RED BRICK SOLUTION

Hydrology Study

January 12, 2022

APN:3128-241-09

3128-241-14

NE CORNER OF JONATHAN ROAD – HOLLY ROAD.

San Bernardino County, California

PROFESSIONAL ENGINEER'S AFFIRMATIVE STATEMENT

I have examined and am familiar with the information in this document and all appendices, and based on my inquiries of individuals immediately responsible for obtaining the information in this document, I believe that the information is true, accurate, and complete

Prepared by

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Appendix

I. INTRODUCTION

A. LOCATION OF PROPERTY

The 14.5-acre project site is located on the north side of Holly Rd. between Jonathan St. and Highway 395 in Adelanto CA, APN's 3128-241-09 and 3128-241-14.

B. PURPOSE AND SCOPE

The purpose of this study is to determine onsite 100-year storm flow before and after development and establish the difference between 90% of the predeveloped Q (CFS), and the developed Q which needs to be retained. This study also determines how to contain the increased flow and size the retention basin. Off-site flows are directed around the project on previously developed streets which divert flows East and West to off-site natural and historic drainage systems.

C. METHODOLOGY

This study is based on using the San Bernardino County Hydrology Manual and Addendum B, and CivilDesign Rational Method Software to model the storm channel flows.

The following criteria were used for the on-site flows:

1.	Current land use:	Vacant Land
2.	Proportion Currently Impervious:	0.1 %
3.	Proportion Impervious After Development:	50.0% (5 -7 Dwellings per acre)
4.	Intended Use:	Residential Tract
5.	NOAA 14 Precipitation	100-year 1-hour = 1.03
6.	Soil Type	105, Bryman Loamy Fine Sand, Group C (24.9%) and 112, Cajon Sand, Group A (75.1%)
7.	San Bernardino County Hydrology Manual	Rational Method
8.	San Bernardino County Hydrology Manual	Unit Hydrograph

D. COMPLIANCE WITH REGULATIONS

All calculations are based on generally accepted engineering practices in accordance with the San Bernardino County Hydrology Manual's Hydrologic Criteria and Drainage Design including the April 2010 Addendum that addresses the Antecedent Moisture Condition (AMC) for arid regions of the County, the Detention Basin Design Criteria handout, and the Memo dated September 4, 1987 addressing Detention Design Criteria and pre-developed storm years to be used.

E. FLOODPLAIN INFORMATION

The project site is located inside of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Panel 06071C5795H effective August 28, 2008. This panel indicates that the project is within Zone X. (See Exhibit B) for San Bernardino County.

II. ON-SITE HYDROLOGY:

A. PRE-DEVELOPED ON-SITE DRAINAGE DESCRIPTION

The 14.5-acre site is currently pre-developed and consists of sandy and loamy sand, with sparse vegetation. Starting near the southwestern corner property line, the land slopes north as three (3) individual subareas consisting of an initial area and a tributary conveyance directing each storm flow due north to the northern property line without any confluence one with the other (see Appendix A Exhibit B)

The 1st Drainage Area “A” consists of a 1.49-acres initial Subarea 1A that flows 242.11 ft. to the north creating an elevation change of 5.39 ft. and a slope of 2.23%. Subarea 2A transports these storm flows 443.32 ft to the north creating an elevation change of 3.53 ft. at a slope of 0.79% over 3.75 acres.

The 2nd Drainage Area “B” consists of a 1.38-acre Initial Subarea 1B that flows 230.9 ft to the north with an elevation change of 5.86 ft. and a slope of 2.54%. Subarea 2B conveys these flows north 470.51 ft. with an elevation change of 2.94 ft. at a slope of 0.62% over 3.38-acres.

The 3rd Drainage Area “C” consists of a 1.03-acre Initial Subarea 1C contains 1.03 acres that flows north 241.11 ft. with an elevation change of 5.87 ft. at a slope of 2.43%. Subarea 2C conveys these storm flows north 358.66 ft, with an elevation change of 3.61 ft. at a slope of 1.00%. over 3.95-acres.

B. PRE-DEVELOPED ON-SITE HYDROLOGY ANALYSIS

Using CivilDesign Rational Method Software, each of the 3-Draiange Areas was analyzed to determine the 25-year Pre-Developed 1-Hour Peak Storm flows associated each area as follows:

- Drainage Area A (DA-A) Q_{25} = 5.93 cfs
- Drainage Area B (DA-B) Q_{25} = 5.10 cfs
- Drainage Area C (DA-C) Q_{25} = 7.66 cfs

Although these flows are independent of each other, a forced confluence was analyzed for use in determining the retention volume required. It was determined that the total confluence Pre-Developed Peak Storm Flow is 18.79 cfs.

C. POST-DEVELOPED ON-SITE DRAINAGE DESCRIPTION

The post-developed the site will consist of a residential tract with 86 - 5000 sq. ft. lots. Considering the accompanying streets and gutters, this will add a total impervious area of about 50%. The streets, gutters and storm water pipes will direct flows to a retention basin that will contain the total retention volume required to release 90% of the pre-developed storm flows downstream.

The 14.5-acre on-site developed site consists of one (1) Drainage Area subdivided into three (3) drainage management areas (DMA).

DMA-A has an Initial Area 1A consisting of 0.57 acres with a flow travel length of 289 ft. heading north along the east half of Jonathan Street with an elevation difference of 4.16 ft. resulting in a slope of 1.44%. Subarea 2A consist of 1.80-acres and has a flow path of 302 ft. along the east half of Jonathan Street with an elevation change of 3 ft. and a slope of 0.99%. Subarea 3A consist of 2.33-acres and conveys the previous flows 372 ft. east along the south half of "A" Lane and south on the west half of "B" Street to a cross-gutter that directs these flows east to the east half of "B" Street. This flow path has an elevation change of 1.5 ft. and a slope of 0.40%. Subarea 4A consist of 1.49-acres that lie along the east side of "B" Street. Storm flows collect along the east side of "B" Street heading north where they add to the cross-gutter previously mentioned that has a flow path of 183 ft. heading east through Subarea 4A to "E" Court via a box channel. This cross-gutter / box channel conveyance has an elevation change of 0.7 ft. and a slope of 0.38%. Subarea 5A consist of 1.88-acres along the north side of "E" Court with a flow path of 397 ft. heading east with an elevation change of 1.6 ft. and a slope of 0.40% to a low point that creates a sump condition for a curb-opening inlet catch basin that captures these flows and pipes them intro the proposed retention basin.

DMA-B has an Initial Area 1B consisting of 0.64 acres with a flow travel length of 312 ft. heading north along the east side of "B" Street on to "C" street with an elevation change of 6.8 ft. and slope of 2.18%. Subarea 2B consists of 3.11 acres that straddles both sides of "C" Street with a flow path of 362 ft. heading east with an elevation change of 1.5 ft. and a slope of 0.41%. Subarea 3B consists of 1.43 acres that includes the west half of "D" Street and the south half of "E" Court. The conveyance path flows north on "D" Street 311 ft. with an elevation change of 1.6 ft. and a slope of 0.51% merging with the flows from the south side of "E" court prior to being re-directed east on "E" Court to confluence with DMA-C storm flows.

DMA-C has an Initial Area 1C consisting of 0.48 acres with a flow travel length of 265 ft heading north along the east side of "D" Street with an elevation change of 6.7 ft. and a slope of 2.52%. Subarea 2C consist of 1.12 acres along the east side of "D" Street which conveys these flows north another 320 ft. to "E" Court with an elevation change of 1.40 ft. and a slope of 0.44%, at which point these flows confluence with DMA-B being re-directed east along "E" Court to a low point that creates a sump condition for a curb-opening inlet catch basin that captures these flows and pipes them north to confluence with DMA-A flows prior to being piped into then retention basin.

D. POST-DEVELOPED ON-SITE HYDROLOGY ANALYSIS

Appendix A Exhibit C shows the developed site and associated subareas as discussed above. Entering this data into the CivilDesign Rational Method Software for the 100-year post-developed 1-Hour Peak Storm flows associated with each area yielded the Q100 data listed on the hydrologic Data Table.

E. DEVELOPED ON-SITE HYDRAULICS

When running the overall storm using the Unit Hydrograph method, the overall peak flow increased from 28.86 cfs to 30.73 cfs

The half street capacity of the local interior street can carry the up ton 16 cfdn at ba 0.40% slope which is greater than the maximum 100-year Half- Street flow in "D" street of 13.18 cfs.

It was determined that the curb opening catch basins at nodes 4, 8, 12, and 17 will need to be sized to convey 13.18 cfs, 8.76 cfs, 4.31 cfs, and 3.19 cfs respectively. Referring to Appendix D Exhibit H a 6-inch curb face curb opening catch basin would need to size as a 14-ft, 14-ft, 7-ft, and 3.5-ft wide respectively. Preliminary storm drainpipe sizing was determined by Civildesign software and is called out on Exhibit C for each location.

F. RETENTION BASIN SIZING.

Appendix "D" Exhibit G shows the proposed on-site basin size and layout. The proposed basin can effectively retain 1.12 acre-t o storm flows before it starts to spill over. The basin has been designed with a 10-ft wide bench around the top with a 15-ft wide bench on the spillway side. The interior side slopes are at 3:1 at maximum depth of 10-feet.
The overall developed 100-year 3-hour storm can reach its peak storm flow of 30.73 cfs and begin to recede down to the 90% pre-developed Q25 storm flow /of 19.74 cfs with an associated volume of 0.9856-acre feet which is than that provided.

The on-site street, storm drain, and catch basin system as well as the retention release spillway will be documented in the final hydrology study.RETENTION bASIN

The retention basin volume was determined by holding the storm volume until storm flows subside to 90% of the undeveloped peak flow of 18.70 which is (18.70*0.9=) 16.83 CFS. The storm volume at the 16.83 CFS flow on the subsiding leg of the unit hydrograph yields a required retention storm volume of 0.969 ac-ft. or 42,210 cubic feet.

III. CONCLUSIONS AND RECOMENDATIONS:

The proposed project is not subject to off-site storm flows that would flood the site, and the 100-year developed storm flows can be mitigated to below 90% of the un-developed 25-year storm flows by means of a minimum 42,210 cubic foot retention basin.

IV. REFERENCES:

County San Bernardino of Public Works Low Impact Development Standards Manual. Updated February 2014.

County of San Bernardino Public Works Hydrology Manual. Created in August 1986.
http://cms.sbcounty.gov/Portals/50/floodcontrol/HydrologyManual.pdf

Federal Emergency Management Agency website: https://msc.fema.gov/portal accessed August 2020.

NOAA Atlas 14, Volume 6, Version 2 POINT PRECIPITATION FREQUENCY (PF) ESTIMATES WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION. Accessed August 2020.

NRCS Soils Data from Soil Map; San Bernardino County, California, Mojave River Area; Version 8, Jul 31, 2019 Accessed August 2020.

APPENDIX A

Exhibits:

Land Use / Location Map – A

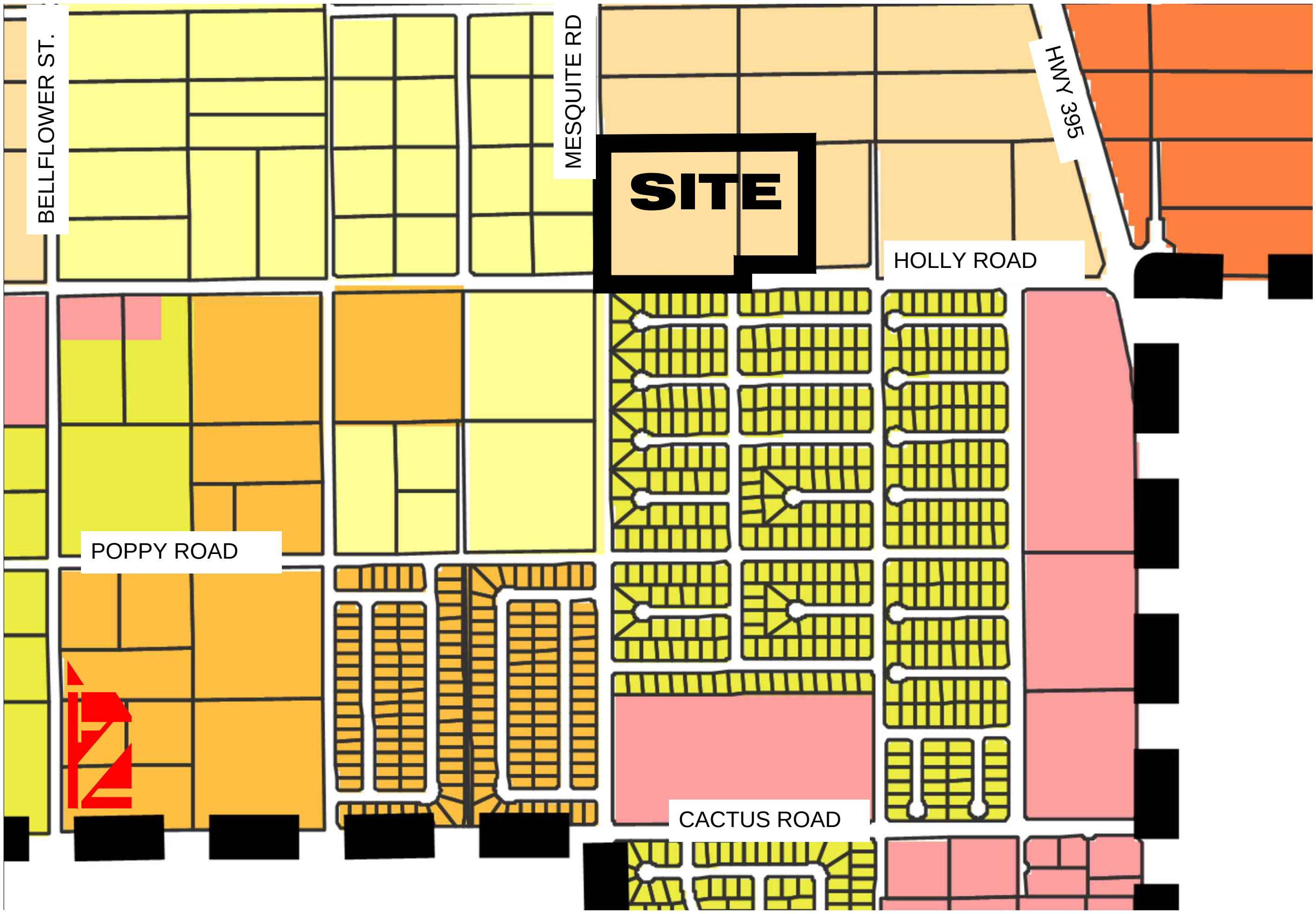
Rational Method Pre-Developed Subarea Map – B

