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Carmax

City of Victorville
San Bernardino County, California

HYDROLOGY REPORT

Prepared For:
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Charles Lockman, PE

August 21, 2018
JN 163697

TABLE OF CONTENTS

INTRODUCTION

The project is a 4.76 acre commercial development located at 14901 Civic Drive in the City of Victorville, CA.

The peak flow hydrologic analysis generated for this study includes 10-year design storm, 25-year design storm, and 100-year design storm analysis. Refer to Appendix A through Appendix D for complete design results.

Goals
This Hydrology Report was generated to specifically achieve the following goals:

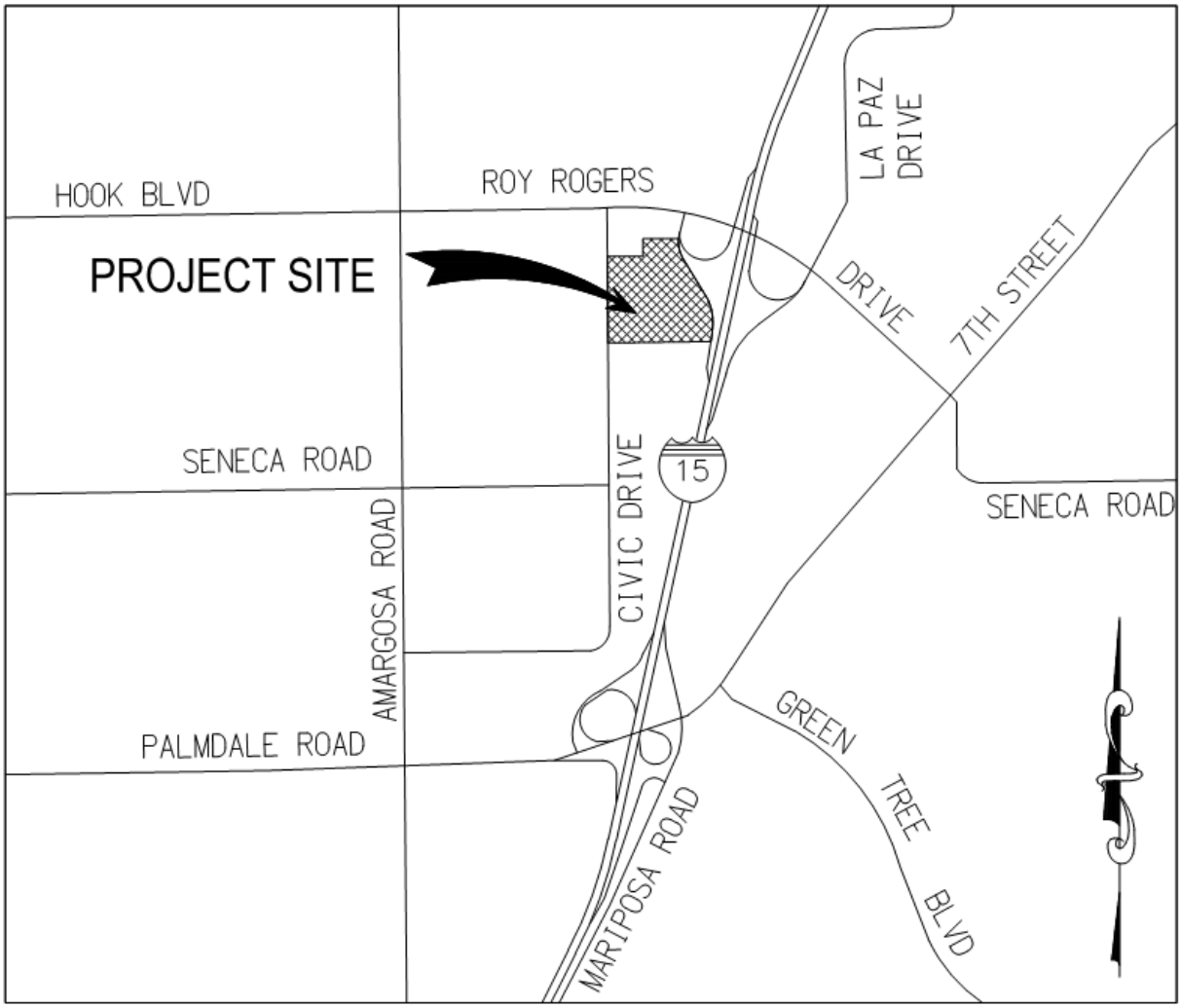
- To calculate pre- and post-development peak flows for the 10 year, 25 year, and 100 year storm events.
- To demonstrate that the proposed Best Management Practices (BMP's) are sized to mitigate peak flows and not increase runoff due to proposed land improvements.

PROJECT DESCRIPTION

Existing Conditions
The 4.76 acre project site is a undeveloped vacant site with poor land cover. Soil conditions for the site are classified as type D. Topography shows existing grades sloping down from a high point located in the middle of the site. Precipitation generated onsite sheet flows away from the site to adjacent properties. (See Appendix A)

Proposed Conditions
Development of the 4.76 acre site includes a central facility with associated parking lots located along the north, east, and southwest corner of the property. Landscaping will be provided along the perimeter of the site. Precise grading in the parking lots will capture and direct flows to catch basins placed throughout the site. Storm flows will confluence while traveling towards the west side of the property and ultimately join at a proposed diversion structure. Low flows entering the diversion structure will be directed to a proposed CDS unit located downstream of the diversion structure to filter the first flush stormwater. This filtered stormwater will then be stored in proposed underground chambers leading towards a proposed Drywell. High flows will bypass the diversion structure and travel towards the existing 54" storm drain main located along Civic Drive. All flows entering the underground chambers will be sized to satisfy the WQMP requirements for Design Capture Volume or the difference in volume between Pre- and Post-Development condition, whichever is greater. (See Appendix C)

VICINITY MAP



VICINITY MAP
NOT TO SCALE

Figure 1-1

SITE MAP

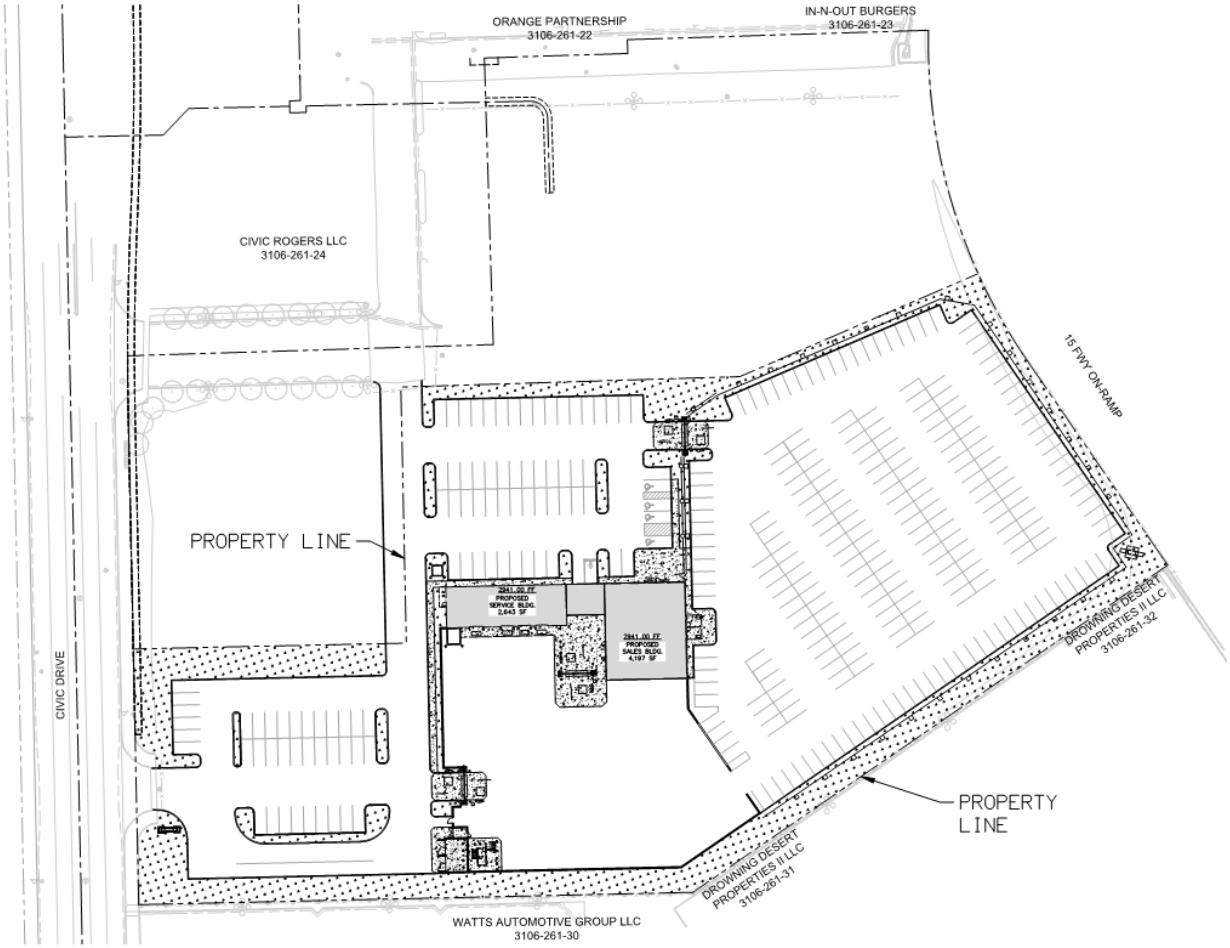


Figure 1-2
NTS

HYDROLOGIC METHODOLOGY

Hydrologic calculations to evaluate surface runoff associated with the 10-year, 25-year, and 100-year storm events were performed using data from the *Web Soils Survey* and *NOAA Atlas Point Precipitation Frequency Estimates to* find soil classification and rainfall intensity values.

