8.500(Ft.)
Slope =    0.03004  s(%)=      3.00
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.614 min.
Rainfall intensity =      2.050(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.545
Subarea runoff =      1.005(CFS)
Total initial stream area =         0.900(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.810(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    87.500(Ft.)
Downstream point elevation =    80.700(Ft.)
Channel length thru subarea  =   503.000(Ft.)
Channel base width     =   10.000(Ft.)
```

```
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      1.942(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      1.942(CFS)
Depth of flow =   0.113(Ft.), Average velocity =   1.097(Ft/s)
Channel flow top width =   21.312(Ft.)
Flow Velocity =    1.10(Ft/s)
Travel time  =    7.64 min.
Time of concentration =   21.26 min.
Critical depth =      0.090(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Rainfall intensity =      1.569(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.436
Subarea runoff =      1.798(CFS) for    3.200(Ac.)
Total runoff =      2.803(CFS)
Effective area this stream =        4.10(Ac.)
Total Study Area (Main Stream No. 1) =        4.10(Ac.)
Area averaged Fm value =    0.810(In/Hr)
Depth of flow =   0.137(Ft.), Average velocity =   1.218(Ft/s)
Critical depth =      0.111(Ft.)
End of computations, Total Study Area =            4.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
```

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San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
     Rational Hydrology Study        Date: 09/02/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
EXISTING CONDITIONS WATERSHED B
10-YR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.842 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Initial subarea data:
Initial area flow distance =   206.000(Ft.)
Top (of initial area) elevation =    94.600(Ft.)
Bottom (of initial area) elevation =    88.500(Ft.)
Difference in elevation =     6.100(Ft.)
Slope =    0.02961  s(%)=       2.96
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.024 min.
Rainfall intensity =      2.209(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.570
Subarea runoff =      0.642(CFS)
Total initial stream area =        0.510(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.810(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    88.500(Ft.)
Downstream point elevation =    79.900(Ft.)
Channel length thru subarea  =   566.000(Ft.)
Channel base width    =   10.000(Ft.)
```

```
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      0.855(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      0.855(CFS)
Depth of flow =   0.071(Ft.), Average velocity =   0.894(Ft/s)
Channel flow top width =   17.068(Ft.)
Flow Velocity =    0.89(Ft/s)
Travel time  =   10.55 min.
Time of concentration =   22.57 min.