Rational Method Post-Developed Subarea Map – C

Soil Type – D 1-5

NOAA 14 Precipitation – E

FEMA MAP - F



LAND USE AND ZONING DISTRICTS

Light Manufacturing Cannabis Only (LMCO)	Desert Living (DL-2.5) (1 du/2.5 ac)	High Density Residential (R3-30)
Airport Development District (ADD) *	Light Manufacturing (LM)	Single Family Residential (R-S1)
Airport Park (AP) *	Manufacturing/Industrial (MI)	Single Family Residential (R-S5)
Business Park (BP)	Mixed Use (MU) (12 - 18 du/ac)	Single Family Residential (R-1)
Commercial (C)	Open Space (OS)	Medium Density Residential (R3-8)
Desert Living (DL-5) (1 du/5 ac)	Public Utilities (PU)	
Desert Living (DL-9) (1 du/9 ac)	Medium Density Residential (R-M12)	

DATE: 01/10/2022

SCALE: NTS

EXHIBIT A

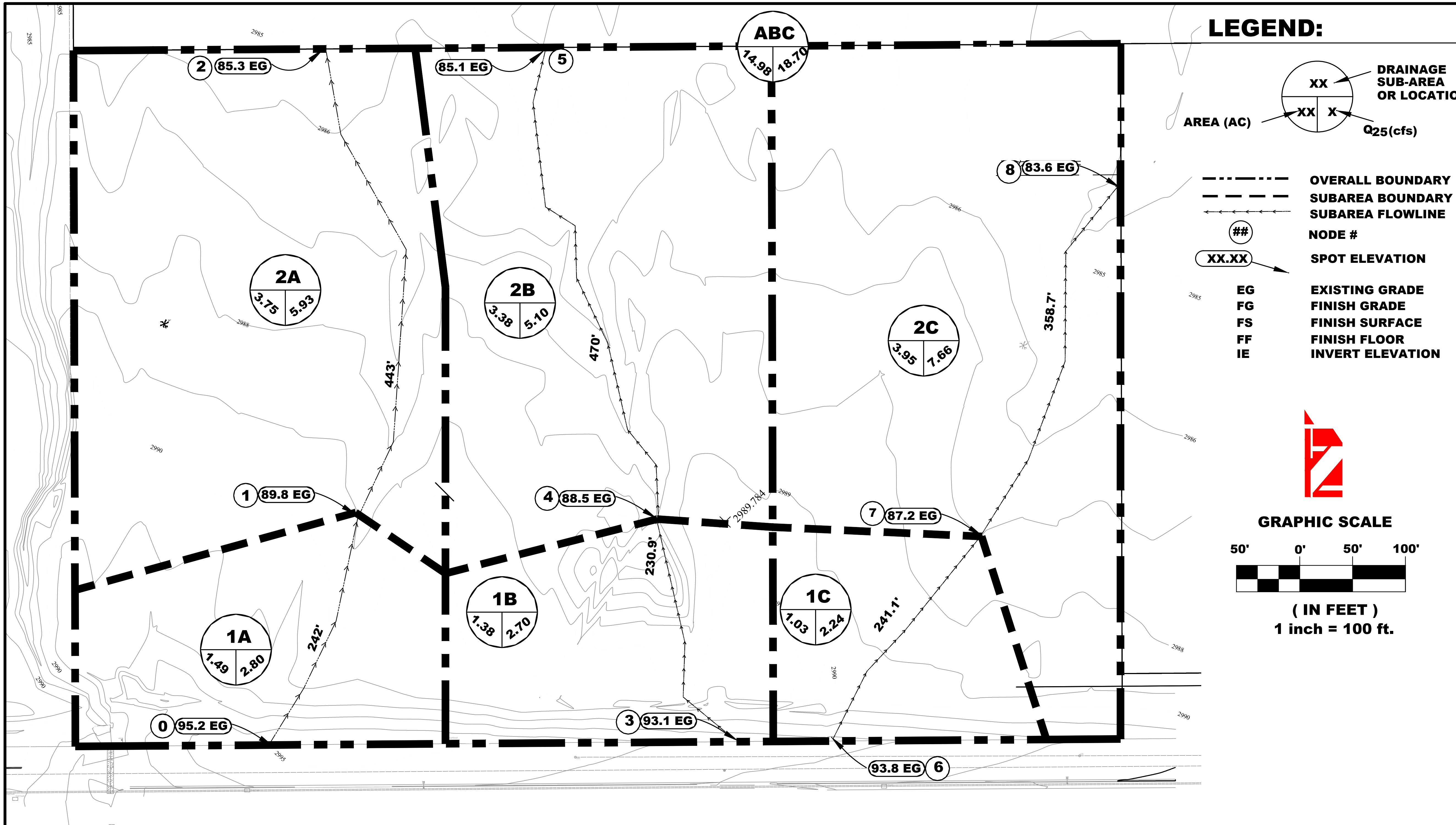
TTM 20143

LAND USE & ZONNING

LOCATION MAP

RED BRICK SOLUTION

CONSULTING ENGINEERS & ARCHITECTS



HYDROLOGY STUDY MAP

PRE-DEVELOPED CONDITION

FOR:
TTM 20143

IN THE:
CITY OF ADELANTO

APN:
3128-241-09
3128-241-14

RED BRICK SOLUTION

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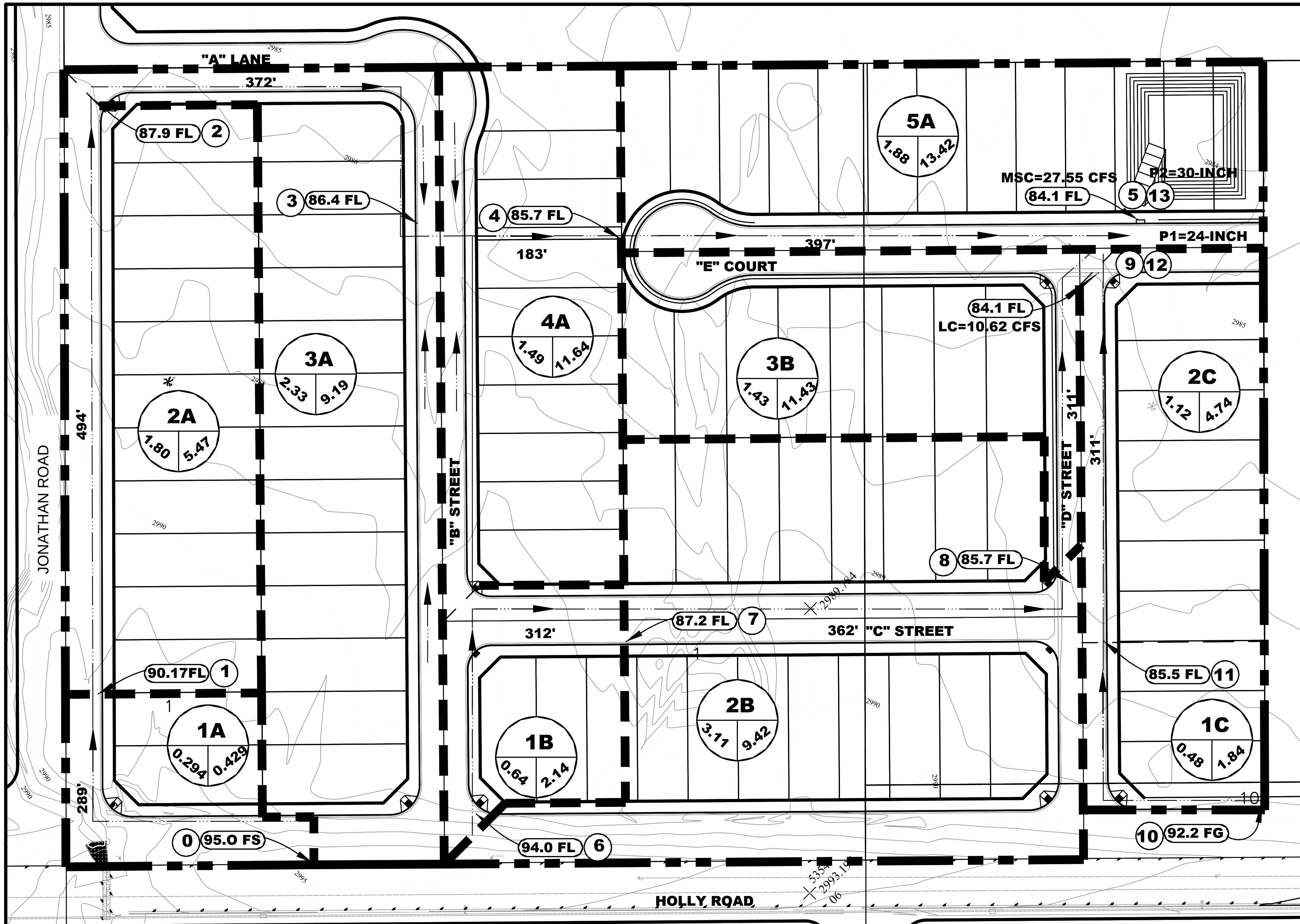
EXHIBIT B



LEGEND:

DRAINAGE SUB-AREA OR LOCATION (XX)

AREA (AC) (XX)

Q_{100}(cfs) (X)

OVERALL BOUNDARY

SUBAREA BOUNDARY

SUBAREA FLOWLINE

NODE # (##)

SPOT ELEVATION (XX.XX)

ABREVIATIONS

AC	ACRES
CFS	CUBIC-FEET/SECOND
EG	EXISTING GRADE
FG	FINISH GRADE
FS	FINISH SURFACE
FF	FINISH FLOOR
IE	INVERT ELEVATION
LC	MINOR STREAM CONFLUENCE
MSC	MAIN STREAM CONFLUENCE

GRAPHIC SCALE

50' 0' 50' 100'

(IN FEET)

1 inch = 100 ft.