Rational Method

The hydrologic calculations to determine the peak flow rates for different storm events were performed using the criteria in the *San Bernardino County Hydrology Manual*. The Rational Method is an empirical computation procedure for developing a peak runoff rate (discharge) for storms of a specific recurrence interval. Rational Method equations are based on the assumption that the peak flow rate is directly proportional to the drainage area, rainfall intensity, and a loss rate coefficient, which describes the effects of land use and soil type. The Rational Method flow rates were computed using Civil Design sofware.

This Rational Method analysis is used as the basis for development of the small area unit hydrographs and flood routing analysis. This methodology is consistent with Section J of the hydrology manual.

Soil Type

The soil type within the project area is classified as Type D. (see Appendix F)

Loss Rates

Watershed losses generally consist of infiltration, depression storage, vegetation, and minor amounts of evaporation. Loss rates vary with each land use and soil type. The procedures and criteria used in this study for estimating loss rates follow the guidelines of the *San Bernardino Hydrology Manual*.

The Antecedent Moisture Condition (AMC) indicates the soil wetness prior to a particular storm and the runoff potential for the subject storm. An AMC is defined as:

AMC I: Lowest runoff potential

AMC II: Moderate runoff potential

AMC III: Highest runoff potential

AMC II was applied for the 10-year and 25-year storm events. AMC III was applied for the 100-year storm event as outlined in the San Bernardino Hydrology manual.

Precipitation

Rainfall intensity was determined using *NOAA Atlas Point Precipitation Frequency Estimates* for 10-year, 25-year, & 100-year recurrence intervals with durations varying according to the time of concentration. (see Appendix E)

EXISTING CONDITION ANALYSIS

A summary of peak flows for existing conditions was generated as follows;

Table 1: Existing Condition Rational Method Results

Watershed Area	*Area (ac.)*	*10-Year Storm Event*	*25-Year Storm Event*	*100-Year Storm Event*
A1	0.62	0.83 cfs	1.10 cfs	1.64 cfs
B1	0.73	1.04 cfs	1.37 cfs	2.04 cfs
C1	1.91	1.78 cfs	2.36 cfs	3.68 cfs
D1	1.06	1.35 cfs	1.79 cfs	2.69 cfs
E1	0.44	0.64 cfs	0.84 cfs	1.25 cfs
Total	**4.76**	**5.64 cfs**	**7.46 cfs**	**11.30 cfs**

Refer to Appendix B for complete existing condition design results.

PROPOSED CONDITION ANALYSIS

A summary of peak flows for proposed conditions was generated as follows;

Table 2: Proposed Condition Rational Method Results

	Watershed Area (ac.)	*10-Year Storm Event*	*25-Year Storm Event*	*100-Year Storm Event*
Total	**4.76**	**9.10 cfs**	**11.77 cfs**	**16.51 cfs**

Refer to Appendix D for complete proposed condition design results.

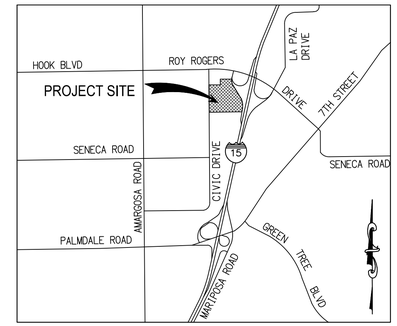
CONCLUSION

Hydrology studies were performed for the 10-year design storm, 25-year design storm, and 100-year design storm for pre- and post-development conditions. In comparing pre- and post-development conditions, peak flows increased under post development conditions due to the increase in impervious land cover. An increase of 5.21 cfs resulted which is calculated as the difference between pre and post-development conditions for the 100-year design storm. This difference in runoff is equivalent to approximately 4,000 cubic feet of volume.

The WQMP requires a minimum design capture volume of 10,418.60 cubic feet. The project will provide an underground storage chamber to satisfy the WQMP conditions by providing a storage capacity of 10,500 cubic feet of volume. This proposed underground storage will lead into a proposed Drywell onsite. Therefore, stormwater runoff will not increase under post-development conditions.

Appendix A

Hydrology Map – Pre-Development Condition



VICINITY MAP
NOT TO SCALE

EXISTING 12" WATER
EXISTING FIRE HYDRANT
EXISTING WATER METERS
EXISTING 15" SEWER
EXISTING 54" STORM DRAIN
CIVIC DRIVE
NOT A PART
PROPERTY LINE
EXISTING 6' FENCE
15 FWY ON-RAMP
EXISTING 4' FENCE
PROPERTY LINE
EXISTING FIRE HYDRANT
EXISTING DRIVEWAY ACCESS
EXISTING 4' FENCE

500 2936.5EL Tc=10.52min Q100=1.25cfs
101 2935.1 EL Tc=11.87min Q100=1.64cfs
400 2936.8EL Tc=12.73min Q100=2.69cfs
200 2934.4 EL Tc=10.87min Q100=2.04cfs
100 2939.8 EL
300 2937.2EL Tc=19.99min Q100=3.68fs

A1 0.62
E1 0.44
B1 0.73
D1 1.06
C1 1.91

L=220'
L=303'
L=293'
L=274'
L=484'
L=593'

LEGEND

- PROPERTY LINE
- CENTER LINE
- EXISTING RETAINING WALL
- SUBAREA BOUNDARY
- WATERSHED DESIGNATION
- SUBAREA NUMBER
- SUBAREA AREA, AC
- NODE NUMBER
- FINISH GRADE/FLOW LINE ELEVATION
- TIME OF CONCENTRATION
- DISCHARGE AT NODE
- STORM YEAR FREQUENCY
- DIRECTION OF FLOW
- FLOW PATH OF TRAVEL & LENGTH
- EX. SANITARY SEWER
- EX. DOMESTIC WATER
- EX. STORM DRAIN
- STORM DRAIN MANHOLE
- FIRE HYDRANT
- GRATE CATCH BASIN
- CURB OPENING INLET

SCALE 1"=30'

30 15 0 30 60 90
SCALE: 1"=30'

HYDROLOGY EXHIBIT
PRE-DEVELOPMENT CONDITION

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Plot Date: 08/21/2018 4:09:26 PM
User: Rolando.hernandez
File Name: H:\PDATA\163697\Admin\Reports\Hydrology\HY-PRE.dwg
Last Update: 8/21/2018 4:08:58 PM

Appendix B

Rational Method Calculations (10-Yr, 25-Yr, 100-Yr)

Pre-Development

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

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Rational Hydrology Study Date: 08/21/18

CARMAX DEVELOPMENT
10-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.643 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 303.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2935.100(Ft.)
Difference in elevation = 4.700(Ft.)
Slope = 0.01551 s(%)= 1.55
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.874 min.
Rainfall intensity = 1.700(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.788
Subarea runoff = 0.831(CFS)
Total initial stream area = 0.620(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 0.62 (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 = 89.0

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CARMAX DEVELOPMENT
10-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.643 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 200.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2934.400(Ft.)
Difference in elevation = 5.400(Ft.)
Slope = 0.01971 s(%)= 1.97
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.873 min.
Rainfall intensity = 1.792(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.794
Subarea runoff = 1.039(CFS)
Total initial stream area = 0.730(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 0.73 (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 = 89.0

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PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.643 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 300.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 593.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2937.200(Ft.)
Difference in elevation = 2.600(Ft.)
Slope = 0.00438 s(%)= 0.44
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.999 min.
Rainfall intensity = 1.243(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.747
Subarea runoff = 1.775(CFS)
Total initial stream area = 1.910(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 1.91 (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 = 89.0

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.643 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 400.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 293.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2936.800(Ft.)
Difference in elevation = 3.000(Ft.)
Slope = 0.01024 s(%)= 1.02
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.731 min.
Rainfall intensity = 1.630(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.784
Subarea runoff = 1.354(CFS)
Total initial stream area = 1.060(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 1.06 (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 = 89.0

San Bernardino County Rational Hydrology Program

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10-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.643 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 500.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 220.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2936.500(Ft.)
Difference in elevation = 3.300(Ft.)
Slope = 0.01500 s(%)= 1.50
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.517 min.
Rainfall intensity = 1.828(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.796
Subarea runoff = 0.640(CFS)
Total initial stream area = 0.440(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 0.44 (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 = 89.0