Critical depth =      0.056(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Rainfall intensity =      1.514(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.419
Subarea runoff =      0.346(CFS) for    1.050(Ac.)
Total runoff =      0.989(CFS)
Effective area this stream =        1.56(Ac.)
Total Study Area (Main Stream No. 1) =        1.56(Ac.)
Area averaged Fm value =    0.810(In/Hr)
Depth of flow =   0.076(Ft.), Average velocity =   0.935(Ft/s)
Critical depth =      0.061(Ft.)
End of computations, Total Study Area =            1.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
```

```
           San Bernardino County Rational Hydrology Program

               (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
     Rational Hydrology Study       Date: 09/02/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
EXISTING CONDITIONS WATERSHED C
10-YR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.842 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station      31.000
**** INITIAL AREA EVALUATION ****

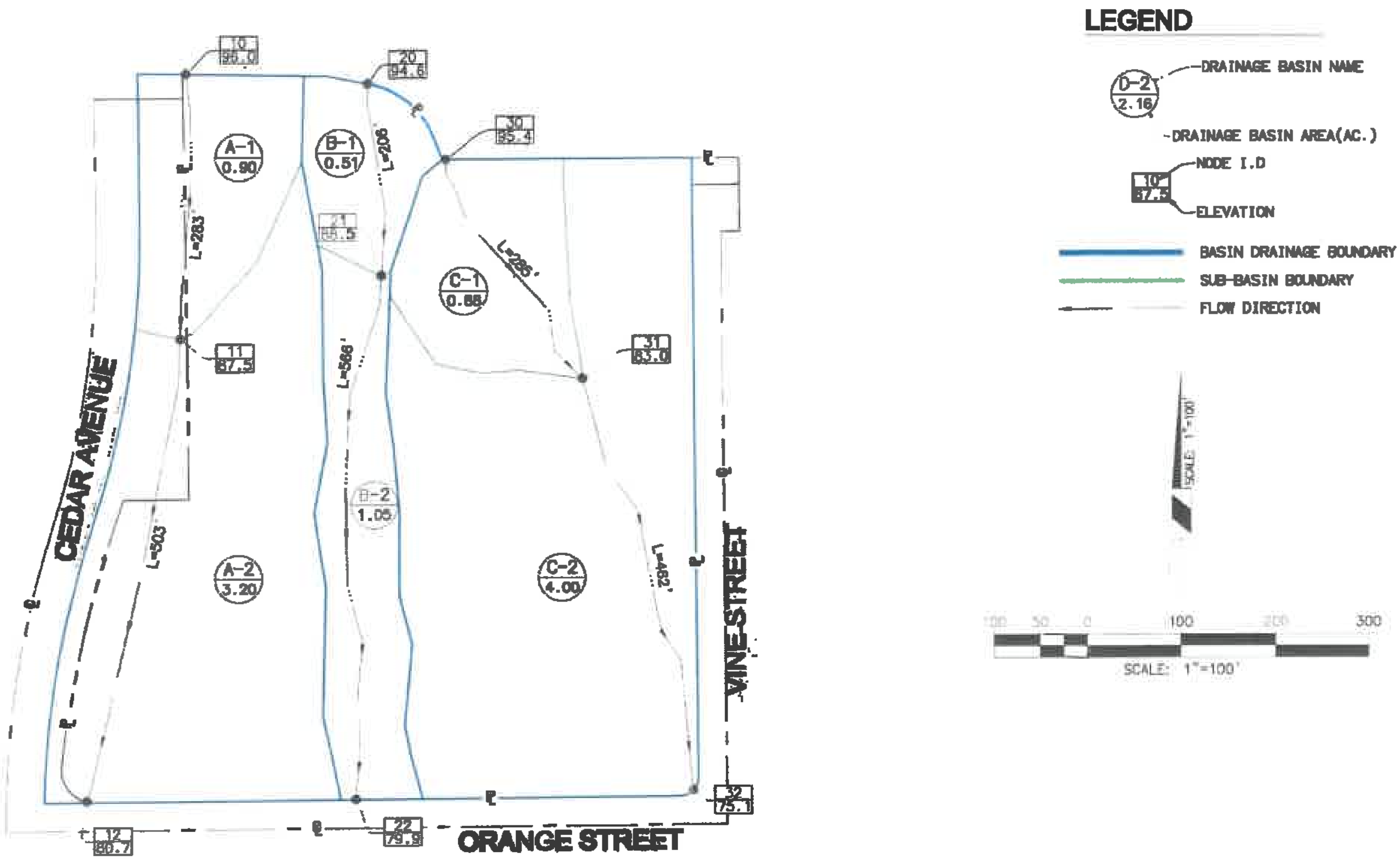
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Initial subarea data:
Initial area flow distance =   285.000(Ft.)
Top (of initial area) elevation =    95.400(Ft.)
Bottom (of initial area) elevation =    83.000(Ft.)
Difference in elevation =    12.400(Ft.)
Slope =    0.04351  s(%)=       4.35
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.677 min.
Rainfall intensity =       2.140(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.560
Subarea runoff =       1.054(CFS)
Total initial stream area =        0.880(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.810(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       31.000 to Point/Station      32.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    83.000(Ft.)
Downstream point elevation =    75.100(Ft.)
Channel length thru subarea  =   462.000(Ft.)
Channel base width    =   10.000(Ft.)
```

```
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      2.515(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.515(CFS)
Depth of flow =   0.122(Ft.), Average velocity =   1.284(Ft/s)
Channel flow top width =   22.171(Ft.)
Flow Velocity =    1.28(Ft/s)
Travel time  =    6.00 min.
Time of concentration =   18.67 min.
Critical depth =      0.104(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.810(In/Hr)
Rainfall intensity =      1.696(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.470
Subarea runoff =      2.841(CFS) for    4.000(Ac.)
Total runoff =      3.894(CFS)
Effective area this stream =        4.88(Ac.)
Total Study Area (Main Stream No. 1) =        4.88(Ac.)
Area averaged Fm value =    0.810(In/Hr)
Depth of flow =   0.152(Ft.), Average velocity =   1.453(Ft/s)
Critical depth =      0.133(Ft.)
End of computations, Total Study Area =            4.88 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
```