HYDROLOGY STUDY MAP

POST-DEVELOPED CONDITION

FOR:
TTM 20143

IN THE:
CITY OF ADELANTO

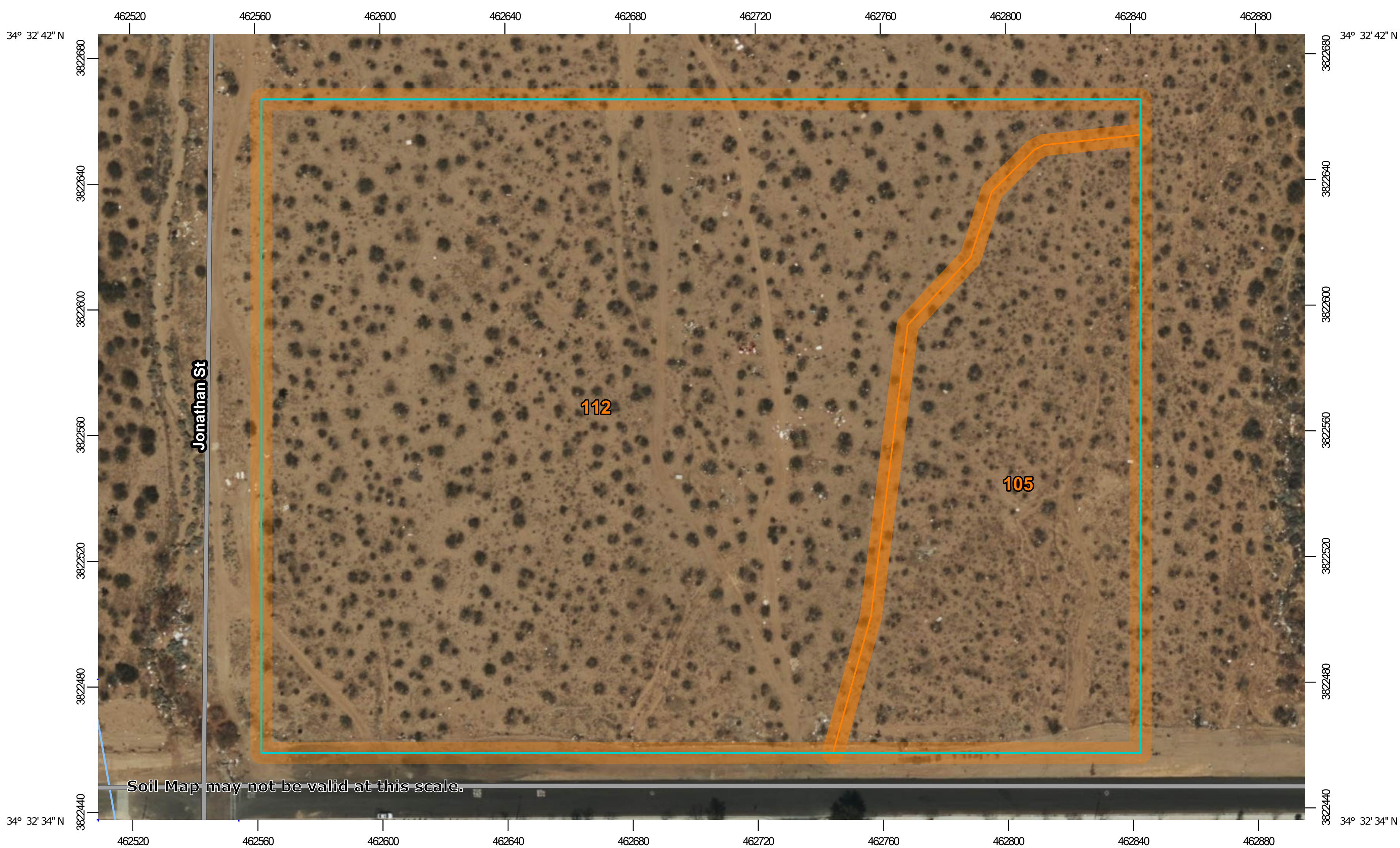
APN:
3128-241-09
3128-241-14

RED BRICK SOLUTION

CONSULTING ENGINEERS & ARCHITECTS

EXHIBIT C

Soil Map—San Bernardino County, California, Mojave River Area
(Holly Street, Adelanto CA)



Map Scale: 1:1,760 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

EXHIBIT D1

EXHIBIT D2

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
105	BRYMAN LOAMY FINE SAND, 0 TO 2 PERCENT SLOPES	3.6	24.9%
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	10.9	75.1%
Totals for Area of Interest		**14.5**	**100.0%**

EXHIBIT D3

San Bernardino County, California, Mojave River Area

105—BRYMAN LOAMY FINE SAND, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkr9
Elevation: 2,800 to 3,200 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Bryman and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bryman

Setting

Landform: Fan remnants
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 9 inches: loamy fine sand
H2 - 9 to 12 inches: sandy loam
H3 - 12 to 32 inches: sandy clay loam
H4 - 32 to 46 inches: sandy loam
H5 - 46 to 99 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.9 inches)

EXHIBIT D4

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Cajon

Percent of map unit: 5 percent
Hydric soil rating: No

Helendale

Percent of map unit: 5 percent
Hydric soil rating: No

Mohave variant

Percent of map unit: 5 percent
Hydric soil rating: No

Bryman, gravelly surface

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 13, Sep 13, 2021

EXHIBIT D5

San Bernardino County, California, Mojave River Area

112—CAJON SAND, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrj
Elevation: 1,800 to 3,200 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Cajon

Setting

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

Typical profile

H1 - 0 to 7 inches: sand
H2 - 7 to 25 inches: sand
H3 - 25 to 45 inches: gravelly sand
H4 - 45 to 60 inches: stratified sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

NOAA Atlas 14, Volume 6, Version 2
Location name: Adelanto, California, USA*
Latitude: 34.5442°, Longitude: -117.4058°
Elevation: 2987.09 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	0.082 (0.068-0.100)	0.115 (0.095-0.141)	0.160 (0.131-0.196)	0.198 (0.161-0.245)	0.251 (0.198-0.321)	0.293 (0.227-0.383)	0.338 (0.255-0.452)	0.385 (0.282-0.529)	0.450 (0.317-0.646)	0.503 (0.342-0.747)
10-min	0.117 (0.097-0.143)	0.165 (0.136-0.202)	0.229 (0.188-0.281)	0.283 (0.231-0.351)	0.359 (0.284-0.460)	0.420 (0.325-0.549)	0.484 (0.365-0.648)	0.551 (0.405-0.759)	0.646 (0.454-0.926)	0.721 (0.490-1.07)
15-min	0.142 (0.117-0.173)	0.199 (0.164-0.244)	0.277 (0.228-0.340)	0.342 (0.279-0.424)	0.435 (0.343-0.556)	0.508 (0.393-0.664)	0.585 (0.442-0.784)	0.667 (0.489-0.918)	0.781 (0.550-1.12)	0.872 (0.593-1.29)
30-min	0.199 (0.164-0.243)	0.279 (0.230-0.342)	0.389 (0.320-0.477)	0.480 (0.392-0.595)	0.610 (0.482-0.781)	0.713 (0.551-0.932)	0.821 (0.620-1.10)	0.936 (0.686-1.29)	1.10 (0.771-1.57)	1.22 (0.832-1.82)
60-min	0.250 (0.206-0.306)	0.351 (0.289-0.430)	0.488 (0.401-0.599)	0.603 (0.492-0.747)	0.766 (0.605-0.980)	0.896 (0.692-1.17)	1.03 (0.778-1.38)	1.18 (0.862-1.62)	1.38 (0.969-1.97)	1.54 (1.05-2.28)
2-hr	0.349 (0.288-0.427)	0.472 (0.389-0.578)	0.641 (0.527-0.787)	0.785 (0.640-0.971)	0.989 (0.780-1.26)	1.15 (0.891-1.51)	1.33 (1.00-1.77)	1.51 (1.11-2.08)	1.77 (1.24-2.53)	1.97 (1.34-2.93)
3-hr	0.427 (0.352-0.522)	0.570 (0.470-0.698)	0.768 (0.631-0.943)	0.936 (0.764-1.16)	1.18 (0.929-1.51)	1.37 (1.06-1.79)	1.58 (1.19-2.11)	1.80 (1.32-2.47)	2.10 (1.48-3.02)	2.35 (1.60-3.49)
6-hr	0.577 (0.477-0.706)	0.766 (0.632-0.938)	1.03 (0.845-1.26)	1.25 (1.02-1.55)	1.57 (1.24-2.01)	1.83 (1.41-2.39)	2.10 (1.59-2.81)	2.39 (1.76-3.30)	2.81 (1.98-4.03)	3.15 (2.14-4.67)
12-hr	0.724 (0.598-0.885)	0.984 (0.812-1.21)	1.34 (1.11-1.65)	1.65 (1.34-2.04)	2.08 (1.64-2.66)	2.43 (1.88-3.17)	2.80 (2.11-3.74)	3.19 (2.34-4.39)	3.74 (2.63-5.37)	4.19 (2.85-6.22)
24-hr	0.959 (0.851-1.10)	1.34 (1.19-1.55)	1.87 (1.65-2.16)	2.31 (2.03-2.69)	2.94 (2.49-3.54)	3.44 (2.85-4.23)	3.97 (3.21-5.00)	4.53 (3.57-5.86)	5.32 (4.02-7.18)	5.95 (4.35-8.32)
2-day	1.06 (0.939-1.22)	1.50 (1.33-1.72)	2.10 (1.85-2.42)	2.61 (2.28-3.03)	3.32 (2.81-4.00)	3.89 (3.23-4.79)	4.50 (3.64-5.67)	5.14 (4.05-6.66)	6.05 (4.58-8.17)	6.79 (4.96-9.48)
3-day	1.14 (1.01-1.31)	1.61 (1.43-1.86)	2.27 (2.00-2.62)	2.82 (2.47-3.28)	3.60 (3.05-4.33)	4.22 (3.51-5.19)	4.88 (3.95-6.15)	5.59 (4.40-7.23)	6.58 (4.97-8.89)	7.39 (5.40-10.3)
4-day	1.21 (1.07-1.39)	1.72 (1.52-1.98)	2.42 (2.14-2.80)	3.01 (2.64-3.51)	3.84 (3.26-4.63)	4.51 (3.74-5.54)	5.21 (4.22-6.57)	5.96 (4.70-7.72)	7.02 (5.31-9.48)	7.88 (5.75-11.0)
7-day	1.29 (1.15-1.49)	1.83 (1.62-2.10)	2.57 (2.27-2.97)	3.20 (2.80-3.73)	4.08 (3.46-4.92)	4.78 (3.97-5.88)	5.52 (4.47-6.95)	6.29 (4.96-8.15)	7.38 (5.57-9.96)	8.24 (6.02-11.5)
10-day	1.36 (1.21-1.57)	1.93 (1.71-2.22)	2.71 (2.40-3.13)	3.37 (2.96-3.93)	4.31 (3.66-5.19)	5.06 (4.20-6.21)	5.83 (4.72-7.34)	6.64 (5.23-8.61)	7.79 (5.89-10.5)	8.69 (6.35-12.1)
20-day	1.58 (1.40-1.82)	2.25 (2.00-2.60)	3.21 (2.83-3.70)	4.01 (3.52-4.68)	5.18 (4.39-6.23)	6.10 (5.07-7.51)	7.08 (5.73-8.91)	8.10 (6.38-10.5)	9.51 (7.19-12.8)	10.6 (7.76-14.9)
30-day	1.79 (1.59-2.06)	2.56 (2.27-2.95)	3.67 (3.24-4.24)	4.62 (4.05-5.39)	6.01 (5.09-7.24)	7.13 (5.91-8.76)	8.29 (6.72-10.4)	9.52 (7.50-12.3)	11.2 (8.49-15.2)	12.6 (9.18-17.6)
45-day	2.07 (1.84-2.39)	2.97 (2.63-3.43)	4.28 (3.78-4.94)	5.42 (4.75-6.32)	7.11 (6.03-8.57)	8.50 (7.05-10.4)	9.95 (8.06-12.5)	11.5 (9.05-14.9)	13.6 (10.3-18.4)	15.3 (11.2-21.4)
60-day	2.30 (2.04-2.65)	3.28 (2.90-3.78)	4.73 (4.18-5.47)	6.02 (5.27-7.01)	7.93 (6.72-9.55)	9.52 (7.90-11.7)	11.2 (9.08-14.1)	13.0 (10.2-16.8)	15.5 (11.7-21.0)	17.6 (12.8-24.5)

[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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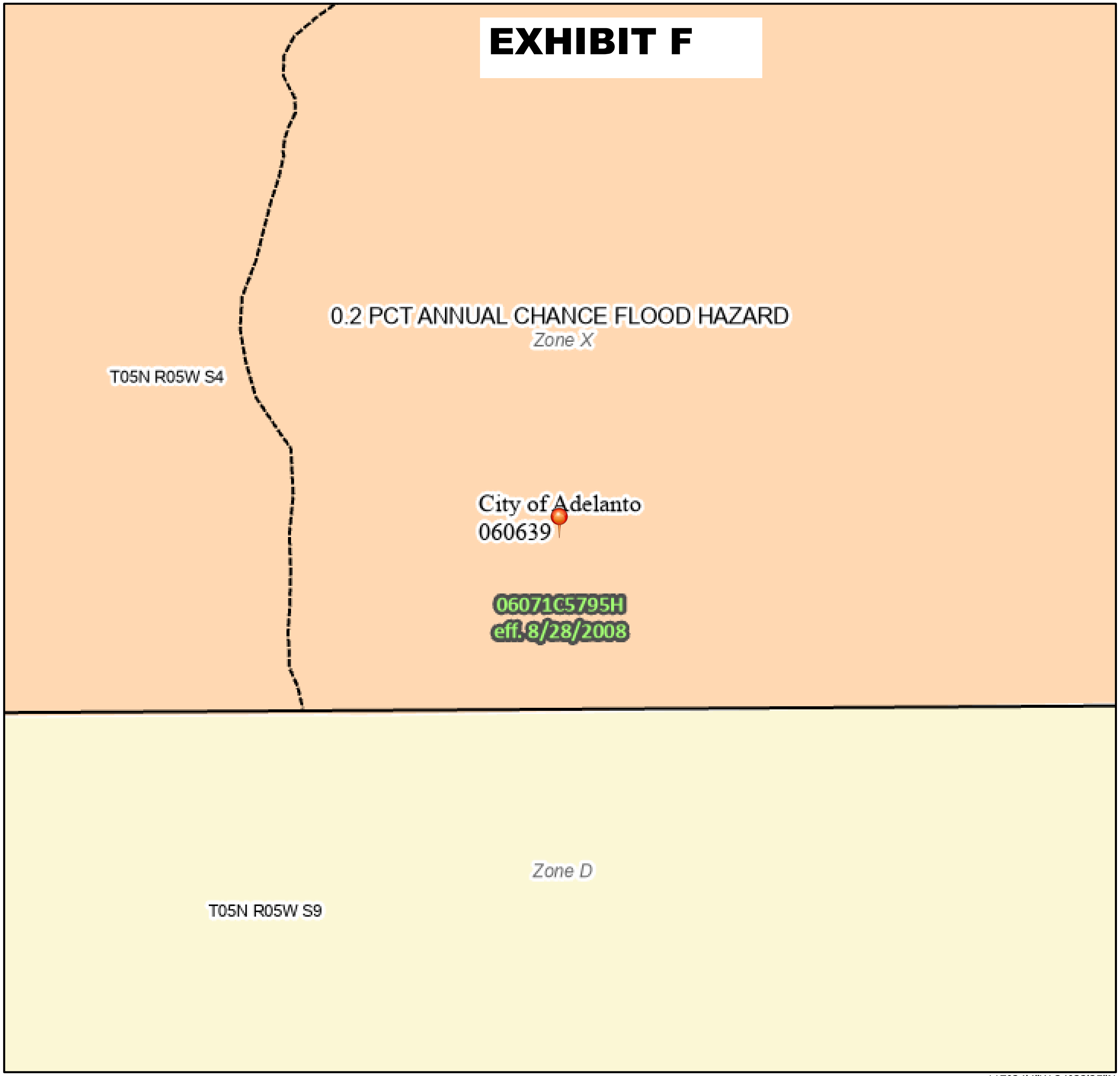
PF graphical