San Bernardino County Rational Hydrology Program

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CARMAX DEVELOPMENT
25-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.822 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 303.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2935.100(Ft.)
Difference in elevation = 4.700(Ft.)
Slope = 0.01551 s(%)= 1.55
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.874 min.
Rainfall intensity = 2.173(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.813
Subarea runoff = 1.095(CFS)
Total initial stream area = 0.620(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 0.62 (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 = 89.0

San Bernardino County Rational Hydrology Program

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CRAMAX DEVELOPMENT
25-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.822 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 200.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2934.400(Ft.)
Difference in elevation = 5.400(Ft.)
Slope = 0.01971 s(%)= 1.97
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.873 min.
Rainfall intensity = 2.291(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.817
Subarea runoff = 1.367(CFS)
Total initial stream area = 0.730(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 0.73 (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 = 89.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

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CARMAX DEVELOPMENT
25-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.822 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 300.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 593.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2937.200(Ft.)
Difference in elevation = 2.600(Ft.)
Slope = 0.00438 s(%)= 0.44
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.999 min.
Rainfall intensity = 1.589(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.781
Subarea runoff = 2.369(CFS)
Total initial stream area = 1.910(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 1.91 (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 = 89.0

San Bernardino County Rational Hydrology Program

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25-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.822 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 400.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 293.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2936.800(Ft.)
Difference in elevation = 3.000(Ft.)
Slope = 0.01024 s(%)= 1.02
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.731 min.
Rainfall intensity = 2.084(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.809
Subarea runoff = 1.787(CFS)
Total initial stream area = 1.060(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 1.06 (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 = 89.0

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: 08/21/18

CARMAX DEVELOPMENT
25-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.822 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 500.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.211(In/Hr)
Initial subarea data:
Initial area flow distance = 220.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2936.500(Ft.)
Difference in elevation = 3.300(Ft.)
Slope = 0.01500 s(%)= 1.50
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.517 min.
Rainfall intensity = 2.337(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.819
Subarea runoff = 0.842(CFS)
Total initial stream area = 0.440(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.211(In/Hr)
End of computations, Total Study Area = 0.44 (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 = 89.0

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: 08/21/18

CARMAX DEVELOPMENT
100-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.130 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Adjusted SCS curve number for AMC 3 = 97.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.044(In/Hr)
Initial subarea data:
Initial area flow distance = 303.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2935.100(Ft.)
Difference in elevation = 4.700(Ft.)
Slope = 0.01551 s(%)= 1.55
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.874 min.
Rainfall intensity = 2.987(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff = 1.642(CFS)
Total initial stream area = 0.620(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.044(In/Hr)
End of computations, Total Study Area = 0.62 (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 = 89.0

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: 08/21/18

CRAMAX DEVELOPMENT
100-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.130 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 100.000 to Point/Station 200.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Adjusted SCS curve number for AMC 3 = 97.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.044(In/Hr)
Initial subarea data:
Initial area flow distance = 274.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2934.400(Ft.)
Difference in elevation = 5.400(Ft.)
Slope = 0.01971 s(%)= 1.97
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.873 min.
Rainfall intensity = 3.149(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
Subarea runoff = 2.040(CFS)
Total initial stream area = 0.730(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.044(In/Hr)
End of computations, Total Study Area = 0.73 (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 = 89.0

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: 08/21/18

CARMAX DEVELOPMENT
100-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.130 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 100.000 to Point/Station 300.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Adjusted SCS curve number for AMC 3 = 97.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.044(In/Hr)
Initial subarea data:
Initial area flow distance = 593.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2937.200(Ft.)
Difference in elevation = 2.600(Ft.)
Slope = 0.00438 s(%)= 0.44
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.999 min.
Rainfall intensity = 2.185(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
Subarea runoff = 3.680(CFS)
Total initial stream area = 1.910(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.044(In/Hr)
End of computations, Total Study Area = 1.91 (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 = 89.0

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: 08/21/18

CARMAX DEVELOPMENT
100-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.130 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 100.000 to Point/Station 400.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Adjusted SCS curve number for AMC 3 = 97.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.044(In/Hr)
Initial subarea data:
Initial area flow distance = 293.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2936.800(Ft.)
Difference in elevation = 3.000(Ft.)
Slope = 0.01024 s(%)= 1.02
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.731 min.
Rainfall intensity = 2.865(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff = 2.691(CFS)
Total initial stream area = 1.060(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.044(In/Hr)
End of computations, Total Study Area = 1.06 (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 = 89.0

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: 08/21/18

CARMAX DEVELOPMENT
100-YEAR RATIONAL METHOD
PRE-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.130 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

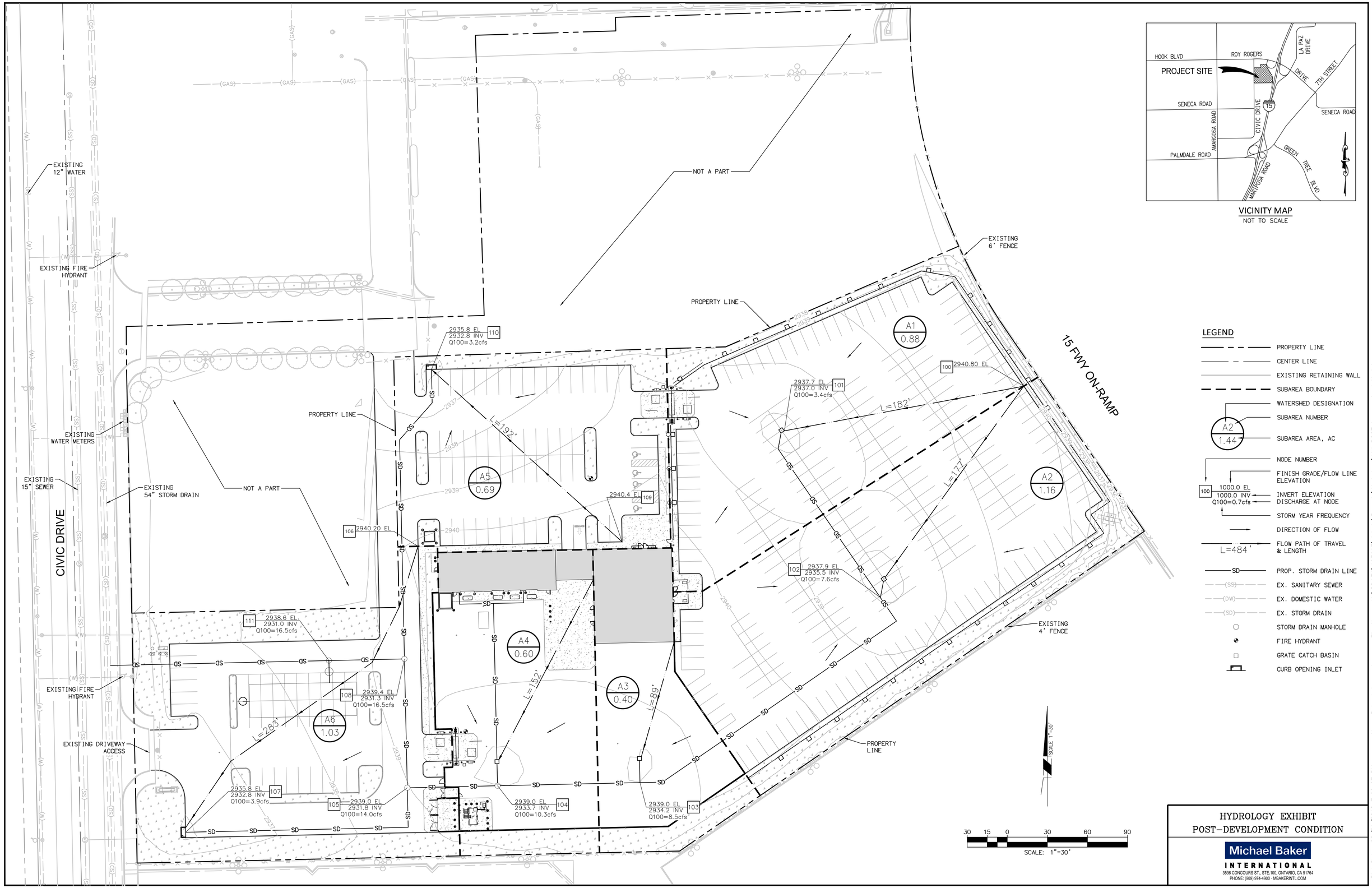
++
Process from Point/Station 100.000 to Point/Station 500.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
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
SCS curve number for soil(AMC 2) = 89.00
Adjusted SCS curve number for AMC 3 = 97.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.044(In/Hr)
Initial subarea data:
Initial area flow distance = 220.000(Ft.)
Top (of initial area) elevation = 2939.800(Ft.)
Bottom (of initial area) elevation = 2936.500(Ft.)
Difference in elevation = 3.300(Ft.)
Slope = 0.01500 s(%)= 1.50
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.517 min.
Rainfall intensity = 3.212(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
Subarea runoff = 1.255(CFS)
Total initial stream area = 0.440(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.044(In/Hr)
End of computations, Total Study Area = 0.44 (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 = 89.0