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CEDAR AVE. TEHNOLOGY PARK

EXISTING DRAINAGE MAP

DEVELOPMENT HYDROLOGY ANALYSIS, RATIONAL METHOD

Appendix B

APPENDIX B

HYDROLOGY ANALYSIS, RATIONAL METHOD

B1: Post-Project Development Conditions, 100-year storm event

B2: Post-Project Development Conditions, 10-year storm event

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              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
      Rational Hydrology Study        Date: 09/01/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
PROPOSED WATERSHED A
100 YEAR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.842(In.)
  100 Year storm 1 hour rainfall  =      1.340(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.340 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   225.000(Ft.)
Top (of initial area) elevation =    87.300(Ft.)
Bottom (of initial area) elevation =    85.300(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.00889  s(%)=       0.89
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.823 min.
Rainfall intensity =      4.939(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff =      3.180(CFS)
Total initial stream area =        0.730(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    85.300(Ft.)
Downstream point elevation =    83.000(Ft.)
Channel length thru subarea  =   455.000(Ft.)
Channel base width  =    3.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      7.901(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
```

```
Flow(q) thru subarea =       7.901(CFS)
Depth of flow =   0.258(Ft.), Average velocity =   1.922(Ft/s)
Channel flow top width =   28.829(Ft.)
Flow Velocity =     1.92(Ft/s)
Travel time  =    3.95 min.
Time of concentration =   10.77 min.
Critical depth =       0.246(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      3.756(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.877
Subarea runoff =      9.363(CFS) for    3.080(Ac.)
Total runoff =     12.543(CFS)
Effective area this stream =        3.81(Ac.)
Total Study Area (Main Stream No. 1) =        3.81(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.312(Ft.), Average velocity =   2.159(Ft/s)
Critical depth =       0.301(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      12.000 to Point/Station      13.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =    80.000(Ft.)
Downstream point/station elevation =    79.000(Ft.)
Pipe length  =     75.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.543(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    12.543(CFS)
Normal flow depth in pipe =   12.77(In.)
Flow top width inside pipe =   20.50(In.)
Critical Depth =    15.83(In.)
Pipe flow velocity =      8.19(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    10.92 min.
End of computations, Total Study Area =           3.81 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  32.0
```