EXHIBIT E

National Flood Hazard Layer FIRMette

FEMA

117°24'42"W 34°32'55"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

117°24'4"W 34°32'25"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/17/2021 at 3:55 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX B:

Rational Method Analysis:

Pre-developed 25-Year 1-Hour

Developed 10-Year 1-Hour

Developed 100-Year 1-Hour

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2018 Version 9.0
Rational Hydrology Study Date: 12/17/21

---

25 year, 1 hour storm
210046 Undeveloped
AMC II

Program License Serial Number 6434

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

```
Rational hydrology study storm event year is    25.0
Computed rainfall intensity:
Storm year =    25.00   1 hour rainfall =     0.766 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
1A   Process from Point/Station       0.000 to Point/Station       1.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   242.110(Ft.)
Top (of initial area) elevation =  2995.210(Ft.)
Bottom (of initial area) elevation =  2989.820(Ft.)
Difference in elevation =      5.390(Ft.)
Slope =    0.02226  s(%)=      2.23
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.098 min.
Rainfall intensity =      2.667(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.705
Subarea runoff =      2.800(CFS)
Total initial stream area =        1.490(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
2A   Process from Point/Station       1.000 to Point/Station       2.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  2989.820(Ft.)
Downstream point elevation =  2986.290(Ft.)
Channel length thru subarea  =   443.320(Ft.)
Channel base width     =   14.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      4.409(CFS)
Manning's 'N'    = 0.033
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      4.409(CFS)
```

```
Depth of flow =   0.183(Ft.), Average velocity =   1.038(Ft/s)
Channel flow top width =   32.331(Ft.)
Flow Velocity =    1.04(Ft/s)
Travel time  =    7.12 min.
Time of concentration =   17.22 min.
Critical depth =      0.125(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Rainfall intensity =      1.836(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.616
Subarea runoff =      3.129(CFS) for    3.750(Ac.)
Total runoff =      5.930(CFS)
Effective area this stream =        5.24(Ac.)
Total Study Area (Main Stream No. 1) =        5.24(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.213(Ft.), Average velocity =   1.128(Ft/s)
Critical depth =      0.147(Ft.)


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Process from Point/Station       1.000 to Point/Station       2.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.240(Ac.)
Runoff from this stream =      5.930(CFS)
Time of concentration =   17.22 min.
Rainfall intensity =     1.836(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.000 to Point/Station       4.000
1B **** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   230.900(Ft.)
Top (of initial area) elevation =  2993.910(Ft.)
Bottom (of initial area) elevation =  2988.050(Ft.)
Difference in elevation =     5.860(Ft.)
Slope =    0.02538  s(%)=       2.54
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.652 min.
Rainfall intensity =      2.752(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.711
Subarea runoff =      2.700(CFS)
Total initial stream area =        1.380(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)


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Process from Point/Station       4.000 to Point/Station       5.000
2B **** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  2988.050(Ft.)
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Downstream point elevation =  2985.110(Ft.)
Channel length thru subarea  =   470.510(Ft.)
Channel base width     =    14.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      3.948(CFS)
Manning's 'N'    = 0.033
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      3.948(CFS)
Depth of flow =   0.184(Ft.), Average velocity =   0.923(Ft/s)
Channel flow top width =   32.434(Ft.)
Flow Velocity =    0.92(Ft/s)
Travel time  =    8.50 min.
Time of concentration =   18.15 min.
Critical depth =      0.117(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Rainfall intensity =      1.769(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.606
Subarea runoff =      2.400(CFS) for    3.380(Ac.)
Total runoff =      5.100(CFS)
Effective area this stream =        4.76(Ac.)
Total Study Area (Main Stream No. 1) =       10.00(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.210(Ft.), Average velocity =   0.991(Ft/s)
Critical depth =      0.135(Ft.)


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Process from Point/Station       4.000 to Point/Station       5.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.760(Ac.)
Runoff from this stream =      5.100(CFS)
Time of concentration =   18.15 min.
Rainfall intensity =     1.769(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station       7.000
**** INITIAL AREA EVALUATION ****
1C ______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.200
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.800
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 82.20
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.332(In/Hr)
Initial subarea data:
Initial area flow distance =   241.110(Ft.)
Top (of initial area) elevation =  2993.800(Ft.)
Bottom (of initial area) elevation =  2987.210(Ft.)
Difference in elevation =     6.590(Ft.)
Slope =    0.02733  s(%)=       2.73
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.676 min.
Rainfall intensity =      2.747(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.791
Subarea runoff =      2.239(CFS)
Total initial stream area =        1.030(Ac.)
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Pervious area fraction = 1.000
Initial area Fm value =    0.332(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       7.000 to Point/Station       8.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  2987.210(Ft.)
Downstream point elevation =  2983.600(Ft.)
Channel length thru subarea  =   358.660(Ft.)
Channel base width     =   14.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      4.984(CFS)
Manning's 'N'    = 0.033
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      4.984(CFS)
Depth of flow =   0.184(Ft.), Average velocity =   1.169(Ft/s)
Channel flow top width =   32.382(Ft.)
Flow Velocity =    1.17(Ft/s)
Travel time  =    5.11 min.
Time of concentration =   14.79 min.
Critical depth =      0.134(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.200
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.800
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 82.20
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.332(In/Hr)
Rainfall intensity =      2.042(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.754
Subarea runoff =      5.423(CFS) for    3.950(Ac.)
Total runoff =      7.662(CFS)
Effective area this stream =       4.98(Ac.)
Total Study Area (Main Stream No. 1) =       14.98(Ac.)
Area averaged Fm value =    0.332(In/Hr)
Depth of flow =   0.229(Ft.), Average velocity =   1.318(Ft/s)
Critical depth =      0.170(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       7.000 to Point/Station       8.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      4.980(Ac.)
Runoff from this stream =      7.662(CFS)
Time of concentration =   14.79 min.
Rainfall intensity =     2.042(In/Hr)
Area averaged loss rate (Fm) =    0.3320(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

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


1      5.93     5.240     17.22    0.578      1.836
2      5.10     4.760     18.15    0.578      1.769
3      7.66     4.980     14.79    0.332      2.042
Qmax(1) =
          1.000 *    1.000 *     5.930) +
          1.056 *    0.948 *     5.100) +
          0.880 *    1.000 *     7.662) + =      17.777
Qmax(2) =
          0.947 *    1.000 *     5.930) +
          1.000 *    1.000 *     5.100) +
```

```
          0.840 *    1.000 *     7.662) + =      17.154
Qmax(3) =
          1.164 *    0.859 *     5.930) +
          1.229 *    0.815 *     5.100) +
          1.000 *    1.000 *     7.662) + =      18.698

Total of 3 streams to confluence:
Flow rates before confluence point:
       5.930       5.100       7.662
Maximum flow rates at confluence using above data:
       17.777       17.154       18.698
Area of streams before confluence:
        5.240        4.760        4.980
Effective area values after confluence:
       14.734       14.980       13.360
Results of confluence:
Total flow rate =     18.698(CFS)
Time of concentration =    14.790 min.
Effective stream area after confluence =     13.360(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.496(In/Hr)
Study area total (this main stream) =      14.98(Ac.)
End of computations, Total Study Area =          14.98 (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 =  72.1
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2018 Version 9.0
Rational Hydrology Study Date: 12/13/21

10-year 1-hr storm
Developed project 210046
AMC II

Program License Serial Number 6434

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

```
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.603 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        0.000 to Point/Station       1.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Initial subarea data:
Initial area flow distance =    289.000(Ft.)
Top (of initial area) elevation =  2994.330(Ft.)
Bottom (of initial area) elevation =  2990.170(Ft.)
Difference in elevation =      4.160(Ft.)
Slope =    0.01439  s(%)=       1.44
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.763 min.
Rainfall intensity =      2.318(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.710
Subarea runoff =      0.938(CFS)
Total initial stream area =         0.570(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.489(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station       2.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2990.170(Ft.)
End of street segment elevation =  2987.900(Ft.)
Length of street segment  =   494.000(Ft.)
Height of curb above gutter flowline  =     8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      1.740(CFS)
Depth of flow =   0.302(Ft.), Average velocity =   1.517(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.372(Ft.)
Flow velocity =   1.52(Ft/s)
Travel time =    5.43 min.     TC =   14.19  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Rainfall intensity =      1.654(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.634
Subarea runoff =      1.547(CFS) for    1.800(Ac.)
Total runoff =      2.486(CFS)
Effective area this stream =       2.37(Ac.)
Total Study Area (Main Stream No. 1) =       2.37(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      2.486(CFS)
Half street flow at end of street =      2.486(CFS)
Depth of flow =   0.334(Ft.), Average velocity =   1.653(Ft/s)
Flow width (from curb towards crown)=  11.968(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2987.900(Ft.)
End of street segment elevation =  2986.400(Ft.)
Length of street segment  =   372.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.220(CFS)
Depth of flow =   0.367(Ft.), Average velocity =   1.676(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.603(Ft.)
Flow velocity =   1.68(Ft/s)
Travel time =    3.70 min.     TC =   17.89  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Rainfall intensity =      1.407(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.587
```

```
Subarea runoff =      1.396(CFS) for    2.330(Ac.)
Total runoff =      3.882(CFS)
Effective area this stream =        4.70(Ac.)
Total Study Area (Main Stream No. 1) =        4.70(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      3.882(CFS)
Half street flow at end of street =      3.882(CFS)
Depth of flow =   0.388(Ft.), Average velocity =   1.754(Ft/s)
Flow width (from curb towards crown)=  14.635(Ft.)


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Process from Point/Station       3.000 to Point/Station       4.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  2986.400(Ft.)
Downstream point elevation =  2985.700(Ft.)
Channel length thru subarea  =   183.000(Ft.)
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Estimated mean flow rate at midpoint of channel =      4.390(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.670(Ft.)
Flow(q) thru subarea =      4.390(CFS)
Depth of flow =   0.472(Ft.), Average velocity =   3.097(Ft/s)
Channel flow top width =    3.000(Ft.)
Flow Velocity =    3.10(Ft/s)
Travel time  =    0.98 min.
Time of concentration =   18.88 min.
Critical depth =      0.406(Ft.)
 Adding area flow to channel
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Rainfall intensity =      1.355(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.575
Subarea runoff =      0.942(CFS) for    1.490(Ac.)
Total runoff =      4.824(CFS)
Effective area this stream =        6.19(Ac.)
Total Study Area (Main Stream No. 1) =        6.19(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Depth of flow =   0.503(Ft.), Average velocity =   3.196(Ft/s)
Critical depth =      0.430(Ft.)


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Process from Point/Station       4.000 to Point/Station       5.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2985.700(Ft.)
End of street segment elevation =  2984.100(Ft.)
Length of street segment  =   397.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
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Estimated mean flow rate at midpoint of street =      5.037(CFS)
Depth of flow =   0.419(Ft.), Average velocity =   1.870(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.195(Ft.)
Flow velocity =   1.87(Ft/s)
Travel time =    3.54 min.     TC =   22.41  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Rainfall intensity =      1.201(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.534
Subarea runoff =      0.350(CFS) for    1.880(Ac.)
Total runoff =      5.174(CFS)
Effective area this stream =        8.07(Ac.)
Total Study Area (Main Stream No. 1) =        8.07(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      5.174(CFS)
Half street flow at end of street =      5.174(CFS)
Depth of flow =   0.422(Ft.), Average velocity =   1.882(Ft/s)
Flow width (from curb towards crown)=  16.365(Ft.)


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Process from Point/Station       4.000 to Point/Station       5.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      8.070(Ac.)
Runoff from this stream =      5.174(CFS)
Time of concentration =   22.41 min.
Rainfall intensity =     1.201(In/Hr)
Area averaged loss rate (Fm) =    0.4889(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station       7.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Initial subarea data:
Initial area flow distance =   312.000(Ft.)
Top (of initial area) elevation =  2994.000(Ft.)
Bottom (of initial area) elevation =    87.200(Ft.)
Difference in elevation =  2906.800(Ft.)
Slope =    9.31667  s(%)=     931.67
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    2.476 min.
Rainfall intensity =      5.616(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.822
Subarea runoff =      2.953(CFS)
Total initial stream area =        0.640(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.489(In/Hr)


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Process from Point/Station       7.000 to Point/Station       8.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    87.200(Ft.)
End of street segment elevation =    85.700(Ft.)
Length of street segment  =   362.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.008
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      5.723(CFS)
Depth of flow =   0.353(Ft.), Average velocity =   1.645(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.916(Ft.)
Flow velocity =   1.64(Ft/s)
Travel time =    3.67 min.     TC =    6.14  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Rainfall intensity =      2.972(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.752
Subarea runoff =      5.429(CFS) for    3.110(Ac.)
Total runoff =      8.382(CFS)
Effective area this stream =        3.75(Ac.)
Total Study Area (Main Stream No. 2) =       11.82(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      8.382(CFS)
Half street flow at end of street =      4.191(CFS)
Depth of flow =   0.395(Ft.), Average velocity =   1.806(Ft/s)
Flow width (from curb towards crown)=  14.999(Ft.)