Appendix C

Hydrology Map – Post-Development Condition



VICINITY MAP
NOT TO SCALE

LEGEND

- PROPERTY LINE
- CENTER LINE
- EXISTING RETAINING WALL
- SUBAREA BOUNDARY
- WATERSHED DESIGNATION
- A2 / 1.44 — SUBAREA NUMBER, SUBAREA AREA, AC
- NODE NUMBER
- 100 / 1000.0 EL / 1000.0 INV / Q100=0.7cfs — FINISH GRADE/FLOW LINE ELEVATION, INVERT ELEVATION, DISCHARGE AT NODE
- STORM YEAR FREQUENCY
- DIRECTION OF FLOW
- L=484' — FLOW PATH OF TRAVEL & LENGTH
- SD — PROP. STORM DRAIN LINE
- (SS) — EX. SANITARY SEWER
- (DW) — EX. DOMESTIC WATER
- (SD) — EX. STORM DRAIN
- STORM DRAIN MANHOLE
- FIRE HYDRANT
- GRATE CATCH BASIN
- CURB OPENING INLET

HYDROLOGY EXHIBIT
POST-DEVELOPMENT CONDITION

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Plot Date: 08/21/2018 7:20:27 PM
User: Rolando.hernandez
File Name: H:\PDATA\163697\Admin\Reports\Hydrology\HY-POST.dwg
Last Update: 8/21/2018 7:19:56 PM

Appendix D

Rational Method Calculations (10-Yr, 25-Yr, 100-Yr)

Post-Development

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: 08/21/18

CARMAX DEVELOPMENT
10-YEAR RATIONAL METHOD
POST-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.643 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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

COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.045(In/Hr)
Initial subarea data:
Initial area flow distance = 182.000(Ft.)
Top (of initial area) elevation = 2939.500(Ft.)
Bottom (of initial area) elevation = 2938.000(Ft.)
Difference in elevation = 1.500(Ft.)
Slope = 0.00824 s(%)= 0.82
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.364 min.
Rainfall intensity = 2.471(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff = 1.921(CFS)
Total initial stream area = 0.880(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.045(In/Hr)

++
Process from Point/Station 101.000 to Point/Station 102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 2937.000(Ft.)
Downstream point/station elevation = 2935.500(Ft.)
Pipe length = 147.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 1.921(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 1.921(CFS)
Normal flow depth in pipe = 6.23(In.)
Flow top width inside pipe = 11.99(In.)
Critical Depth = 7.10(In.)
Pipe flow velocity = 4.66(Ft/s)
Travel time through pipe = 0.53 min.
Time of concentration (TC) = 6.89 min.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Time of concentration =     6.89 min.
Rainfall intensity =      2.356(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.883
Subarea runoff =      2.321(CFS) for    1.160(Ac.)
Total runoff =      4.243(CFS)
Effective area this stream =        2.04(Ac.)
Total Study Area (Main Stream No. 1) =        2.04(Ac.)
Area averaged Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  2935.500(Ft.)
Downstream point/station elevation =  2934.200(Ft.)
Pipe length  =   250.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.243(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.243(CFS)
Normal flow depth in pipe =   11.24(In.)
Flow top width inside pipe =   13.00(In.)
Critical Depth =   10.01(In.)
Pipe flow velocity =      4.30(Ft/s)
Travel time through pipe =    0.97 min.
Time of concentration (TC) =     7.86 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Time of concentration =     7.86 min.
Rainfall intensity =      2.177(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =      0.439(CFS) for    0.400(Ac.)
Total runoff =      4.682(CFS)
Effective area this stream =        2.44(Ac.)
Total Study Area (Main Stream No. 1) =        2.44(Ac.)
Area averaged Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  2934.200(Ft.)
Downstream point/station elevation =  2933.700(Ft.)
Pipe length  =   106.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.682(CFS)
Nearest computed pipe diameter  =     18.00(In.)
```

```
Calculated individual pipe flow  =     4.682(CFS)
Normal flow depth in pipe =   10.56(In.)
Flow top width inside pipe =   17.73(In.)
Critical Depth =    9.97(In.)
Pipe flow velocity =      4.34(Ft/s)
Travel time through pipe =    0.41 min.
Time of concentration (TC) =     8.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Time of concentration =     8.26 min.
Rainfall intensity =      2.112(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =      0.974(CFS) for    0.600(Ac.)
Total runoff =      5.655(CFS)
Effective area this stream =        3.04(Ac.)
Total Study Area (Main Stream No. 1) =        3.04(Ac.)
Area averaged Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  2933.700(Ft.)
Downstream point/station elevation =  2931.800(Ft.)
Pipe length  =    67.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.655(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.655(CFS)
Normal flow depth in pipe =    9.27(In.)
Flow top width inside pipe =   10.06(In.)
Critical Depth =   11.33(In.)
Pipe flow velocity =      8.69(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     8.39 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.040(Ac.)
Runoff from this stream =      5.655(CFS)
Time of concentration =    8.39 min.
Rainfall intensity =     2.093(In/Hr)
Area averaged loss rate (Fm) =    0.0453(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
```

```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Initial subarea data:
Initial area flow distance =   283.000(Ft.)
Top (of initial area) elevation =  2940.200(Ft.)
Bottom (of initial area) elevation =  2935.800(Ft.)
Difference in elevation =     4.400(Ft.)
Slope =    0.01555  s(%)=       1.55
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.687 min.
Rainfall intensity =      2.399(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff =      2.181(CFS)
Total initial stream area =        1.030(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2932.800(Ft.)
Downstream point/station elevation =  2931.800(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.181(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.181(CFS)
Normal flow depth in pipe =    8.55(In.)
Flow top width inside pipe =   10.86(In.)
Critical Depth =    7.58(In.)
Pipe flow velocity =      3.64(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =     7.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.030(Ac.)
Runoff from this stream =      2.181(CFS)
Time of concentration =    7.58 min.
Rainfall intensity =     2.224(In/Hr)
Area averaged loss rate (Fm) =    0.0453(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      5.66     3.040      8.39    0.045      2.093
2      2.18     1.030      7.58    0.045      2.224
Qmax(1) =
          1.000 *    1.000 *     5.655) +
          0.940 *    1.000 *     2.181) + =       7.705
Qmax(2) =
          1.064 *    0.904 *     5.655) +
          1.000 *    1.000 *     2.181) + =       7.619

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.655       2.181
Maximum flow rates at confluence using above data:
        7.705        7.619
Area of streams before confluence:
        3.040        1.030
Effective area values after confluence:
        4.070        3.777
Results of confluence:
Total flow rate =      7.705(CFS)
```

```
Time of concentration =     8.393 min.
Effective stream area after confluence =      4.070(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.045(In/Hr)
Study area total (this main stream) =       4.07(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2931.800(Ft.)
Downstream point/station elevation =  2931.300(Ft.)
Pipe length  =    96.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.705(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     7.705(CFS)
Normal flow depth in pipe =   12.62(In.)
Flow top width inside pipe =   20.57(In.)
Critical Depth =   12.35(In.)
Pipe flow velocity =      5.10(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =     8.71 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.070(Ac.)
Runoff from this stream =      7.705(CFS)
Time of concentration =    8.71 min.
Rainfall intensity =     2.047(In/Hr)
Area averaged loss rate (Fm) =    0.0453(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Initial subarea data:
Initial area flow distance =   192.000(Ft.)
Top (of initial area) elevation =  2940.400(Ft.)
Bottom (of initial area) elevation =  2932.800(Ft.)
Difference in elevation =     7.600(Ft.)
Slope =    0.03958  s(%)=       3.96
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    4.750 min.
Rainfall intensity =      2.945(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff =      1.801(CFS)
Total initial stream area =        0.690(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2932.800(Ft.)
Downstream point/station elevation =  2931.300(Ft.)
Pipe length  =   225.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     1.801(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     1.801(CFS)
Normal flow depth in pipe =    6.83(In.)
Flow top width inside pipe =   11.88(In.)
Critical Depth =    6.85(In.)
Pipe flow velocity =      3.90(Ft/s)
Travel time through pipe =    0.96 min.
Time of concentration (TC) =     5.71 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.690(Ac.)
Runoff from this stream =      1.801(CFS)
Time of concentration =    5.71 min.
Rainfall intensity =     2.637(In/Hr)
Area averaged loss rate (Fm) =    0.0453(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      7.71     4.070      8.71    0.045      2.047
2      1.80     0.690      5.71    0.045      2.637
Qmax(1) =
          1.000 *    1.000 *     7.705) +
          0.773 *    1.000 *     1.801) + =       9.097
Qmax(2) =
          1.294 *    0.656 *     7.705) +
          1.000 *    1.000 *     1.801) + =       8.343