```
                San Bernardino County Rational Hydrology Program

                     (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
       Rational Hydrology Study        Date: 09/01/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
PROPOSED WATERSHED B
100 YEAR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
   10 Year storm 1 hour rainfall  =      0.842(In.)
  100 Year storm 1 hour rainfall  =      1.340(In.)
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.340 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   500.000(Ft.)
Top (of initial area) elevation =    89.200(Ft.)
Bottom (of initial area) elevation =    84.200(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01000  s(%)=       1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.172 min.
Rainfall intensity =      4.135(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.879
Subarea runoff =      2.689(CFS)
Total initial stream area =        0.740(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =    79.000(Ft.)
Downstream point/station elevation =    74.000(Ft.)
Pipe length  =   290.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.689(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.689(CFS)
Normal flow depth in pipe =    6.53(In.)
Flow top width inside pipe =   11.95(In.)
Critical Depth =    8.43(In.)
```

```
Pipe flow velocity =      6.16(Ft/s)
Travel time through pipe =    0.78 min.
Time of concentration (TC) =     9.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      21.000 to Point/Station      22.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.740(Ac.)
Runoff from this stream =      2.689(CFS)
Time of concentration =    9.96 min.
Rainfall intensity =     3.937(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      23.000 to Point/Station      24.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   480.000(Ft.)
Top (of initial area) elevation =    85.000(Ft.)
Bottom (of initial area) elevation =    80.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01042  s(%)=      1.04
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.950 min.
Rainfall intensity =     4.197(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.879
Subarea runoff =     13.170(CFS)
Total initial stream area =       3.570(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      24.000 to Point/Station      22.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =     77.000(Ft.)
Downstream point/station elevation =     74.000(Ft.)
Pipe length  =   140.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     13.170(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     13.170(CFS)
Normal flow depth in pipe =   12.82(In.)
Flow top width inside pipe =   16.30(In.)
Critical Depth =   16.27(In.)
Pipe flow velocity =     9.78(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     9.19 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      24.000 to Point/Station      22.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      3.570(Ac.)
Runoff from this stream =     13.170(CFS)
```

```
Time of concentration =    9.19 min.
Rainfall intensity =     4.131(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

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


1      2.69     0.740      9.96    0.098      3.937
2     13.17     3.570      9.19    0.098      4.131
Qmax(1) =
          1.000 *    1.000 *     2.689) +
          0.952 *    1.000 *    13.170) + =      15.225
Qmax(2) =
          1.051 *    0.923 *     2.689) +
          1.000 *    1.000 *    13.170) + =      15.777

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.689      13.170
Maximum flow rates at confluence using above data:
       15.225      15.777
Area of streams before confluence:
        0.740        3.570
Effective area values after confluence:
        4.310        4.253
Results of confluence:
Total flow rate =     15.777(CFS)
Time of concentration =     9.189 min.
Effective stream area after confluence =      4.253(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total (this main stream) =      4.31(Ac.)
End of computations, Total Study Area =          4.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  32.0
```

```
              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2014 Version 9.0
      Rational Hydrology Study       Date: 09/02/16
------------------------------------------------------------------------
CEDAR AVENUE TECHNOLOGY PARK
DEVELOPED CONDITIONS WATERSHED A
10-YR STORM EVENT ANALYSIS

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


Program License Serial Number 6341

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.842 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   225.000(Ft.)
Top (of initial area) elevation =    87.300(Ft.)
Bottom (of initial area) elevation =    85.300(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.00889  s(%)=       0.89
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.823 min.
Rainfall intensity =      3.103(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.872
Subarea runoff =      1.975(CFS)
Total initial stream area =        0.730(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =    85.300(Ft.)
Downstream point elevation =    83.000(Ft.)
Channel length thru subarea  =   455.000(Ft.)
Channel base width    =    3.000(Ft.)
```

```
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      4.777(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      4.777(CFS)
Depth of flow =   0.209(Ft.), Average velocity =   1.693(Ft/s)
Channel flow top width =   23.946(Ft.)
Flow Velocity =    1.69(Ft/s)
Travel time  =    4.48 min.
Time of concentration =   11.30 min.
Critical depth =      0.197(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      2.292(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.862
Subarea runoff =      5.551(CFS) for    3.080(Ac.)
Total runoff =      7.525(CFS)
Effective area this stream =        3.81(Ac.)
Total Study Area (Main Stream No. 1) =        3.81(Ac.)
Area averaged Fm value =    0.098(In/Hr)
Depth of flow =   0.253(Ft.), Average velocity =   1.899(Ft/s)
Critical depth =      0.240(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station      13.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =    80.000(Ft.)
Downstream point/station elevation =    79.000(Ft.)
Pipe length  =    75.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.525(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.525(CFS)
Normal flow depth in pipe =   10.27(In.)
Flow top width inside pipe =   17.82(In.)
Critical Depth =   12.75(In.)
Pipe flow velocity =      7.23(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    11.48 min.
End of computations, Total Study Area =            3.81 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2014 Version 9.0
Rational Hydrology Study Date: 09/02/16