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Process from Point/Station       8.000 to Point/Station       9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    85.700(Ft.)
End of street segment elevation =    84.100(Ft.)
Length of street segment  =   311.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.008
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      8.686(CFS)
Depth of flow =   0.476(Ft.), Average velocity =   2.345(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  19.062(Ft.)
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Flow velocity =   2.34(Ft/s)
Travel time =    2.21 min.     TC =    8.35  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Rainfall intensity =      2.397(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.716
Subarea runoff =      0.514(CFS) for    1.430(Ac.)
Total runoff =      8.896(CFS)
Effective area this stream =        5.18(Ac.)
Total Study Area (Main Stream No. 2) =       13.25(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      8.896(CFS)
Half street flow at end of street =      8.896(CFS)
Depth of flow =   0.480(Ft.), Average velocity =   2.358(Ft/s)
Flow width (from curb towards crown)=  19.237(Ft.)


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Process from Point/Station        8.000 to Point/Station        9.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.180(Ac.)
Runoff from this stream =      8.896(CFS)
Time of concentration =    8.35 min.
Rainfall intensity =     2.397(In/Hr)
Area averaged loss rate (Fm) =    0.4889(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Initial subarea data:
Initial area flow distance =   265.000(Ft.)
Top (of initial area) elevation =    92.200(Ft.)
Bottom (of initial area) elevation =    85.500(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02528  s(%)=       2.53
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.563 min.
Rainfall intensity =      2.570(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.729
Subarea runoff =      0.899(CFS)
Total initial stream area =        0.480(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.489(In/Hr)


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Process from Point/Station       11.000 to Point/Station       12.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    85.500(Ft.)
End of street segment elevation =    84.100(Ft.)
Length of street segment  =   320.000(Ft.)
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Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.008
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      1.531(CFS)
Depth of flow =   0.294(Ft.), Average velocity =   1.444(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   9.943(Ft.)
Flow velocity =   1.44(Ft/s)
Travel time =    3.69 min.     TC =   11.26  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.489(In/Hr)
Rainfall intensity =      1.946(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.674
Subarea runoff =      1.199(CFS) for    1.120(Ac.)
Total runoff =      2.098(CFS)
Effective area this stream =        1.60(Ac.)
Total Study Area (Main Stream No. 2) =       14.85(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      2.098(CFS)
Half street flow at end of street =      2.098(CFS)
Depth of flow =   0.321(Ft.), Average velocity =   1.558(Ft/s)
Flow width (from curb towards crown)=  11.294(Ft.)


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Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      1.600(Ac.)
Runoff from this stream =      2.098(CFS)
Time of concentration =   11.26 min.
Rainfall intensity =     1.946(In/Hr)
Area averaged loss rate (Fm) =    0.4889(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Summary of stream data:

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


1      8.90     5.180      8.35    0.489      2.397
2      2.10     1.600     11.26    0.489      1.946
Qmax(1) =
          1.000 *    1.000 *     8.896) +
          1.310 *    0.742 *     2.098) + =      10.935
Qmax(2) =
          0.763 *    1.000 *     8.896) +
          1.000 *    1.000 *     2.098) + =       8.889

Total of 2 streams to confluence:
Flow rates before confluence point:
       8.896       2.098
Maximum flow rates at confluence using above data:
```

```
       10.935        8.889
Area of streams before confluence:
        5.180        1.600
Effective area values after confluence:
        6.368        6.780
Results of confluence:
Total flow rate =     10.935(CFS)
Time of concentration =     8.355 min.
Effective stream area after confluence =      6.368(Ac.)
Study area average Pervious fraction(Ap) =  0.500
Study area average soil loss rate(Fm) =    0.489(In/Hr)
Study area total (this main stream) =      6.78(Ac.)


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Process from Point/Station       12.000 to Point/Station      13.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =    84.100(Ft.)
Downstream point/station elevation =    83.700(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    10.935(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    10.935(CFS)
Normal flow depth in pipe =   14.16(In.)
Flow top width inside pipe =   19.69(In.)
Critical Depth =   14.78(In.)
Pipe flow velocity =      6.34(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =     8.46 min.


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Process from Point/Station       83.700 to Point/Station      83.500
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      6.368(Ac.)
Runoff from this stream =     10.935(CFS)
Time of concentration =    8.46 min.
Rainfall intensity =     2.376(In/Hr)
Area averaged loss rate (Fm) =    0.4889(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Summary of stream data:

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


1      5.17     8.070     22.41    0.489      1.201
2     10.94     6.368      8.46    0.489      2.376
Qmax(1) =
          1.000 *    1.000 *     5.174) +
          0.377 *    1.000 *    10.935) + =       9.302
Qmax(2) =
          2.649 *    0.377 *     5.174) +
          1.000 *    1.000 *    10.935) + =      16.109

Total of 2 main streams to confluence:
Flow rates before confluence point:
       6.174      11.935
Maximum flow rates at confluence using above data:
        9.302       16.109
Area of streams before confluence:
        8.070        6.368
Effective area values after confluence:
       14.438        9.413


Results of confluence:
```

```
Total flow rate =     16.109(CFS)
Time of concentration =     8.460 min.
Effective stream area after confluence  =      9.413(Ac.)
Study area average Pervious fraction(Ap) =  0.500
Study area average soil loss rate(Fm) =    0.489(In/Hr)
Study area total =      14.44(Ac.)


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Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =    83.700(Ft.)
Downstream point/station elevation =    83.500(Ft.)
Pipe length  =    20.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    16.109(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    16.109(CFS)
Normal flow depth in pipe =   16.57(In.)
Flow top width inside pipe =   22.19(In.)
Critical Depth =   17.36(In.)
Pipe flow velocity =      6.97(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     8.51 min.
End of computations, Total Study Area =           14.85 (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) = 0.500
Area averaged SCS curve number =  32.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2018 Version 9.0
Rational Hydrology Study Date: 12/18/21

100-Year 1-Hour
Project 210046 Developed
AMC III

Program License Serial Number 6434

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.030 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

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1A Process from Point/Station 0.000 to Point/Station 1.000
**** INITIAL AREA EVALUATION ****

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RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000 Max loss rate(Fm)= 0.393(In/Hr)
Initial subarea data:
Initial area flow distance = 289.000(Ft.)
Top (of initial area) elevation = 2994.330(Ft.)
Bottom (of initial area) elevation = 2990.170(Ft.)
Difference in elevation = 4.160(Ft.)
Slope = 0.01439 s(%)= 1.44
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.763 min.
Rainfall intensity = 3.960(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.811
Subarea runoff = 1.830(CFS)
Total initial stream area = 0.570(Ac.)
Pervious area fraction = 0.500
Initial area Fm value = 0.393(In/Hr)

++
2A Process from Point/Station 1.000 to Point/Station 2.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

____
Top of street segment elevation = 2990.170(Ft.)
End of street segment elevation = 2987.900(Ft.)
Length of street segment = 494.000(Ft.)
Height of curb above gutter flowline = 8.0(In.)
Width of half street (curb to crown) = 30.000(Ft.)
Distance from crown to crossfall grade break = 28.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [1] side(s) of the street

```
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.692(CFS)
Depth of flow =   0.375(Ft.), Average velocity =   1.820(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.990(Ft.)
Flow velocity =   1.82(Ft/s)
Travel time =    4.52 min.     TC =   13.29  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.393(In/Hr)
Rainfall intensity =      2.959(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.781
Subarea runoff =      3.644(CFS) for    1.800(Ac.)
Total runoff =      5.474(CFS)
Effective area this stream =        2.37(Ac.)
Total Study Area (Main Stream No. 1) =        2.37(Ac.)
Area averaged Fm value =    0.393(In/Hr)
Street flow at end of street =      5.474(CFS)
Half street flow at end of street =      5.474(CFS)
Depth of flow =   0.421(Ft.), Average velocity =   2.005(Ft/s)
Flow width (from curb towards crown)=  16.307(Ft.)


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Process from Point/Station       2.000 to Point/Station       3.000
3A **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2987.900(Ft.)
End of street segment elevation =  2986.400(Ft.)
Length of street segment  =   372.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      7.358(CFS)
Depth of flow =   0.470(Ft.), Average velocity =   2.053(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  18.742(Ft.)
Flow velocity =   2.05(Ft/s)
Travel time =    3.02 min.     TC =   16.31  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.393(In/Hr)
```

```
Rainfall intensity =      2.564(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.762
Subarea runoff =      3.710(CFS) for    2.330(Ac.)
Total runoff =      9.185(CFS)
Effective area this stream =        4.70(Ac.)
Total Study Area (Main Stream No. 1) =        4.70(Ac.)
Area averaged Fm value =    0.393(In/Hr)
Street flow at end of street =      9.185(CFS)
Half street flow at end of street =      9.185(CFS)
Depth of flow =   0.502(Ft.), Average velocity =   2.186(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  20.000(Ft.)
```

4A

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.000 to Point/Station       4.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  2986.400(Ft.)
Downstream point elevation =  2985.700(Ft.)
Channel length thru subarea  =   183.000(Ft.)
Channel base width     =    4.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Estimated mean flow rate at midpoint of channel =     10.438(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     10.438(CFS)
Depth of flow =   0.673(Ft.), Average velocity =   3.878(Ft/s)
Channel flow top width =    4.000(Ft.)
Flow Velocity =    3.88(Ft/s)
Travel time  =    0.79 min.
Time of concentration =   17.09 min.
Critical depth =      0.594(Ft.)
 Adding area flow to channel
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.393(In/Hr)
Rainfall intensity =      2.481(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.758
Subarea runoff =      2.448(CFS) for    1.490(Ac.)
Total runoff =     11.633(CFS)
Effective area this stream =        6.19(Ac.)
Total Study Area (Main Stream No. 1) =        6.19(Ac.)
Area averaged Fm value =    0.393(In/Hr)
Depth of flow =   0.724(Ft.), Average velocity =   4.019(Ft/s)
Critical depth =      0.641(Ft.)
```

5A

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.000 to Point/Station       5.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2985.700(Ft.)
End of street segment elevation =  2984.100(Ft.)
Length of street segment  =   397.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
```

```
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     12.558(CFS)
Depth of flow =   0.545(Ft.), Average velocity =   2.475(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.000(Ft.)
Flow velocity =   2.47(Ft/s)
Travel time =    2.67 min.     TC =   19.77  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.393(In/Hr)
Rainfall intensity =      2.241(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.742
Subarea runoff =      1.790(CFS) for    1.880(Ac.)
Total runoff =     13.424(CFS)
Effective area this stream =        8.07(Ac.)
Total Study Area (Main Stream No. 1) =        8.07(Ac.)
Area averaged Fm value =    0.393(In/Hr)
Street flow at end of street =     13.424(CFS)
Half street flow at end of street =     13.424(CFS)
Depth of flow =   0.556(Ft.), Average velocity =   2.541(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  20.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
MSC21  Process from Point/Station       4.000 to Point/Station       5.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      8.070(Ac.)
Runoff from this stream =     13.424(CFS)
Time of concentration =   19.77 min.
Rainfall intensity =     2.241(In/Hr)
Area averaged loss rate (Fm) =    0.3926(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
1B  Process from Point/Station       6.000 to Point/Station       7.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.393(In/Hr)
Initial subarea data:
Initial area flow distance =   312.000(Ft.)
Top (of initial area) elevation =  2994.000(Ft.)
Bottom (of initial area) elevation =  2987.200(Ft.)
Difference in elevation =     6.800(Ft.)
Slope =    0.02179  s(%)=       2.18
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.316 min.
```

```
Rainfall intensity =      4.108(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.814
Subarea runoff =      2.140(CFS)
Total initial stream area =        0.640(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.393(In/Hr)
```