Total of 2 streams to confluence:
Flow rates before confluence point:
       7.705       1.801
Maximum flow rates at confluence using above data:
        9.097        8.343
Area of streams before confluence:
        4.070        0.690
Effective area values after confluence:
        4.760        3.360
Results of confluence:
Total flow rate =      9.097(CFS)
Time of concentration =     8.707 min.
Effective stream area after confluence =      4.760(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.045(In/Hr)
Study area total (this main stream) =       4.76(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2931.300(Ft.)
Downstream point/station elevation =  2931.000(Ft.)
Pipe length  =    56.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.097(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     9.097(CFS)
Normal flow depth in pipe =   14.02(In.)
Flow top width inside pipe =   19.79(In.)
Critical Depth =   13.47(In.)
Pipe flow velocity =      5.34(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     8.88 min.
End of computations, Total Study Area =            4.76 (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 = 75.0

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: 08/21/18

CARMAX DEVELOPMENT
25-YEAR RATIONAL METHOD
POST-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.822 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

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

COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.045(In/Hr)
Initial subarea data:
Initial area flow distance = 182.000(Ft.)
Top (of initial area) elevation = 2939.500(Ft.)
Bottom (of initial area) elevation = 2938.000(Ft.)
Difference in elevation = 1.500(Ft.)
Slope = 0.00824 s(%)= 0.82
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.364 min.
Rainfall intensity = 3.159(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff = 2.466(CFS)
Total initial stream area = 0.880(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.045(In/Hr)

++
Process from Point/Station 101.000 to Point/Station 102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 2937.000(Ft.)
Downstream point/station elevation = 2935.500(Ft.)
Pipe length = 147.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 2.466(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 2.466(CFS)
Normal flow depth in pipe = 7.29(In.)
Flow top width inside pipe = 11.72(In.)
Critical Depth = 8.07(In.)
Pipe flow velocity = 4.93(Ft/s)
Travel time through pipe = 0.50 min.
Time of concentration (TC) = 6.86 min.

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Time of concentration =     6.86 min.
Rainfall intensity =      3.020(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.886
Subarea runoff =      2.995(CFS) for    1.160(Ac.)
Total runoff =      5.461(CFS)
Effective area this stream =        2.04(Ac.)
Total Study Area (Main Stream No. 1) =        2.04(Ac.)
Area averaged Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  2935.500(Ft.)
Downstream point/station elevation =  2934.200(Ft.)
Pipe length  =   250.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.461(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.461(CFS)
Normal flow depth in pipe =   11.32(In.)
Flow top width inside pipe =   17.39(In.)
Critical Depth =   10.81(In.)
Pipe flow velocity =      4.67(Ft/s)
Travel time through pipe =    0.89 min.
Time of concentration (TC) =     7.75 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Time of concentration =     7.75 min.
Rainfall intensity =      2.806(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.885
Subarea runoff =      0.601(CFS) for    0.400(Ac.)
Total runoff =      6.062(CFS)
Effective area this stream =        2.44(Ac.)
Total Study Area (Main Stream No. 1) =        2.44(Ac.)
Area averaged Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  2934.200(Ft.)
Downstream point/station elevation =  2933.700(Ft.)
Pipe length  =   106.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.062(CFS)
Nearest computed pipe diameter  =     18.00(In.)
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```
Calculated individual pipe flow  =     6.062(CFS)
Normal flow depth in pipe =   12.63(In.)
Flow top width inside pipe =   16.47(In.)
Critical Depth =   11.40(In.)
Pipe flow velocity =      4.57(Ft/s)
Travel time through pipe =    0.39 min.
Time of concentration (TC) =     8.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Time of concentration =     8.14 min.
Rainfall intensity =      2.725(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.885
Subarea runoff =      1.270(CFS) for    0.600(Ac.)
Total runoff =      7.333(CFS)
Effective area this stream =        3.04(Ac.)
Total Study Area (Main Stream No. 1) =        3.04(Ac.)
Area averaged Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  2933.700(Ft.)
Downstream point/station elevation =  2931.800(Ft.)
Pipe length  =    67.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.333(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.333(CFS)
Normal flow depth in pipe =    9.02(In.)
Flow top width inside pipe =   14.69(In.)
Critical Depth =   12.96(In.)
Pipe flow velocity =      9.51(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     8.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.040(Ac.)
Runoff from this stream =      7.333(CFS)
Time of concentration =    8.26 min.
Rainfall intensity =     2.702(In/Hr)
Area averaged loss rate (Fm) =    0.0453(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
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```
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Initial subarea data:
Initial area flow distance =   283.000(Ft.)
Top (of initial area) elevation =  2940.200(Ft.)
Bottom (of initial area) elevation =  2935.800(Ft.)
Difference in elevation =     4.400(Ft.)
Slope =    0.01555  s(%)=       1.55
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.687 min.
Rainfall intensity =      3.066(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff =      2.800(CFS)
Total initial stream area =        1.030(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2932.800(Ft.)
Downstream point/station elevation =  2931.800(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.800(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.800(CFS)
Normal flow depth in pipe =    8.44(In.)
Flow top width inside pipe =   14.88(In.)
Critical Depth =    8.06(In.)
Pipe flow velocity =      3.94(Ft/s)
Travel time through pipe =    0.83 min.
Time of concentration (TC) =     7.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.030(Ac.)
Runoff from this stream =      2.800(CFS)
Time of concentration =    7.52 min.
Rainfall intensity =     2.859(In/Hr)
Area averaged loss rate (Fm) =    0.0453(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      7.33     3.040      8.26    0.045      2.702
2      2.80     1.030      7.52    0.045      2.859
Qmax(1) =
          1.000 *    1.000 *     7.333) +
          0.944 *    1.000 *     2.800) + =       9.977
Qmax(2) =
          1.059 *    0.910 *     7.333) +
          1.000 *    1.000 *     2.800) + =       9.869

Total of 2 streams to confluence:
Flow rates before confluence point:
       7.333       2.800
Maximum flow rates at confluence using above data:
       9.977       9.869
Area of streams before confluence:
       3.040       1.030
Effective area values after confluence:
       4.070       3.797
Results of confluence:
Total flow rate =      9.977(CFS)
```

```
Time of concentration =     8.256 min.
Effective stream area after confluence =      4.070(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.045(In/Hr)
Study area total (this main stream) =       4.07(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2931.800(Ft.)
Downstream point/station elevation =  2931.300(Ft.)
Pipe length  =    96.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.977(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     9.977(CFS)
Normal flow depth in pipe =   15.19(In.)
Flow top width inside pipe =   18.79(In.)
Critical Depth =   14.13(In.)
Pipe flow velocity =      5.36(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =     8.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.070(Ac.)
Runoff from this stream =      9.977(CFS)
Time of concentration =    8.56 min.
Rainfall intensity =     2.645(In/Hr)
Area averaged loss rate (Fm) =    0.0453(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.045(In/Hr)
Initial subarea data:
Initial area flow distance =   192.000(Ft.)
Top (of initial area) elevation =  2940.400(Ft.)
Bottom (of initial area) elevation =  2932.800(Ft.)
Difference in elevation =     7.600(Ft.)
Slope =    0.03958  s(%)=       3.96
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    4.750 min.
Rainfall intensity =      3.765(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.889
Subarea runoff =      2.310(CFS)
Total initial stream area =        0.690(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.045(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2932.800(Ft.)
Downstream point/station elevation =  2931.300(Ft.)
Pipe length  =   225.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     2.310(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.310(CFS)
Normal flow depth in pipe =    8.07(In.)
Flow top width inside pipe =   11.26(In.)
Critical Depth =    7.81(In.)
Pipe flow velocity =      4.11(Ft/s)
Travel time through pipe =    0.91 min.
Time of concentration (TC) =     5.66 min.


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Process from Point/Station      108.000 to Point/Station      108.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.690(Ac.)
Runoff from this stream =      2.310(CFS)
Time of concentration =    5.66 min.
Rainfall intensity =     3.388(In/Hr)
Area averaged loss rate (Fm) =    0.0453(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      9.98     4.070      8.56    0.045      2.645
2      2.31     0.690      5.66    0.045      3.388
Qmax(1) =
          1.000 *    1.000 *     9.977) +
          0.778 *    1.000 *     2.310) + =      11.773
Qmax(2) =
          1.286 *    0.662 *     9.977) +
          1.000 *    1.000 *     2.310) + =      10.801

Total of 2 streams to confluence:
Flow rates before confluence point:
       9.977       2.310
Maximum flow rates at confluence using above data:
      11.773       10.801
Area of streams before confluence:
        4.070        0.690
Effective area values after confluence:
        4.760        3.384
Results of confluence:
Total flow rate =     11.773(CFS)
Time of concentration =     8.555 min.
Effective stream area after confluence =      4.760(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.045(In/Hr)
Study area total (this main stream) =       4.76(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2931.300(Ft.)
Downstream point/station elevation =  2931.000(Ft.)
Pipe length  =    56.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.773(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    11.773(CFS)
Normal flow depth in pipe =   14.95(In.)
Flow top width inside pipe =   23.26(In.)
Critical Depth =   14.79(In.)
Pipe flow velocity =      5.72(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =     8.72 min.
End of computations, Total Study Area =            4.76 (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 = 75.0