CEDAR AVENUE TECHNOLOGY PARK
DEVELOPED CONDITIONS WATERSHED B
10-YR STORM EVENT ANALYSIS

Program License Serial Number 6341

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.842 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 20.000 to Point/Station 21.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.098(In/Hr)
Initial subarea data:
Initial area flow distance = 500.000(Ft.)
Top (of initial area) elevation = 89.200(Ft.)
Bottom (of initial area) elevation = 84.200(Ft.)
Difference in elevation = 5.000(Ft.)
Slope = 0.01000 s(%)= 1.00
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.172 min.
Rainfall intensity = 2.599(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.866
Subarea runoff = 1.665(CFS)
Total initial stream area = 0.740(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.098(In/Hr)

++
Process from Point/Station 21.000 to Point/Station 22.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 79.000(Ft.)
Downstream point/station elevation = 74.000(Ft.)
Pipe length = 290.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 1.665(CFS)

```
Nearest computed pipe diameter  =     9.00(In.)
Calculated individual pipe flow  =    1.665(CFS)
Normal flow depth in pipe =    5.91(In.)
Flow top width inside pipe =    8.55(In.)
Critical Depth =    7.12(In.)
Pipe flow velocity =      5.42(Ft/s)
Travel time through pipe =    0.89 min.
Time of concentration (TC) =    10.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      21.000 to Point/Station      22.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.740(Ac.)
Runoff from this stream =      1.665(CFS)
Time of concentration =   10.06 min.
Rainfall intensity =     2.458(In/Hr)
Area averaged loss rate (Fm) =    0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      23.000 to Point/Station      24.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.098(In/Hr)
Initial subarea data:
Initial area flow distance =   480.000(Ft.)
Top (of initial area) elevation =    85.000(Ft.)
Bottom (of initial area) elevation =    80.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.01042  s(%)=      1.04
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.950 min.
Rainfall intensity =       2.637(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.867
Subarea runoff =      8.158(CFS)
Total initial stream area =        3.570(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.098(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      24.000 to Point/Station      22.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =    77.000(Ft.)
Downstream point/station elevation =    74.000(Ft.)
Pipe length  =   140.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.158(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     8.158(CFS)
Normal flow depth in pipe =   10.75(In.)
Flow top width inside pipe =   13.52(In.)
Critical Depth =   13.46(In.)
```

Pipe flow velocity = 8.67(Ft/s)
Travel time through pipe = 0.27 min.
Time of concentration (TC) = 9.22 min.

++
Process from Point/Station 24.000 to Point/Station 22.000
**** CONFLUENCE OF MINOR STREAMS ****

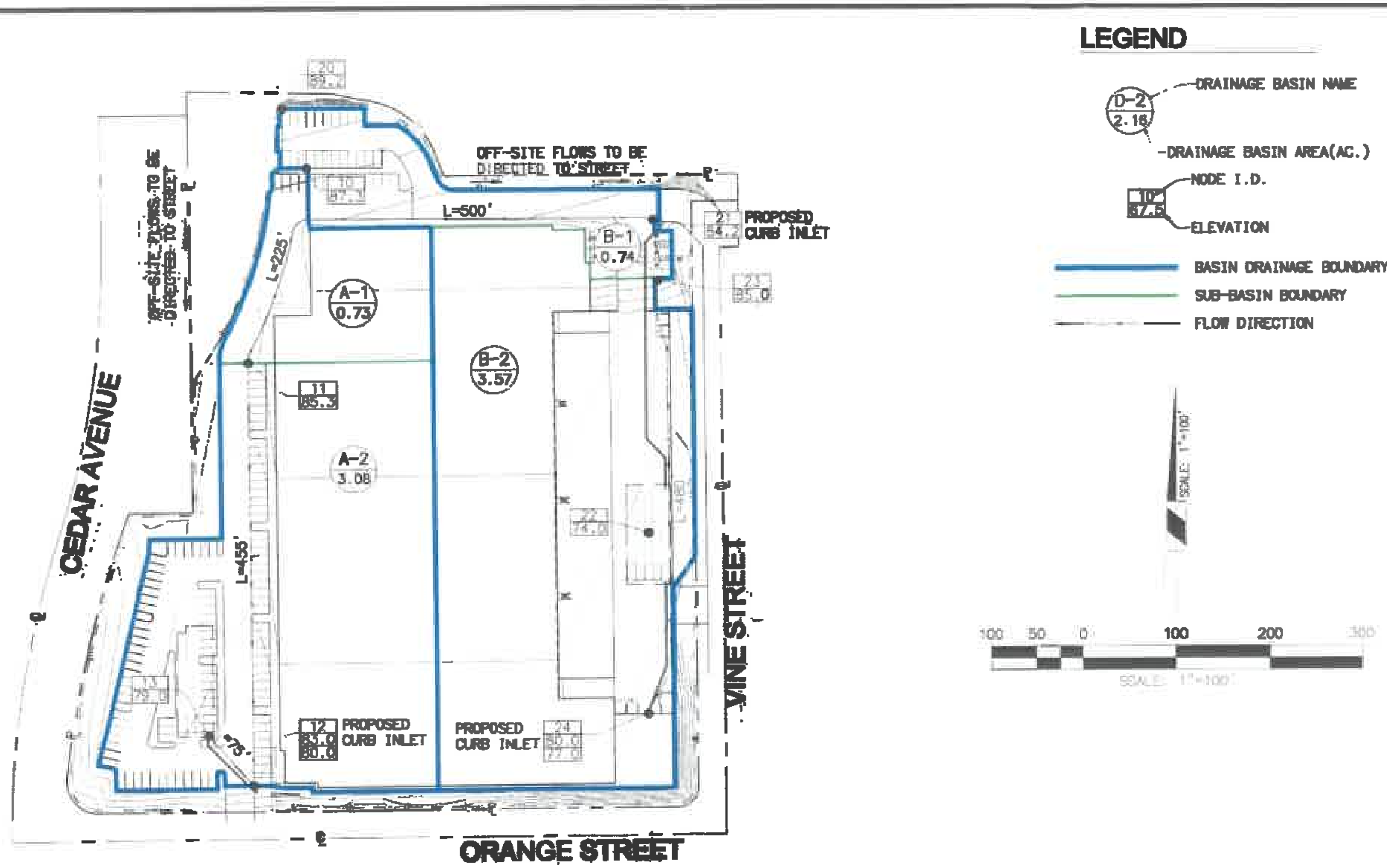
Along Main Stream number: 1 in normal stream number 2
Stream flow area = 3.570(Ac.)
Runoff from this stream = 8.158(CFS)
Time of concentration = 9.22 min.
Rainfall intensity = 2.591(In/Hr)
Area averaged loss rate (Fm) = 0.0978(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream No.	Flow rate (CFS)	Area (Ac.)	TC (min)	Fm (In/Hr)	Rainfall Intensity (In/Hr)
1	1.67	0.740	10.06	0.098	2.458
2	8.16	3.570	9.22	0.098	2.591