2B

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       7.000 to Point/Station       8.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2987.200(Ft.)
End of street segment elevation =  2985.700(Ft.)
Length of street segment  =   362.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      5.839(CFS)
Depth of flow =   0.355(Ft.), Average velocity =   1.653(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.018(Ft.)
Flow velocity =   1.65(Ft/s)
Travel time =    3.65 min.     TC =   11.97  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.393(In/Hr)
Rainfall intensity =      3.184(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.789
Subarea runoff =      7.281(CFS) for    3.110(Ac.)
Total runoff =      9.421(CFS)
Effective area this stream =        3.75(Ac.)
Total Study Area (Main Stream No. 2) =       11.82(Ac.)
Area averaged Fm value =    0.393(In/Hr)
Street flow at end of street =      9.421(CFS)
Half street flow at end of street =      4.710(CFS)
Depth of flow =   0.409(Ft.), Average velocity =   1.858(Ft/s)
Flow width (from curb towards crown)=  15.695(Ft.)
```

3B

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       8.000 to Point/Station       9.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2985.700(Ft.)
End of street segment elevation =  2984.100(Ft.)
Length of street segment  =   311.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     10.453(CFS)
Depth of flow =   0.502(Ft.), Average velocity =   2.477(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.000(Ft.)
Flow velocity =   2.48(Ft/s)
Travel time =    2.09 min.     TC =   14.06  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.393(In/Hr)
Rainfall intensity =      2.844(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.776
Subarea runoff =      2.009(CFS) for    1.430(Ac.)
Total runoff =     11.430(CFS)
Effective area this stream =        5.18(Ac.)
Total Study Area (Main Stream No. 2) =       13.25(Ac.)
Area averaged Fm value =    0.393(In/Hr)
Street flow at end of street =     11.430(CFS)
Half street flow at end of street =     11.430(CFS)
Depth of flow =   0.514(Ft.), Average velocity =   2.566(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  20.000(Ft.)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       8.000 to Point/Station       9.000
LC21 **** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.180(Ac.)
Runoff from this stream =     11.430(CFS)
Time of concentration =   14.06 min.
Rainfall intensity =     2.844(In/Hr)
Area averaged loss rate (Fm) =    0.3926(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
1C Process from Point/Station      10.000 to Point/Station      11.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.131(In/Hr)
Initial subarea data:
Initial area flow distance =   265.000(Ft.)
Top (of initial area) elevation =  2992.200(Ft.)
Bottom (of initial area) elevation =  2985.500(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.02528  s(%)=       2.53
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.563 min.
Rainfall intensity =      4.390(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.873
Subarea runoff =      1.840(CFS)
Total initial stream area =        0.480(Ac.)
Pervious area fraction = 0.500
Initial area Fm value =    0.131(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
```

2C

```
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2985.500(Ft.)
End of street segment elevation =  2984.100(Ft.)
Length of street segment  =   320.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.340(CFS)
Depth of flow =   0.367(Ft.), Average velocity =   1.744(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.580(Ft.)
Flow velocity =   1.74(Ft/s)
Travel time =    3.06 min.     TC =   10.62  min.
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.200
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.800
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 61.60
Adjusted SCS curve number for AMC 3 = 80.28
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.183(In/Hr)
Rainfall intensity =      3.461(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.857
Subarea runoff =      2.904(CFS) for    1.120(Ac.)
Total runoff =      4.744(CFS)
Effective area this stream =        1.60(Ac.)
Total Study Area (Main Stream No. 2) =       14.85(Ac.)
Area averaged Fm value =    0.167(In/Hr)
Street flow at end of street =      4.744(CFS)
Half street flow at end of street =      4.744(CFS)
Depth of flow =   0.406(Ft.), Average velocity =   1.900(Ft/s)
Flow width (from curb towards crown)=  15.573(Ft.)


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

LC22

```
Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      1.600(Ac.)
Runoff from this stream =      4.744(CFS)
Time of concentration =   10.62 min.
Rainfall intensity =     3.461(In/Hr)
Area averaged loss rate (Fm) =    0.1670(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Summary of stream data:

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

```
1     11.43     5.180     14.06    0.393      2.844
2      4.74     1.600     10.62    0.167      3.461
Qmax(1) =
          1.000 *    1.000 *    11.430) +
          0.813 *    1.000 *     4.744) + =      15.285
Qmax(2) =
          1.252 *    0.755 *    11.430) +
          1.000 *    1.000 *     4.744) + =      15.551

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.430       4.744
Maximum flow rates at confluence using above data:
       15.285       15.551
Area of streams before confluence:
        5.180        1.600
Effective area values after confluence:
        6.780        5.513
Results of confluence:
Total flow rate =     15.551(CFS)
Time of concentration =    10.622 min.
Effective stream area after confluence =      5.513(Ac.)
Study area average Pervious fraction(Ap) =  0.500
Study area average soil loss rate(Fm) =    0.339(In/Hr)
Study area total (this main stream) =       6.78(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
```

P1

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2984.100(Ft.)
Downstream point/station elevation =  2983.700(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    15.551(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    15.551(CFS)
Normal flow depth in pipe =   16.15(In.)
Flow top width inside pipe =   22.52(In.)
Critical Depth =   17.06(In.)
Pipe flow velocity =      6.92(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    10.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
```

MSC22

```
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.513(Ac.)
Runoff from this stream =     15.551(CFS)
Time of concentration =   10.72 min.
Rainfall intensity =     3.439(In/Hr)
Area averaged loss rate (Fm) =    0.3393(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Summary of stream data:

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


1     13.42     8.070     19.77    0.393      2.241
2     15.55     5.513     10.72    0.339      3.439
Qmax(1) =
          1.000 *    1.000 *    13.424) +
          0.613 *    1.000 *    15.551) + =      22.962
Qmax(2) =
```

```
          1.648 *    0.542 *    13.424) +
          1.000 *    1.000 *    15.551) + =      27.550

Total of 2 main streams to confluence:
Flow rates before confluence point:
      14.424      16.551
Maximum flow rates at confluence using above data:
       22.962       27.550
Area of streams before confluence:
        8.070        5.513
Effective area values after confluence:
       13.583        9.889


Results of confluence:
Total flow rate =     27.550(CFS)
Time of concentration =    10.718 min.
Effective stream area after confluence  =      9.889(Ac.)
Study area average Pervious fraction(Ap) =  0.500
Study area average soil loss rate(Fm) =    0.371(In/Hr)
Study area total =      13.58(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  2983.700(Ft.)
Downstream point/station elevation =  2983.500(Ft.)
Pipe length  =    20.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    27.550(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    27.550(CFS)
Normal flow depth in pipe =   19.83(In.)
Flow top width inside pipe =   28.40(In.)
Critical Depth =   21.47(In.)
Pipe flow velocity =      8.00(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    10.76 min.
End of computations, Total Study Area =           14.85 (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) = 0.500
Area averaged SCS curve number =  35.4
```

APPENDIX C:

Unit-Hydrograph Method Analysis:

Developed 10-Year 24-Hour

Developed 100-Year 3-Hour

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 12/13/21

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6434

10-year 24-hour
Developed
AMC III

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
14.85	1	0.60
Rainfall data for year 10		
14.85	6	1.25
Rainfall data for year 10		
14.85	24	2.31

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	32.0	14.85	1.000	0.978	0.500	0.489

Area-averaged adjusted loss rate Fm (In/Hr) = 0.489

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
7.42	0.500	32.0	32.0	11.55	0.000
7.42	0.500	98.0	98.0	0.20	0.901

Area-averaged catchment yield fraction, Y = 0.451
Area-averaged low loss fraction, Yb = 0.549
User entry of time of concentration = 0.123 (hours)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      14.85(Ac.)
Catchment Lag time =   0.098 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 84.6196
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.489(In/Hr)
Average low loss rate fraction (Yb) = 0.549 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.286(In)
Computed peak 30-minute rainfall =  0.490(In)
Specified peak 1-hour rainfall =  0.603(In)
Computed peak 3-hour rainfall =  0.943(In)
Specified peak 6-hour rainfall =  1.250(In)
Specified peak 24-hour rainfall =  2.310(In)


Rainfall depth area reduction factors:
Using a total area of      14.85(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.286(In)
30-minute factor = 0.999    Adjusted rainfall =  0.489(In)
1-hour factor = 0.999       Adjusted rainfall =  0.603(In)
3-hour factor = 1.000       Adjusted rainfall =  0.943(In)
6-hour factor = 1.000       Adjusted rainfall =  1.250(In)
24-hour factor = 1.000      Adjusted rainfall =  2.310(In)
---------------------------------------------------------------------

                      U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
               (K =       179.59 (CFS))

  1               12.188                 21.888
  2               60.056                 85.968
  3               79.484                 34.890
  4               88.172                 15.604
  5               92.985                  8.644
  6               95.964                  5.349
  7               97.716                  3.147
  8               98.716                  1.797
  9               99.602                  1.591
 10              100.000                  0.714
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.15(In)
Total effective rainfall =      1.16(In)
Peak flow rate in flood hydrograph =     23.03(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f      H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        7.5      15.0      22.5      30.0
-----------------------------------------------------------------------
  5+ 5       0.1293      0.35  Q  V       |         |         |         |
  5+10       0.1317      0.35  Q  V       |         |         |         |
  5+15       0.1342      0.35  Q  V       |         |         |         |
  5+20       0.1366      0.36  Q  V       |         |         |         |
  5+25       0.1391      0.36  Q  V       |         |         |         |
  5+30       0.1416      0.36  Q  V       |         |         |         |
  5+35       0.1441      0.36  Q   V      |         |         |         |
  5+40       0.1466      0.36  Q   V      |         |         |         |
  5+45       0.1491      0.36  Q   V      |         |         |         |
```

```
 5+50       0.1516      0.37  Q   V     |         |         |         |
 5+55       0.1541      0.37  Q   V     |         |         |         |
 6+ 0       0.1567      0.37  Q   V     |         |         |         |
 6+ 5       0.1592      0.37  Q   V     |         |         |         |
 6+10       0.1618      0.37  Q   V     |         |         |         |
 6+15       0.1644      0.37  Q   V     |         |         |         |
 6+20       0.1670      0.38  Q   V     |         |         |         |
 6+25       0.1696      0.38  Q   V     |         |         |         |
 6+30       0.1722      0.38  Q   V     |         |         |         |
 6+35       0.1748      0.38  Q   V     |         |         |         |
 6+40       0.1775      0.38  Q   V     |         |         |         |
 6+45       0.1801      0.39  Q    V    |         |         |         |
 6+50       0.1828      0.39  Q    V    |         |         |         |
 6+55       0.1854      0.39  Q    V    |         |         |         |
 7+ 0       0.1881      0.39  Q    V    |         |         |         |
 7+ 5       0.1908      0.39  Q    V    |         |         |         |
 7+10       0.1936      0.40  Q    V    |         |         |         |
 7+15       0.1963      0.40  Q    V    |         |         |         |
 7+20       0.1991      0.40  Q    V    |         |         |         |
 7+25       0.2018      0.40  Q    V    |         |         |         |
 7+30       0.2046      0.40  Q    V    |         |         |         |
 7+35       0.2074      0.41  Q    V    |         |         |         |
 7+40       0.2102      0.41  Q    V    |         |         |         |
 7+45       0.2130      0.41  Q    V    |         |         |         |
 7+50       0.2159      0.41  Q     V   |         |         |         |
 7+55       0.2187      0.41  Q     V   |         |         |         |
 8+ 0       0.2216      0.42  Q     V   |         |         |         |
 8+ 5       0.2245      0.42  Q     V   |         |         |         |
 8+10       0.2274      0.42  Q     V   |         |         |         |
 8+15       0.2303      0.42  Q     V   |         |         |         |
 8+20       0.2332      0.43  Q     V   |         |         |         |
 8+25       0.2362      0.43  Q     V   |         |         |         |
 8+30       0.2392      0.43  Q     V   |         |         |         |
 8+35       0.2422      0.43  Q     V   |         |         |         |
 8+40       0.2452      0.44  Q     V   |         |         |         |
 8+45       0.2482      0.44  Q     V   |         |         |         |
 8+50       0.2512      0.44  Q      V  |         |         |         |
 8+55       0.2543      0.45  Q      V  |         |         |         |
 9+ 0       0.2574      0.45  Q      V  |         |         |         |
 9+ 5       0.2605      0.45  Q      V  |         |         |         |
 9+10       0.2636      0.45  Q      V  |         |         |         |
 9+15       0.2668      0.46  Q      V  |         |         |         |
 9+20       0.2699      0.46  Q      V  |         |         |         |
 9+25       0.2731      0.46  Q      V  |         |         |         |
 9+30       0.2764      0.47  Q      V  |         |         |         |
 9+35       0.2796      0.47  Q      V  |         |         |         |
 9+40       0.2828      0.47  Q      V  |         |         |         |
 9+45       0.2861      0.48  Q      V  |         |         |         |
 9+50       0.2894      0.48  Q       V |         |         |         |
 9+55       0.2928      0.48  Q       V |         |         |         |
10+ 0       0.2961      0.49  Q       V |         |         |         |
10+ 5       0.2995      0.49  Q       V |         |         |         |
10+10       0.3029      0.49  Q       V |         |         |         |
10+15       0.3063      0.50  Q       V |         |         |         |
10+20       0.3098      0.50  Q       V |         |         |         |
10+25       0.3133      0.51  Q       V |         |         |         |
10+30       0.3168      0.51  Q       V |         |         |         |
10+35       0.3203      0.51  Q       V |         |         |         |
10+40       0.3239      0.52  Q        V|         |         |         |
10+45       0.3275      0.52  Q        V|         |         |         |
10+50       0.3311      0.53  Q        V|         |         |         |
10+55       0.3348      0.53  Q        V|         |         |         |
11+ 0       0.3385      0.54  Q        V|         |         |         |
11+ 5       0.3422      0.54  Q        V|         |         |         |
11+10       0.3460      0.55  Q        V|         |         |         |
11+15       0.3498      0.55  Q        V|         |         |         |
11+20       0.3536      0.56  Q        V|         |         |         |
11+25       0.3575      0.56  Q        V|         |         |         |
11+30       0.3614      0.57  Q         V         |         |         |
11+35       0.3654      0.57  Q         V         |         |         |
11+40       0.3694      0.58  Q         V         |         |         |
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11+45       0.3734      0.59  Q         V         |         |         |
11+50       0.3775      0.59  Q         V         |         |         |
11+55       0.3816      0.60  Q         V         |         |         |
12+ 0       0.3858      0.60  Q         V         |         |         |
12+ 5       0.3899      0.61  Q         V         |         |         |
12+10       0.3940      0.59  Q         |V        |         |         |
12+15       0.3980      0.59  Q         |V        |         |         |
12+20       0.4021      0.59  Q         |V        |         |         |
12+25       0.4062      0.59  Q         |V        |         |         |
12+30       0.4103      0.60  Q         |V        |         |         |
12+35       0.4145      0.61  Q         |V        |         |         |
12+40       0.4187      0.62  Q         |V        |         |         |
12+45       0.4230      0.62  Q         |V        |         |         |
12+50       0.4273      0.63  Q         |V        |         |         |
12+55       0.4318      0.64  Q         | V       |         |         |
13+ 0       0.4362      0.65  Q         | V       |         |         |
13+ 5       0.4408      0.66  Q         | V       |         |         |
13+10       0.4454      0.67  Q         | V       |         |         |
13+15       0.4501      0.68  Q         | V       |         |         |
13+20       0.4549      0.70  Q         | V       |         |         |
13+25       0.4598      0.71  Q         | V       |         |         |
13+30       0.4648      0.72  Q         | V       |         |         |
13+35       0.4698      0.73  Q         |  V      |         |         |
13+40       0.4750      0.75  Q         |  V      |         |         |
13+45       0.4802      0.76  |Q        |  V      |         |         |
13+50       0.4856      0.78  |Q        |  V      |         |         |
13+55       0.4910      0.79  |Q        |  V      |         |         |
14+ 0       0.4967      0.81  |Q        |  V      |         |         |
14+ 5       0.5024      0.83  |Q        |   V     |         |         |
14+10       0.5083      0.85  |Q        |   V     |         |         |
14+15       0.5143      0.87  |Q        |   V     |         |         |
14+20       0.5204      0.90  |Q        |   V     |         |         |
14+25       0.5268      0.92  |Q        |   V     |         |         |
14+30       0.5333      0.95  |Q        |   V     |         |         |
14+35       0.5400      0.98  |Q        |    V    |         |         |
14+40       0.5470      1.01  |Q        |    V    |         |         |
14+45       0.5542      1.04  |Q        |    V    |         |         |
14+50       0.5616      1.08  |Q        |    V    |         |         |
14+55       0.5693      1.12  |Q        |    V    |         |         |
15+ 0       0.5773      1.17  |Q        |     V   |         |         |
15+ 5       0.5857      1.21  |Q        |     V   |         |         |
15+10       0.5945      1.28  |Q        |     V   |         |         |
15+15       0.6037      1.34  |Q        |     V   |         |         |
15+20       0.6135      1.42  |Q        |      V  |         |         |
15+25       0.6234      1.45  |Q        |      V  |         |         |
15+30       0.6327      1.35  |Q        |      V  |         |         |
15+35       0.6422      1.37  |Q        |      V  |         |         |
15+40       0.6524      1.49  |Q        |       V |         |         |
15+45       0.6638      1.65  | Q       |       V |         |         |
15+50       0.6771      1.93  | Q       |       V |         |         |
15+55       0.6932      2.34  |  Q      |        V|         |         |
16+ 0       0.7156      3.25  |   Q     |        V|         |         |
16+ 5       0.7780      9.06  |         | Q       |V        |         |
16+10       0.9367     23.03  |         |         |     V   Q         |
16+15       1.0121     10.96  |         |   Q     |       V |         |
16+20       1.0529      5.91  |      Q  |         |        V|         |
16+25       1.0797      3.89  |    Q    |         |         V         |
16+30       1.1004      3.00  |   Q     |         |         V         |
16+35       1.1163      2.32  |  Q      |         |         |V        |
16+40       1.1291      1.85  | Q       |         |         |V        |
16+45       1.1405      1.66  | Q       |         |         |V        |
16+50       1.1498      1.34  |Q        |         |         | V       |
16+55       1.1573      1.09  |Q        |         |         | V       |
17+ 0       1.1642      1.01  |Q        |         |         | V       |
17+ 5       1.1708      0.95  |Q        |         |         | V       |
17+10       1.1770      0.90  |Q        |         |         | V       |
17+15       1.1829      0.85  |Q        |         |         |  V      |
17+20       1.1885      0.81  |Q        |         |         |  V      |
17+25       1.1939      0.78  |Q        |         |         |  V      |
17+30       1.1990      0.75  Q         |         |         |  V      |
17+35       1.2040      0.72  Q         |         |         |  V      |
```