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: 08/21/18

CARMAX DEVELOPMENT
100-YEAR RATIONAL METHOD
POST-DEVELOPMENT
BY: ROLANDO H. ON 8/21/18

Program License Serial Number 6388

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.130 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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

COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2) = 75.00
Adjusted SCS curve number for AMC 3 = 91.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.017(In/Hr)
Initial subarea data:
Initial area flow distance = 182.000(Ft.)
Top (of initial area) elevation = 2939.500(Ft.)
Bottom (of initial area) elevation = 2938.000(Ft.)
Difference in elevation = 1.500(Ft.)
Slope = 0.00824 s(%)= 0.82
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.364 min.
Rainfall intensity = 4.343(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.896
Subarea runoff = 3.426(CFS)
Total initial stream area = 0.880(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.017(In/Hr)

++
Process from Point/Station 101.000 to Point/Station 102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 2937.000(Ft.)
Downstream point/station elevation = 2935.500(Ft.)
Pipe length = 147.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 3.426(CFS)
Nearest computed pipe diameter = 12.00(In.)
Calculated individual pipe flow = 3.426(CFS)
Normal flow depth in pipe = 9.35(In.)
Flow top width inside pipe = 9.95(In.)
Critical Depth = 9.50(In.)
Pipe flow velocity = 5.22(Ft/s)
Travel time through pipe = 0.47 min.
Time of concentration (TC) = 6.83 min.

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Adjusted SCS curve number for AMC 3 = 91.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.017(In/Hr)
Time of concentration =     6.83 min.
Rainfall intensity =      4.161(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.896
Subarea runoff =      4.182(CFS) for    1.160(Ac.)
Total runoff =      7.608(CFS)
Effective area this stream =        2.04(Ac.)
Total Study Area (Main Stream No. 1) =        2.04(Ac.)
Area averaged Fm value =    0.017(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  2935.500(Ft.)
Downstream point/station elevation =  2934.200(Ft.)
Pipe length  =   250.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.608(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     7.608(CFS)
Normal flow depth in pipe =   12.53(In.)
Flow top width inside pipe =   20.60(In.)
Critical Depth =   12.26(In.)
Pipe flow velocity =      5.08(Ft/s)
Travel time through pipe =    0.82 min.
Time of concentration (TC) =     7.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Adjusted SCS curve number for AMC 3 = 91.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.017(In/Hr)
Time of concentration =     7.65 min.
Rainfall intensity =      3.888(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.896
Subarea runoff =      0.891(CFS) for    0.400(Ac.)
Total runoff =      8.499(CFS)
Effective area this stream =        2.44(Ac.)
Total Study Area (Main Stream No. 1) =        2.44(Ac.)
Area averaged Fm value =    0.017(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  2934.200(Ft.)
Downstream point/station elevation =  2933.700(Ft.)
```

```
Pipe length  =   106.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.499(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     8.499(CFS)
Normal flow depth in pipe =   13.97(In.)
Flow top width inside pipe =   19.82(In.)
Critical Depth =   12.98(In.)
Pipe flow velocity =      5.00(Ft/s)
Travel time through pipe =    0.35 min.
Time of concentration (TC) =     8.01 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Adjusted SCS curve number for AMC 3 = 91.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.017(In/Hr)
Time of concentration =     8.01 min.
Rainfall intensity =      3.784(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.896
Subarea runoff =      1.806(CFS) for    0.600(Ac.)
Total runoff =     10.305(CFS)
Effective area this stream =        3.04(Ac.)
Total Study Area (Main Stream No. 1) =        3.04(Ac.)
Area averaged Fm value =    0.017(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2933.700(Ft.)
Downstream point/station elevation =  2931.800(Ft.)
Pipe length  =    67.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.305(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    10.305(CFS)
Normal flow depth in pipe =   11.65(In.)
Flow top width inside pipe =   12.50(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.09(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =     8.12 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.040(Ac.)
Runoff from this stream =     10.305(CFS)
Time of concentration =    8.12 min.
Rainfall intensity =     3.753(In/Hr)
Area averaged loss rate (Fm) =    0.0174(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Adjusted SCS curve number for AMC 3 = 91.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.017(In/Hr)
Initial subarea data:
Initial area flow distance =   283.000(Ft.)
Top (of initial area) elevation =  2940.200(Ft.)
Bottom (of initial area) elevation =  2935.800(Ft.)
Difference in elevation =     4.400(Ft.)
Slope =    0.01555  s(%)=       1.55
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.687 min.
Rainfall intensity =      4.215(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.896
Subarea runoff =      3.891(CFS)
Total initial stream area =        1.030(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.017(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2932.800(Ft.)
Downstream point/station elevation =  2931.800(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.891(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.891(CFS)
Normal flow depth in pipe =   10.56(In.)
Flow top width inside pipe =   13.70(In.)
Critical Depth =    9.57(In.)
Pipe flow velocity =      4.22(Ft/s)
Travel time through pipe =    0.77 min.
Time of concentration (TC) =     7.46 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.030(Ac.)
Runoff from this stream =      3.891(CFS)
Time of concentration =    7.46 min.
Rainfall intensity =     3.947(In/Hr)
Area averaged loss rate (Fm) =    0.0174(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     10.30     3.040      8.12    0.017      3.753
2      3.89     1.030      7.46    0.017      3.947
Qmax(1) =
          1.000 *    1.000 *    10.305) +
          0.951 *    1.000 *     3.891) + =      14.004
Qmax(2) =
          1.052 *    0.919 *    10.305) +
          1.000 *    1.000 *     3.891) + =      13.858

Total of 2 streams to confluence:
Flow rates before confluence point:
      10.305       3.891
Maximum flow rates at confluence using above data:
       14.004       13.858
Area of streams before confluence:
```

```
        3.040        1.030
Effective area values after confluence:
        4.070        3.825
Results of confluence:
Total flow rate =     14.004(CFS)
Time of concentration =     8.117 min.
Effective stream area after confluence =      4.070(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.017(In/Hr)
Study area total (this main stream) =       4.07(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  2931.800(Ft.)
Downstream point/station elevation =  2931.300(Ft.)
Pipe length  =    96.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.004(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    14.004(CFS)
Normal flow depth in pipe =   17.11(In.)
Flow top width inside pipe =   21.72(In.)
Critical Depth =   16.18(In.)
Pipe flow velocity =      5.84(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     8.39 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.070(Ac.)
Runoff from this stream =     14.004(CFS)
Time of concentration =    8.39 min.
Rainfall intensity =     3.679(In/Hr)
Area averaged loss rate (Fm) =    0.0174(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
COMMERCIAL subarea type
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
SCS curve number for soil(AMC 2)  = 75.00
Adjusted SCS curve number for AMC 3 = 91.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.017(In/Hr)
Initial subarea data:
Initial area flow distance =   192.000(Ft.)
Top (of initial area) elevation =  2940.400(Ft.)
Bottom (of initial area) elevation =  2932.800(Ft.)
Difference in elevation =     7.600(Ft.)
Slope =    0.03958  s(%)=       3.96
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    4.750 min.
Rainfall intensity =      5.176(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.897
Subarea runoff =      3.203(CFS)
Total initial stream area =        0.690(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.017(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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Process from Point/Station      110.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  2932.800(Ft.)
Downstream point/station elevation =  2931.300(Ft.)
Pipe length  =   225.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.203(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.203(CFS)
Normal flow depth in pipe =    8.44(In.)
Flow top width inside pipe =   14.88(In.)
Critical Depth =    8.65(In.)
Pipe flow velocity =      4.51(Ft/s)
Travel time through pipe =    0.83 min.
Time of concentration (TC) =     5.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.690(Ac.)
Runoff from this stream =      3.203(CFS)
Time of concentration =    5.58 min.
Rainfall intensity =     4.698(In/Hr)
Area averaged loss rate (Fm) =    0.0174(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     14.00     4.070      8.39    0.017      3.679
2      3.20     0.690      5.58    0.017      4.698
Qmax(1) =
          1.000 *    1.000 *    14.004) +
          0.782 *    1.000 *     3.203) + =      16.510
Qmax(2) =
          1.278 *    0.665 *    14.004) +
          1.000 *    1.000 *     3.203) + =      15.113