Qmax(1) =
1.000 * 1.000 * 1.665) +
0.947 * 1.000 * 8.158) + = 9.390
Qmax(2) =
1.056 * 0.916 * 1.665) +
1.000 * 1.000 * 8.158) + = 9.770

Total of 2 streams to confluence:
Flow rates before confluence point:
1.665 8.158
Maximum flow rates at confluence using above data:
9.390 9.770
Area of streams before confluence:
0.740 3.570
Effective area values after confluence:
4.310 4.248
Results of confluence:
Total flow rate = 9.770(CFS)
Time of concentration = 9.219 min.
Effective stream area after confluence = 4.248(Ac.)
Study area average Pervious fraction(Ap) = 0.100
Study area average soil loss rate(Fm) = 0.098(In/Hr)
Study area total (this main stream) = 4.31(Ac.)
End of computations, Total Study Area = 4.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 32.0



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CEDAR AVE. TEHNOLOGY PARK

PROPOSED DRAINAGE MAP

Reference Information

Appendix C

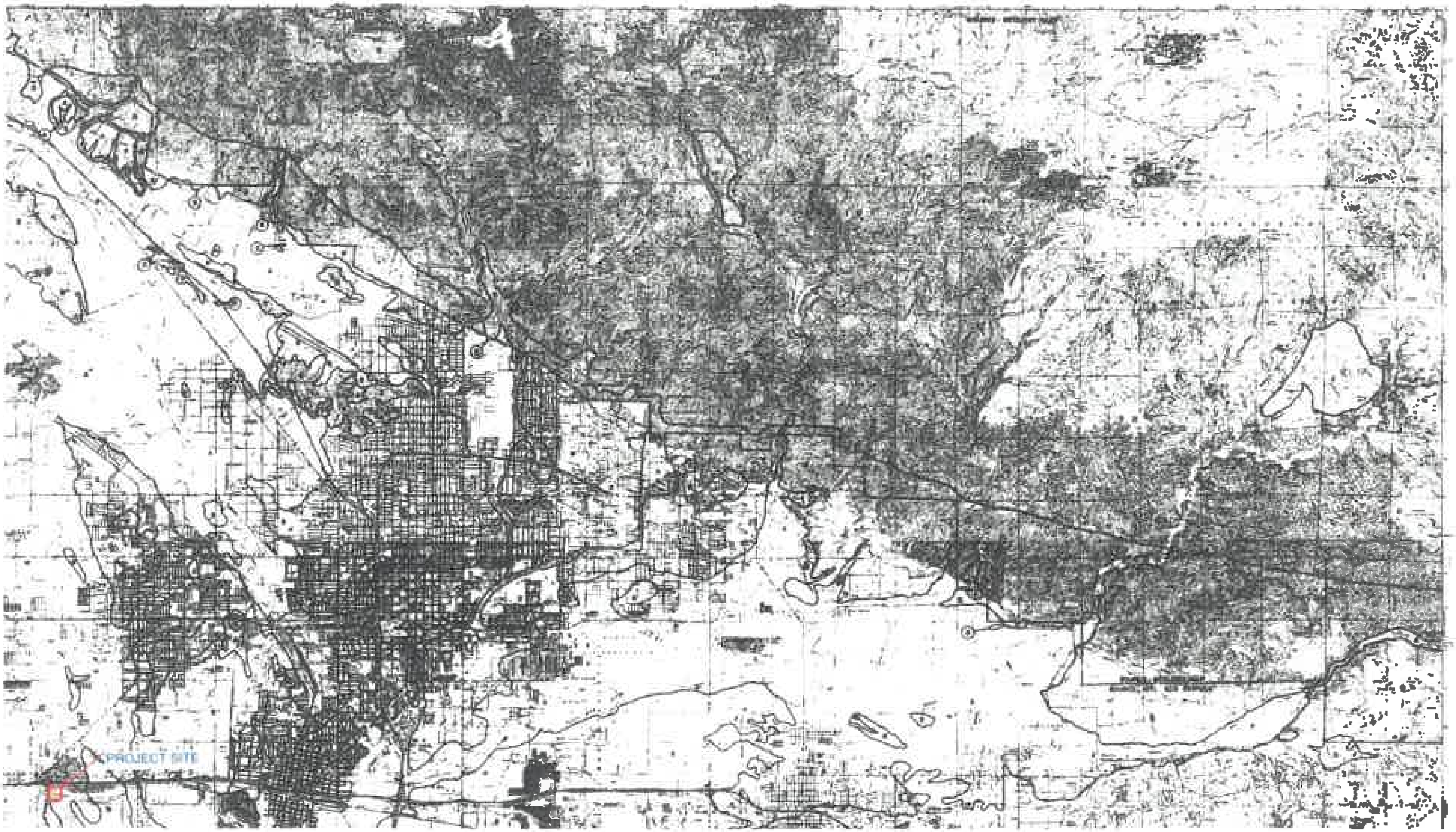
APPENDIX C

REFERENCE INFORMATION

C1: Data from San Bernardino County Hydrology Manual

C2: NOAA Atlas 14 Point Precipitation Table

C3: Reference Plans



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-B AREA

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Bernardino County Southwestern Part, California

August 31, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:1,780 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 25, 50, 100, 150

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 7, Sep 3, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 5, 2015—Jan 18, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Bernardino County Southwestern Part, California (CA677)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
TuB	Tujunga loamy sand, 0 to 5 percent slopes	11.9	100.0%
Totals for Area of Interest		**11.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Bernardino County Southwestern Part, California

TuB—Tujunga loamy sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: hcl1
Elevation: 10 to 2,500 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 250 to 350 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Tujunga, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tujunga, Loamy Sand

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

A - 0 to 6 inches: loamy sand
C1 - 6 to 18 inches: loamy sand
C2 - 18 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Tujunga, gravelly loamy sand

Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Hydric soil rating: No

Hanford, sandy loam

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, US*
Latitude: 34.0661°, Longitude: -117.3940°
Elevation: 1077 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.33 (1.10–1.62)	1.73 (1.44–2.10)	2.26 (1.87–2.74)	2.69 (2.21–3.30)	3.30 (2.62–4.19)	3.77 (2.94–4.90)	4.27 (3.24–5.69)	4.80 (3.54–6.58)	5.53 (3.91–7.92)	6.13 (4.18–9.10)
10-min	0.954 (0.792–1.16)	1.24 (1.03–1.50)	1.61 (1.34–1.96)	1.93 (1.58–2.36)	2.36 (1.88–3.00)	2.71 (2.11–3.51)	3.06 (2.32–4.07)	3.44 (2.53–4.72)	3.97 (2.80–5.68)	4.40 (2.99–6.52)
15-min	0.768 (0.640–0.932)	0.996 (0.828–1.21)	1.30 (1.08–1.58)	1.56 (1.28–1.91)	1.90 (1.51–2.42)	2.18 (1.70–2.83)	2.47 (1.87–3.28)	2.77 (2.04–3.80)	3.20 (2.26–4.58)	3.54 (2.41–5.26)
30-min	0.572 (0.478–0.694)	0.742 (0.618–0.900)	0.968 (0.804–1.18)	1.16 (0.952–1.42)	1.42 (1.13–1.80)	1.62 (1.26–2.11)	1.84 (1.39–2.45)	2.06 (1.52–2.83)	2.38 (1.68–3.41)	2.64 (1.80–3.91)
60-min	0.417 (0.347–0.506)	0.541 (0.450–0.656)	0.705 (0.585–0.858)	0.842 (0.693–1.03)	1.03 (0.820–1.31)	1.18 (0.919–1.54)	1.34 (1.01–1.78)	1.50 (1.11–2.06)	1.73 (1.22–2.48)	1.92 (1.31–2.85)
2-hr	0.305 (0.254–0.370)	0.392 (0.326–0.476)	0.506 (0.420–0.616)	0.600 (0.494–0.737)	0.730 (0.580–0.927)	0.830 (0.646–1.08)	0.934 (0.708–1.24)	1.04 (0.768–1.43)	1.19 (0.842–1.71)	1.31 (0.894–1.95)
3-hr	0.253 (0.211–0.307)	0.324 (0.270–0.394)	0.418 (0.347–0.509)	0.495 (0.407–0.607)	0.599 (0.476–0.761)	0.679 (0.528–0.882)	0.762 (0.578–1.02)	0.848 (0.625–1.16)	0.966 (0.682–1.38)	1.06 (0.723–1.57)
6-hr	0.179 (0.149–0.218)	0.230 (0.191–0.279)	0.296 (0.245–0.360)	0.349 (0.287–0.429)	0.422 (0.335–0.536)	0.477 (0.371–0.620)	0.533 (0.404–0.710)	0.592 (0.436–0.811)	0.671 (0.473–0.960)	0.733 (0.499–1.09)
12-hr	0.119 (0.099–0.144)	0.153 (0.127–0.186)	0.197 (0.164–0.240)	0.233 (0.192–0.286)	0.281 (0.223–0.357)	0.317 (0.247–0.412)	0.354 (0.268–0.471)	0.392 (0.289–0.537)	0.443 (0.312–0.633)	0.482 (0.329–0.715)
24-hr	0.080 (0.071–0.092)	0.104 (0.092–0.120)	0.135 (0.119–0.156)	0.160 (0.140–0.186)	0.193 (0.163–0.232)	0.218 (0.181–0.268)	0.243 (0.197–0.307)	0.269 (0.212–0.349)	0.304 (0.230–0.410)	0.331 (0.242–0.462)
2-day	0.049 (0.043–0.056)	0.064 (0.057–0.074)	0.085 (0.075–0.098)	0.101 (0.088–0.118)	0.124 (0.105–0.149)	0.141 (0.117–0.173)	0.158 (0.128–0.199)	0.176 (0.139–0.228)	0.200 (0.151–0.270)	0.219 (0.160–0.305)
3-day	0.035 (0.031–0.040)	0.047 (0.041–0.054)	0.062 (0.055–0.072)	0.075 (0.066–0.088)	0.093 (0.078–0.112)	0.106 (0.088–0.131)	0.120 (0.097–0.151)	0.134 (0.106–0.174)	0.154 (0.117–0.208)	0.170 (0.124–0.237)
4-day	0.028 (0.025–0.032)	0.038 (0.033–0.044)	0.051 (0.045–0.059)	0.062 (0.054–0.072)	0.077 (0.065–0.093)	0.088 (0.073–0.109)	0.100 (0.081–0.126)	0.113 (0.089–0.146)	0.130 (0.098–0.175)	0.143 (0.105–0.200)
7-day	0.018 (0.016–0.021)	0.025 (0.022–0.029)	0.034 (0.030–0.039)	0.041 (0.036–0.048)	0.052 (0.044–0.062)	0.060 (0.049–0.073)	0.068 (0.055–0.085)	0.077 (0.060–0.099)	0.089 (0.067–0.119)	0.098 (0.072–0.137)
10-day	0.014 (0.012–0.016)	0.019 (0.017–0.022)	0.026 (0.023–0.030)	0.032 (0.028–0.037)	0.040 (0.034–0.048)	0.046 (0.038–0.057)	0.053 (0.043–0.066)	0.060 (0.047–0.077)	0.069 (0.052–0.093)	0.077 (0.056–0.107)
20-day	0.008 (0.007–0.010)	0.012 (0.010–0.013)	0.016 (0.014–0.019)	0.020 (0.017–0.023)	0.025 (0.021–0.030)	0.029 (0.024–0.035)	0.033 (0.027–0.042)	0.038 (0.030–0.049)	0.044 (0.033–0.059)	0.049 (0.036–0.068)
30-day	0.007 (0.006–0.008)	0.009 (0.008–0.011)	0.013 (0.011–0.015)	0.016 (0.014–0.018)	0.020 (0.017–0.024)	0.023 (0.019–0.028)	0.026 (0.021–0.033)	0.030 (0.024–0.039)	0.035 (0.027–0.046)	0.040 (0.029–0.055)
45-day	0.005 (0.005–0.006)	0.007 (0.006–0.008)	0.010 (0.009–0.012)	0.012 (0.011–0.014)	0.016 (0.013–0.019)	0.018 (0.015–0.022)	0.021 (0.017–0.026)	0.024 (0.019–0.031)	0.028 (0.021–0.038)	0.032 (0.023–0.044)
60-day	0.005 (0.004–0.005)	0.006 (0.006–0.007)	0.009 (0.008–0.010)	0.011 (0.009–0.012)	0.013 (0.011–0.016)	0.016 (0.013–0.019)	0.018 (0.015–0.023)	0.021 (0.016–0.027)	0.024 (0.018–0.033)	0.027 (0.020–0.038)

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

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

Please refer to NOAA Atlas 14 document for more information.