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17+40       1.2087      0.69  Q         |         |         |  V      |
17+45       1.2134      0.67  Q         |         |         |  V      |
17+50       1.2179      0.65  Q         |         |         |   V     |
17+55       1.2222      0.63  Q         |         |         |   V     |
18+ 0       1.2264      0.61  Q         |         |         |   V     |
18+ 5       1.2306      0.60  Q         |         |         |   V     |
18+10       1.2348      0.61  Q         |         |         |   V     |
18+15       1.2390      0.61  Q         |         |         |   V     |
18+20       1.2431      0.60  Q         |         |         |   V     |
18+25       1.2471      0.59  Q         |         |         |   V     |
18+30       1.2511      0.58  Q         |         |         |   V     |
18+35       1.2550      0.57  Q         |         |         |    V    |
18+40       1.2588      0.56  Q         |         |         |    V    |
18+45       1.2626      0.55  Q         |         |         |    V    |
18+50       1.2663      0.54  Q         |         |         |    V    |
18+55       1.2699      0.53  Q         |         |         |    V    |
19+ 0       1.2735      0.52  Q         |         |         |    V    |
19+ 5       1.2770      0.51  Q         |         |         |    V    |
19+10       1.2805      0.50  Q         |         |         |    V    |
19+15       1.2839      0.49  Q         |         |         |    V    |
19+20       1.2872      0.49  Q         |         |         |    V    |
19+25       1.2905      0.48  Q         |         |         |     V   |
19+30       1.2938      0.47  Q         |         |         |     V   |
19+35       1.2970      0.47  Q         |         |         |     V   |
19+40       1.3001      0.46  Q         |         |         |     V   |
19+45       1.3033      0.45  Q         |         |         |     V   |
19+50       1.3063      0.45  Q         |         |         |     V   |
19+55       1.3094      0.44  Q         |         |         |     V   |
20+ 0       1.3124      0.44  Q         |         |         |     V   |
20+ 5       1.3154      0.43  Q         |         |         |     V   |
20+10       1.3183      0.43  Q         |         |         |     V   |
20+15       1.3212      0.42  Q         |         |         |     V   |
20+20       1.3241      0.42  Q         |         |         |      V  |
20+25       1.3269      0.41  Q         |         |         |      V  |
20+30       1.3297      0.41  Q         |         |         |      V  |
20+35       1.3325      0.40  Q         |         |         |      V  |
20+40       1.3352      0.40  Q         |         |         |      V  |
20+45       1.3380      0.39  Q         |         |         |      V  |
20+50       1.3406      0.39  Q         |         |         |      V  |
20+55       1.3433      0.39  Q         |         |         |      V  |
21+ 0       1.3459      0.38  Q         |         |         |      V  |
21+ 5       1.3486      0.38  Q         |         |         |      V  |
21+10       1.3511      0.38  Q         |         |         |      V  |
21+15       1.3537      0.37  Q         |         |         |      V  |
21+20       1.3563      0.37  Q         |         |         |      V  |
21+25       1.3588      0.37  Q         |         |         |      V  |
21+30       1.3613      0.36  Q         |         |         |       V |
21+35       1.3637      0.36  Q         |         |         |       V |
21+40       1.3662      0.36  Q         |         |         |       V |
21+45       1.3686      0.35  Q         |         |         |       V |
21+50       1.3710      0.35  Q         |         |         |       V |
21+55       1.3734      0.35  Q         |         |         |       V |
22+ 0       1.3758      0.34  Q         |         |         |       V |
22+ 5       1.3782      0.34  Q         |         |         |       V |
22+10       1.3805      0.34  Q         |         |         |       V |
22+15       1.3828      0.34  Q         |         |         |       V |
22+20       1.3851      0.33  Q         |         |         |       V |
22+25       1.3874      0.33  Q         |         |         |       V |
22+30       1.3897      0.33  Q         |         |         |       V |
22+35       1.3919      0.33  Q         |         |         |       V |
22+40       1.3941      0.32  Q         |         |         |       V |
22+45       1.3964      0.32  Q         |         |         |        V|
22+50       1.3986      0.32  Q         |         |         |        V|
22+55       1.4007      0.32  Q         |         |         |        V|
23+ 0       1.4029      0.32  Q         |         |         |        V|
23+ 5       1.4051      0.31  Q         |         |         |        V|
23+10       1.4072      0.31  Q         |         |         |        V|
23+15       1.4093      0.31  Q         |         |         |        V|
23+20       1.4115      0.31  Q         |         |         |        V|
23+25       1.4136      0.30  Q         |         |         |        V|
23+30       1.4156      0.30  Q         |         |         |        V|
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   23+35       1.4177      0.30  Q         |         |         |        V|
   23+40       1.4198      0.30  Q         |         |         |        V|
   23+45       1.4218      0.30  Q         |         |         |        V|
   23+50       1.4239      0.30  Q         |         |         |        V|
   23+55       1.4259      0.29  Q         |         |         |        V|
   24+ 0       1.4279      0.29  Q         |         |         |        V|
   24+ 5       1.4297      0.26  Q         |         |         |        V|
   24+10       1.4305      0.12  Q         |         |         |        V|
   24+15       1.4309      0.06  Q         |         |         |        V|
   24+20       1.4311      0.03  Q         |         |         |        V|
   24+25       1.4312      0.02  Q         |         |         |        V|
   24+30       1.4313      0.01  Q         |         |         |        V|
   24+35       1.4314      0.01  Q         |         |         |        V|
   24+40       1.4314      0.00  Q         |         |         |        V|
   24+45       1.4314      0.00  Q         |         |         |         V
-----------------------------------------------------------------------
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U n i t   H y d r o g r a p h   A n a l y s i s

Study date 12/18/21

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6434

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100 Year Storm
Project 210046 Developed
AMC III

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
14.85	1	1.03
Rainfall data for year 100		
14.85	6	2.10
Rainfall data for year 100		
14.85	24	3.97

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	52.0	14.85	1.000	0.785	0.500	0.393

Area-averaged adjusted loss rate Fm (In/Hr) = 0.393

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
7.42	0.500	32.0	52.0	9.23	0.100
7.42	0.500	98.0	98.0	0.20	0.941

Area-averaged catchment yield fraction, Y = 0.520
Area-averaged low loss fraction, Yb = 0.480
User entry of time of concentration = 0.303 (hours)

++
Watershed area = 14.85(Ac.)
Catchment Lag time = 0.242 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 34.4011
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.393(In/Hr)
Average low loss rate fraction (Yb) = 0.480 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.489(In)
Computed peak 30-minute rainfall = 0.837(In)
Specified peak 1-hour rainfall = 1.030(In)
Computed peak 3-hour rainfall = 1.594(In)
Specified peak 6-hour rainfall = 2.100(In)
Specified peak 24-hour rainfall = 3.970(In)

Rainfall depth area reduction factors:
Using a total area of 14.85(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999	Adjusted rainfall = 0.488(In)
30-minute factor = 0.999	Adjusted rainfall = 0.836(In)
1-hour factor = 0.999	Adjusted rainfall = 1.029(In)
3-hour factor = 1.000	Adjusted rainfall = 1.594(In)
6-hour factor = 1.000	Adjusted rainfall = 2.100(In)
24-hour factor = 1.000	Adjusted rainfall = 3.970(In)

U n i t   H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 179.59 (CFS))	
1	2.174	3.905
2	12.834	19.145
3	39.833	48.487
4	59.198	34.779
5	69.547	18.586
6	76.434	12.369
7	81.329	8.791
8	85.054	6.690
9	88.066	5.409
10	90.288	3.990
11	92.133	3.315
12	93.683	2.783
13	94.920	2.222
14	95.974	1.892
15	96.839	1.554
16	97.498	1.183
17	97.976	0.859
18	98.331	0.637
19	98.737	0.729
20	99.150	0.741
21	99.521	0.666
22	99.748	0.408
23	100.000	0.204

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4884	0.4884
2	0.6013	0.1129
3	0.6791	0.0778
4	0.7403	0.0612
5	0.7915	0.0513
6	0.8360	0.0445
7	0.8756	0.0396
8	0.9114	0.0358
9	0.9442	0.0328
10	0.9745	0.0303

11	1.0028	0.0283
12	1.0293	0.0265
13	1.0626	0.0333
14	1.0944	0.0318
15	1.1249	0.0305
16	1.1542	0.0293
17	1.1824	0.0282
18	1.2096	0.0272
19	1.2359	0.0263
20	1.2614	0.0255
21	1.2862	0.0247
22	1.3102	0.0240
23	1.3336	0.0234
24	1.3564	0.0228
25	1.3786	0.0222
26	1.4003	0.0217
27	1.4215	0.0212
28	1.4423	0.0207
29	1.4625	0.0203
30	1.4824	0.0199
31	1.5019	0.0195
32	1.5210	0.0191
33	1.5398	0.0187
34	1.5582	0.0184
35	1.5762	0.0181
36	1.5940	0.0178