Total of 2 streams to confluence:
Flow rates before confluence point:
      14.004       3.203
Maximum flow rates at confluence using above data:
       16.510       15.113
Area of streams before confluence:
        4.070        0.690
Effective area values after confluence:
        4.760        3.398
Results of confluence:
Total flow rate =     16.510(CFS)
Time of concentration =     8.390 min.
Effective stream area after confluence =      4.760(Ac.)
Study area average Pervious fraction(Ap) =  0.100
Study area average soil loss rate(Fm) =    0.017(In/Hr)
Study area total (this main stream) =       4.76(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  2931.300(Ft.)
Downstream point/station elevation =  2931.000(Ft.)
Pipe length  =    56.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    16.510(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    16.510(CFS)
Normal flow depth in pipe =   19.59(In.)
```

Flow top width inside pipe = 18.58(In.)
Critical Depth = 17.57(In.)
Pipe flow velocity = 6.01(Ft/s)
Travel time through pipe = 0.16 min.
Time of concentration (TC) = 8.55 min.
End of computations, Total Study Area = 4.76 (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 = 75.0

Appendix E

Rainfall Intensity Data

NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.5194°, Longitude: -117.3218°
Elevation: 2942.7 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.101** (0.083–0.123)	**0.138** (0.114–0.169)	**0.190** (0.156–0.233)	**0.235** (0.192–0.291)	**0.300** (0.237–0.384)	**0.353** (0.273–0.462)	**0.411** (0.310–0.550)	**0.473** (0.347–0.651)	**0.564** (0.397–0.809)	**0.639** (0.435–0.949)
10-min	**0.144** (0.119–0.176)	**0.197** (0.163–0.242)	**0.272** (0.224–0.334)	**0.336** (0.275–0.417)	**0.430** (0.339–0.550)	**0.506** (0.391–0.662)	**0.589** (0.444–0.788)	**0.678** (0.498–0.934)	**0.808** (0.569–1.16)	**0.916** (0.623–1.36)
15-min	**0.174** (0.144–0.213)	**0.239** (0.197–0.293)	**0.329** (0.271–0.404)	**0.407** (0.332–0.504)	**0.520** (0.410–0.665)	**0.612** (0.473–0.800)	**0.712** (0.537–0.953)	**0.820** (0.602–1.13)	**0.977** (0.688–1.40)	**1.11** (0.754–1.64)
30-min	**0.234** (0.193–0.286)	**0.321** (0.265–0.393)	**0.442** (0.364–0.543)	**0.547** (0.446–0.677)	**0.698** (0.551–0.894)	**0.823** (0.636–1.08)	**0.957** (0.722–1.28)	**1.10** (0.809–1.52)	**1.31** (0.925–1.88)	**1.49** (1.01–2.21)
60-min	**0.276** (0.228–0.337)	**0.378** (0.312–0.463)	**0.520** (0.428–0.639)	**0.643** (0.525–0.797)	**0.822** (0.649–1.05)	**0.968** (0.749–1.26)	**1.13** (0.850–1.51)	**1.30** (0.952–1.79)	**1.55** (1.09–2.22)	**1.75** (1.19–2.60)
2-hr	**0.384** (0.317–0.470)	**0.514** (0.424–0.630)	**0.695** (0.571–0.853)	**0.849** (0.693–1.05)	**1.07** (0.845–1.37)	**1.25** (0.967–1.63)	**1.44** (1.09–1.93)	**1.65** (1.21–2.27)	**1.94** (1.37–2.79)	**2.19** (1.49–3.24)
3-hr	**0.458** (0.378–0.561)	**0.610** (0.503–0.747)	**0.818** (0.673–1.00)	**0.995** (0.812–1.23)	**1.25** (0.985–1.60)	**1.45** (1.12–1.90)	**1.67** (1.26–2.23)	**1.90** (1.39–2.61)	**2.23** (1.57–3.20)	**2.49** (1.70–3.70)
6-hr	**0.618** (0.510–0.756)	**0.820** (0.677–1.00)	**1.10** (0.901–1.35)	**1.33** (1.08–1.64)	**1.65** (1.31–2.12)	**1.91** (1.48–2.50)	**2.19** (1.65–2.93)	**2.48** (1.82–3.41)	**2.88** (2.03–4.14)	**3.21** (2.19–4.77)
12-hr	**0.788** (0.650–0.963)	**1.06** (0.873–1.30)	**1.42** (1.17–1.74)	**1.72** (1.40–2.13)	**2.14** (1.69–2.74)	**2.47** (1.91–3.22)	**2.81** (2.12–3.76)	**3.16** (2.32–4.35)	**3.65** (2.57–5.24)	**4.05** (2.75–6.01)