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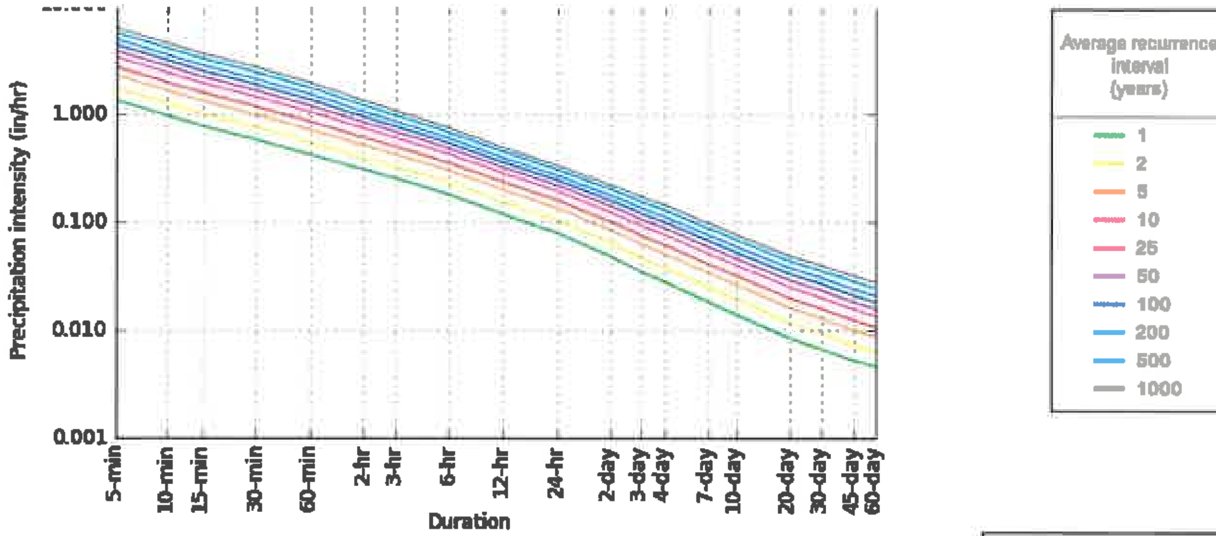
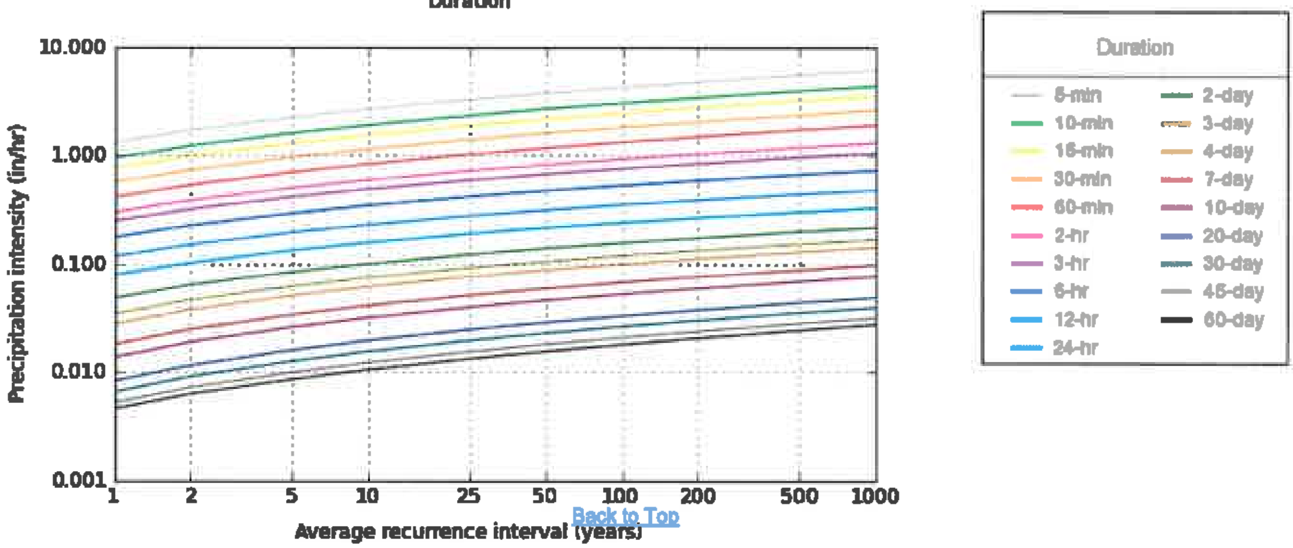
PF graphical





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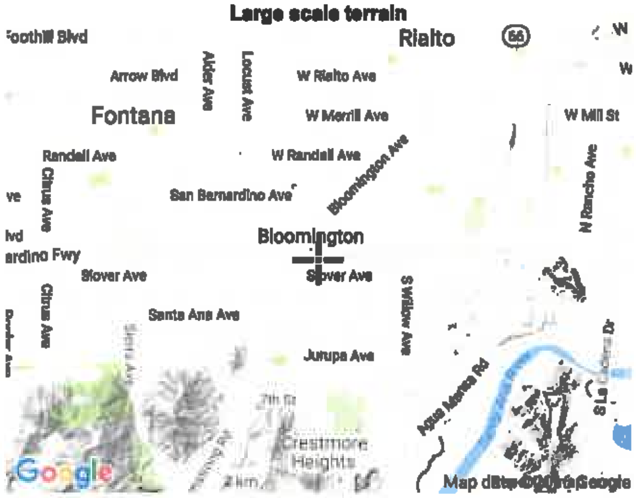
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map

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