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0178	0.0085	0.0093
2	0.0181	0.0087	0.0094
3	0.0187	0.0090	0.0098
4	0.0191	0.0092	0.0099
5	0.0199	0.0095	0.0103
6	0.0203	0.0097	0.0106
7	0.0212	0.0102	0.0110
8	0.0217	0.0104	0.0113
9	0.0228	0.0109	0.0119
10	0.0234	0.0112	0.0122
11	0.0247	0.0119	0.0129
12	0.0255	0.0122	0.0133
13	0.0272	0.0131	0.0142
14	0.0282	0.0135	0.0147
15	0.0305	0.0146	0.0159
16	0.0318	0.0153	0.0166
17	0.0265	0.0127	0.0138
18	0.0283	0.0136	0.0147
19	0.0328	0.0157	0.0171
20	0.0358	0.0172	0.0186
21	0.0445	0.0213	0.0232
22	0.0513	0.0246	0.0267
23	0.0778	0.0327	0.0451
24	0.1129	0.0327	0.0802
25	0.4884	0.0327	0.4557
26	0.0612	0.0294	0.0319
27	0.0396	0.0190	0.0206
28	0.0303	0.0145	0.0158
29	0.0333	0.0160	0.0173
30	0.0293	0.0140	0.0152
31	0.0263	0.0126	0.0137
32	0.0240	0.0115	0.0125
33	0.0222	0.0107	0.0116
34	0.0207	0.0099	0.0108
35	0.0195	0.0093	0.0101
36	0.0184	0.0088	0.0096

Total soil rain loss = 0.54(In)
Total effective rainfall = 1.06(In)

```
     Peak flow rate in flood hydrograph =     27.46(CFS)
     ---------------------------------------------------------------------
     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                         3 - H O U R    S T O R M
                    R u n o f f      H y d r o g r a p h
     --------------------------------------------------------------------
                 Hydrograph in   5   Minute intervals ((CFS))

     --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0         7.5       15.0      22.5      30.0
-----------------------------------------------------------------------
  0+ 5       0.0002      0.04  Q         |         |         |         |
  0+10       0.0017      0.21  Q         |         |         |         |
  0+15       0.0063      0.67  Q         |         |         |         |
  0+20       0.0132      1.00  VQ        |         |         |         |
  0+25       0.0215      1.20  VQ        |         |         |         |
  0+30       0.0308      1.35  VQ        |         |         |         |
  0+35       0.0410      1.47  |Q        |         |         |         |
  0+40       0.0518      1.58  |VQ       |         |         |         |
  0+45       0.0634      1.68  |VQ       |         |         |         |
  0+50       0.0756      1.77  | Q       |         |         |         |
  0+55       0.0884      1.87  | Q       |         |         |         |
  1+ 0       0.1019      1.96  | QV      |         |         |         |
  1+ 5       0.1161      2.06  | QV      |         |         |         |
  1+10       0.1310      2.16  | Q V     |         |         |         |
  1+15       0.1467      2.28  |  QV     |         |         |         |
  1+20       0.1632      2.40  |  Q V    |         |         |         |
  1+25       0.1806      2.52  |  Q V    |         |         |         |
  1+30       0.1985      2.59  |  Q  V   |         |         |         |
  1+35       0.2161      2.57  |  Q  V   |         |         |         |
  1+40       0.2342      2.62  |  Q   V  |         |         |         |
  1+45       0.2535      2.80  |  Q   V  |         |         |         |
  1+50       0.2747      3.08  |   Q   V |         |         |         |
  1+55       0.2991      3.54  |   Q    V|         |         |         |
  2+ 0       0.3295      4.43  |    Q    V         |         |         |
  2+ 5       0.3826      7.71  |         QV        |         |         |
  2+10       0.4910     15.74  |         |    V    Q         |         |
  2+15       0.6802     27.46  |         |         V         |     Q   |
  2+20       0.8227     20.70  |         |         |    V Q  |         |
  2+25       0.9120     12.97  |         |      Q  |      V  |         |
  2+30       0.9782      9.61  |         | Q       |        V|         |
  2+35       1.0313      7.70  |         Q         |         |V        |
  2+40       1.0758      6.47  |       Q |         |         | V       |
  2+45       1.1143      5.59  |      Q  |         |         |   V     |
  2+50       1.1468      4.72  |     Q   |         |         |    V    |
  2+55       1.1757      4.19  |    Q    |         |         |     V   |
  3+ 0       1.2015      3.75  |    Q    |         |         |     V   |
  3+ 5       1.2242      3.30  |   Q     |         |         |      V  |
  3+10       1.2436      2.82  |  Q      |         |         |       V |
  3+15       1.2580      2.09  | Q       |         |         |       V |
  3+20       1.2685      1.52  | Q       |         |         |       V |
  3+25       1.2763      1.14  |Q        |         |         |        V|
  3+30       1.2825      0.89  |Q        |         |         |        V|
  3+35       1.2881      0.82  |Q        |         |         |        V|
  3+40       1.2931      0.72  Q         |         |         |        V|
  3+45       1.2972      0.60  Q         |         |         |        V|
  3+50       1.3001      0.42  Q         |         |         |        V|
  3+55       1.3019      0.27  Q         |         |         |        V|
  4+ 0       1.3029      0.14  Q         |         |         |        V|
  4+ 5       1.3036      0.11  Q         |         |         |        V|
  4+10       1.3042      0.08  Q         |         |         |        V|
  4+15       1.3046      0.06  Q         |         |         |        V|
  4+20       1.3050      0.05  Q         |         |         |        V|
  4+25       1.3052      0.04  Q         |         |         |        V|
  4+30       1.3054      0.03  Q         |         |         |        V|
  4+35       1.3056      0.02  Q         |         |         |        V|
  4+40       1.3056      0.01  Q         |         |         |        V|
  4+45       1.3057      0.01  Q         |         |         |        V|
  4+50       1.3057      0.00  Q         |         |         |        V|
-----------------------------------------------------------------------
```

90%Q_{25}=16.83 CFS

$V_{retention}$=0.8674

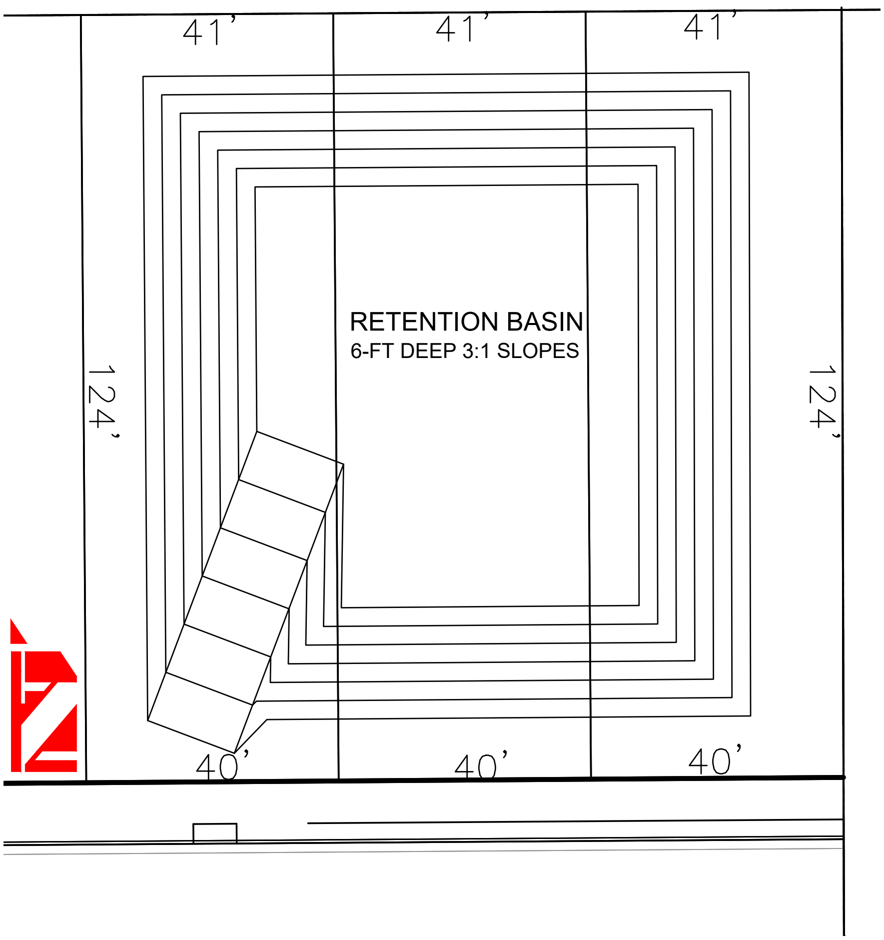
APPENDIX D:

Hydraulic Analysis:

Retention Basin Sizing

Street Capacity

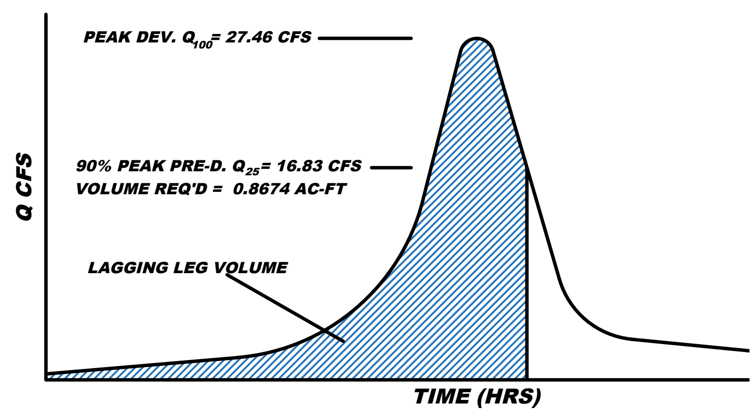
Curb Opening Sump Inlet Sizing



RETENTION BASIN

DESIGN VOLUME

DEPTH	Area sf	Vol/ft ac/ft	Vol accum.
6	10,239.37	0.2206	0.9408
5	8,982.70	0.1928	0.7202
4	7,812.17	0.1667	0.5274
3	6,714.03	0.1424	0.3607
2	5,689.05	0.1197	0.2183
1	4,736.27	0.0986	0.0986
0	3,856.00	0	0



100% RETENTION BASIN

DATE: 01/10/2022

SCALE: 1" = 200'

EXHIBIT G

TTM 20143

RETENTION BASIN

VOLUME CALCULATIONS

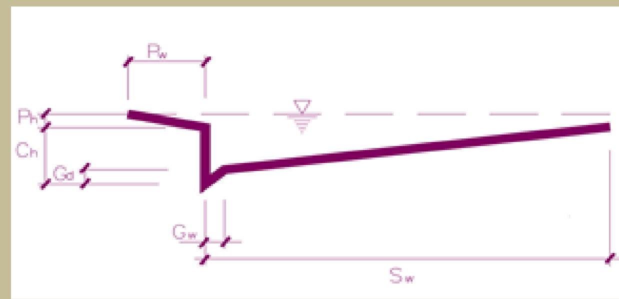
RED BRICK SOLUTION

CONSULTING ENGINEERS & ARCHITECTS

30 FT HALF STREET FLOW CALCULATIONS

Given:

Half Street CL to Curb	Sw	20	Ft
Street X-Slope	Cs =	0.02	Ft/Ft
Gutter Width	Gw =	1.5	Ft
Gutter Depth	Gd =	0.17	Ft
Parkway width	Pw =	10	Ft
Curb Heigth	Ch =	0.5	Ft
Slope of Street	s =	0.004	Ft/Ft
Manning's Coeficient	n=	0.015	
Then:	Ph =	0.2	
	Ch-Gd =	0.33	
	Ch-Gd+Ph	0.53	
	Sw1	16.5	
	Sw2	26.5	



ROW Street Capacity

AREA	A =	7.2225	SF
WETTED PERIMETER	Wp =	32.01	FT
R= A/P	R =	0.225602	
	Q =	16.73	CFS

CF Street Capacity

AREA	A =	3.9225	SF
WETTED PERIMETE	Wp =	22.01	FT
R= A/P	R =	0.178196	
	Q =	7.76	CFS

SUMP FORMULA -LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
PER CATCH BASIN CAPACITIES FOR SUMP CONDITION STD D-26

8-INCH CURB FACE

W=	LENGTH (FEET) OFCATCH BASIN OPENING =	3.50	7.00	14.00	21.00
A=	AREA OF OPENING (Wx0.656) =	2.30	4.59	9.18	13.78
D=	DEPTH (FEET) OF FLOW ABOVE NORMAL GUTTER GRADE=	0.67	0.67	0.67	0.67
Q=	4.3*A*D^0.6 (COMPLETE SUBMERGENCE)	7.76	15.53	31.06	46.58

6-INCH CURB FACE

W=	LENGTH (FEET) OFCATCH BASIN OPENING =	3.50	7.00	14.00	21.00
A=	AREA OF OPENING (Wx0.322) =	1.13	2.25	4.51	6.76
D=	DEPTH (FEET) OF FLOW ABOVE NORMAL GUTTER GRADE=	0.67	0.67	0.67	0.67
Q=	4.3*A*D^0.6 (COMPLETE SUBMERGENCE)	3.81	7.62	15.24	22.87

DATE: 01/10/2022

SCALE: NTS

EXHIBIT H

STREET CAPACITY
CURB INLET CAPACITY

RED BRICK SOLUTION

CONSULTING ENGINEERS & ARCHITECTS