24-hr	**1.02** (0.906–1.18)	**1.40** (1.24–1.61)	**1.89** (1.67–2.19)	**2.30** (2.01–2.68)	**2.86** (2.42–3.44)	**3.29** (2.73–4.05)	**3.74** (3.03–4.71)	**4.20** (3.31–5.44)	**4.84** (3.66–6.53)	**5.34** (3.90–7.46)
2-day	**1.15** (1.02–1.33)	**1.60** (1.41–1.84)	**2.19** (1.93–2.53)	**2.68** (2.34–3.12)	**3.35** (2.84–4.03)	**3.88** (3.22–4.76)	**4.42** (3.58–5.57)	**4.99** (3.93–6.46)	**5.77** (4.36–7.79)	**6.40** (4.67–8.93)
3-day	**1.25** (1.11–1.44)	**1.74** (1.54–2.01)	**2.40** (2.12–2.77)	**2.94** (2.58–3.43)	**3.70** (3.14–4.45)	**4.29** (3.56–5.28)	**4.91** (3.97–6.18)	**5.55** (4.37–7.19)	**6.44** (4.87–8.70)	**7.15** (5.23–9.99)
4-day	**1.33** (1.18–1.53)	**1.86** (1.65–2.14)	**2.56** (2.26–2.96)	**3.14** (2.75–3.66)	**3.94** (3.34–4.75)	**4.57** (3.79–5.62)	**5.22** (4.23–6.58)	**5.90** (4.65–7.64)	**6.84** (5.17–9.24)	**7.59** (5.55–10.6)
7-day	**1.44** (1.28–1.66)	**1.99** (1.76–2.30)	**2.72** (2.40–3.14)	**3.31** (2.90–3.86)	**4.13** (3.50–4.97)	**4.76** (3.95–5.86)	**5.41** (4.39–6.82)	**6.09** (4.80–7.89)	**7.02** (5.31–9.48)	**7.75** (5.66–10.8)
10-day	**1.53** (1.36–1.76)	**2.10** (1.86–2.42)	**2.85** (2.51–3.29)	**3.46** (3.03–4.03)	**4.29** (3.64–5.17)	**4.94** (4.10–6.07)	**5.60** (4.53–7.05)	**6.28** (4.95–8.13)	**7.21** (5.45–9.74)	**7.94** (5.80–11.1)
20-day	**1.77** (1.57–2.04)	**2.44** (2.16–2.81)	**3.33** (2.94–3.85)	**4.06** (3.55–4.72)	**5.05** (4.28–6.09)	**5.83** (4.84–7.16)	**6.62** (5.36–8.34)	**7.44** (5.86–9.64)	**8.56** (6.47–11.6)	**9.44** (6.90–13.2)
30-day	**2.01** (1.78–2.31)	**2.79** (2.47–3.22)	**3.84** (3.40–4.44)	**4.72** (4.13–5.50)	**5.94** (5.03–7.15)	**6.89** (5.72–8.47)	**7.88** (6.38–9.93)	**8.92** (7.03–11.6)	**10.4** (7.83–14.0)	**11.5** (8.39–16.1)
45-day	**2.32** (2.06–2.67)	**3.26** (2.88–3.75)	**4.54** (4.01–5.25)	**5.64** (4.94–6.57)	**7.20** (6.10–8.66)	**8.45** (7.01–10.4)	**9.77** (7.92–12.3)	**11.2** (8.81–14.5)	**13.2** (9.97–17.8)	**14.8** (10.8–20.7)
60-day	**2.53** (2.25–2.92)	**3.57** (3.16–4.11)	**5.02** (4.43–5.80)	**6.28** (5.50–7.32)	**8.12** (6.88–9.78)	**9.64** (8.00–11.8)	**11.3** (9.13–14.2)	**13.0** (10.3–16.9)	**15.6** (11.8–21.1)	**17.7** (13.0–24.8)

[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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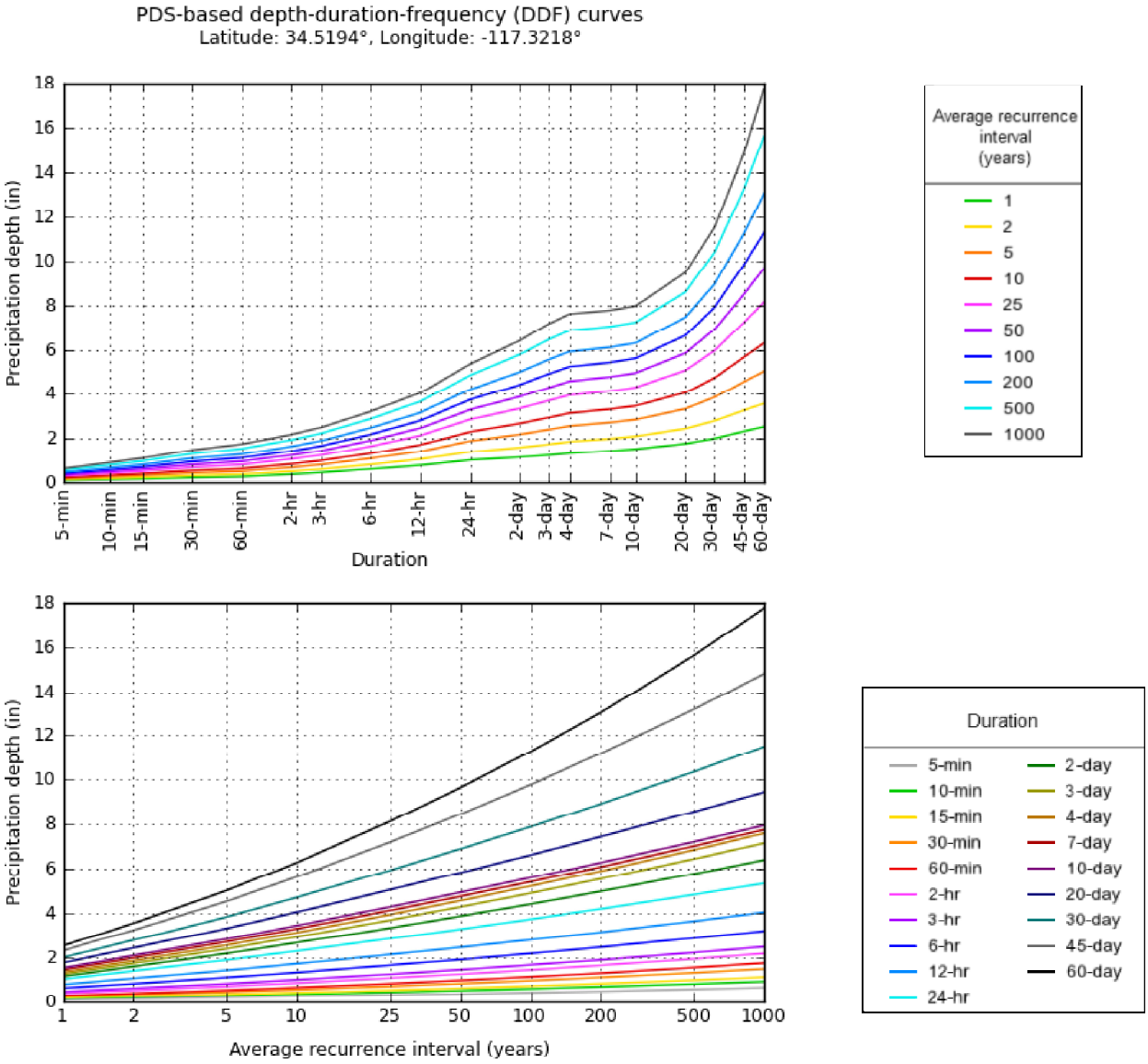
PF graphical



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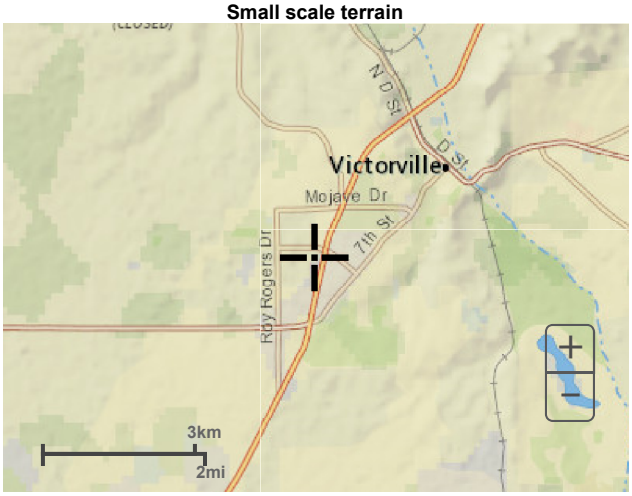
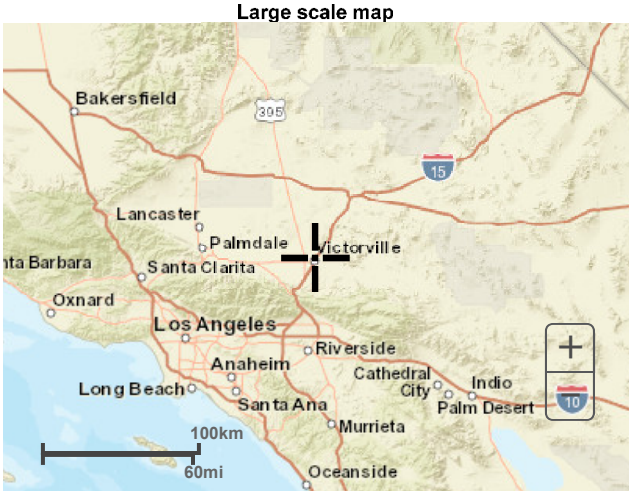
Maps & aerials

Small scale terrain



Large scale terrain

Large scale map



Large scale aerial

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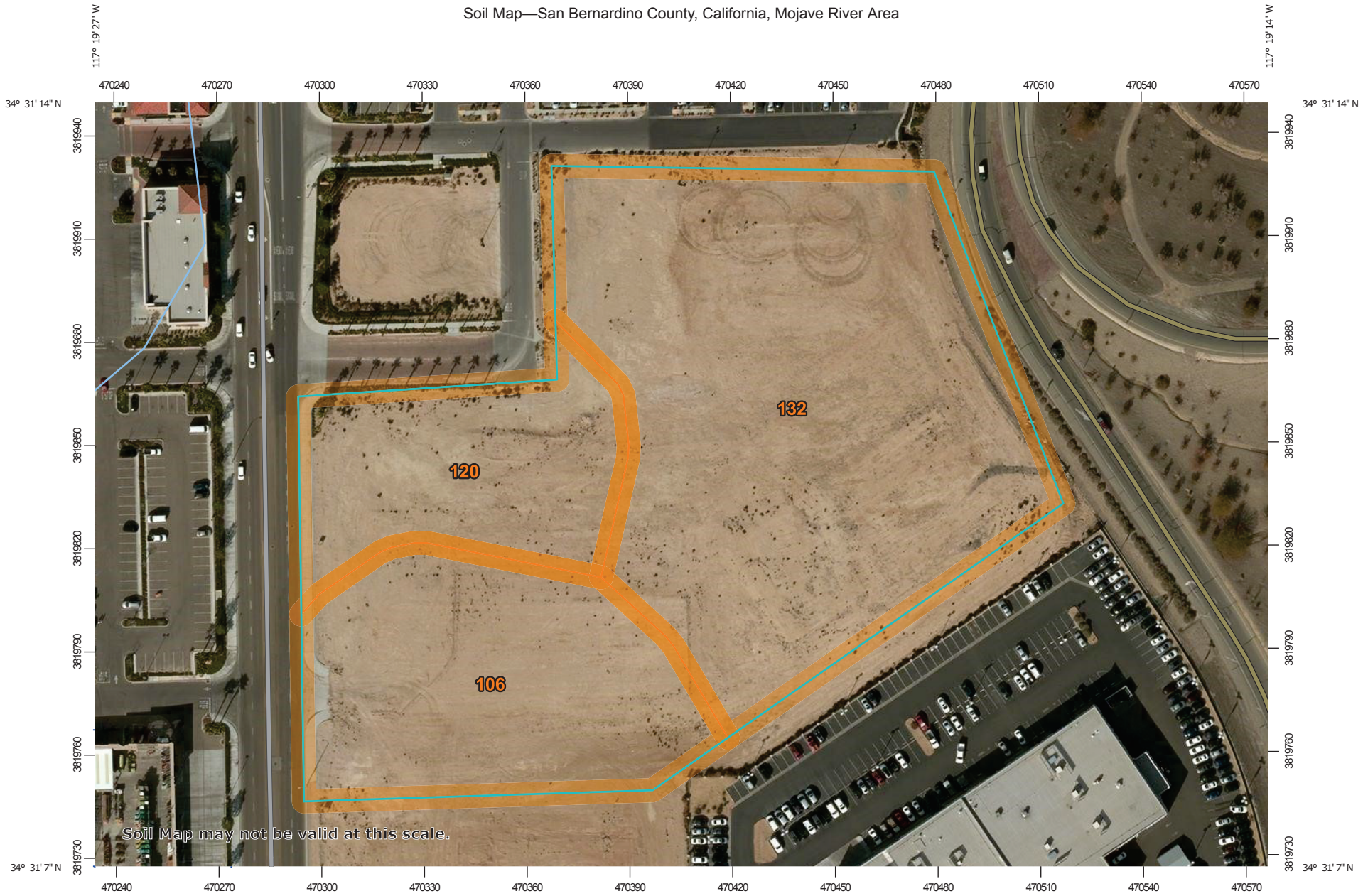
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix F

Soils Map



Map Scale: 1:1,570 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

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:
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, California, Mojave River Area
Survey Area Data: Version 9, Sep 11, 2017

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

Date(s) aerial images were photographed: Feb 1, 2015—Feb 4, 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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
106	BRYMAN LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	1.8	25.4%
120	CAVE LOAM, DRY, 0 TO 2 PERCENT SLOPES	1.2	17.2%
132	HELENDALE LOAMY SAND, 2 TO 5 PERCENT SLOPES	4.1	57.4%
Totals for Area of Interest		**7.2**	**100.0%**