RED BRICK SOLUTION

Hydrology Study

January 12, 2022

APN: 3132-161-61

HOOK BOULEVARD
ADELANTO - CA

San Bernardino

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 5-acre parcel is zoned Single Family residential (R-1) (see appendix A Exhibit A) and is Located 300 feet North of the intersection of Hook Blvd and Verbana Rd, South of the City of Adelano, CA APN 3132-161-61.

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 accordingly. Assuring that the downstream developments only receive their historic storm flows.

C. METHODOLOGY

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

The following criteria was used for the off-site tributary flows (see appendix A Exhibit E):

1.	Current land use:	Vacant Land
2.	Proportion Currently Impervious:	0.1 %
3.	Proportion Impervious After Development:	60.0% (5 -7 Dwellings per acre)
4.	Intended Use:	Residential Tract
5.	NOAA 14 Precipitation	100-year 1-hour = 1.06
6.	Soil Type	105, Bryman Loamy Fine Sand, Group C (100%)
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 is located outside of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Panel 06071C5795H effective August 28, 2008, indicated that the site is in "Zone D" (see appendix A Exhibit F). Zone D is defined by FEMA as "areas in which flood hazards are undetermined, but possible" (see appendix A exhibit F) for the San Bernardino County.

II. OFF-SITE HYDROLOGY

Considering that this project is surrounded by other developments that direct off-site flows around this project, no offsite tributary area is considered as a part of this study.

III. ON-SITE HYDROLOGY:

A. PRE-DEVELOPED DRAINAGE DESCRIPTION

After removing street dedications on Verbena Rd, the remaining 4.75-acre site is currently undeveloped and consists of Bryman loamy fine sand (see appendix A Exhibit D) with sparse vegetation. The project consists of one (1) drainage area, which slopes and drives normally from south-west to north-east corner

of the property. As part of the analysis, the drainage area is divided into four (4) drainage management areas (DMA) (see Appendix A Exhibit B).

The Drainage management Area “A” consists of a 0.91-acres initial Subarea 1A that flows 240 ft. to the north-east with an elevation change of 4.7 ft. and a slope of 1.96%. Subarea 2A transports these storm flows 591 ft to the north having an elevation change of 7.4 ft. at a slope of 1.25% over 1.27 acres. Then, this flow line will confluence with DMA B.

The Drainage management Area “B” consists of a 0.35-acres initial Subarea 1B that flows 190 ft. to the north-east having an elevation change of 4.7 ft., and a slope of 2.47%. Subarea 2B transports these storm flows 195 ft to the north-east at an elevation change of 3.2 ft., slope of 1.64% over 0.56 acres. At the end of subarea 2B, there is a local confluence with area 2C, which will flow though area 3B that consist of 0.52-acres, a flow line of 190 ft, and elevation change of 4 ft at a 2.10% slope.

The Drainage management Area “C” consists of a 0.55-acres initial Subarea 1C that flows 210 ft. to the north-east at an elevation change of 6.7 ft., and a slope of 3.04%. Subarea 2C consists of an area of 0.65 acres, elevation change of 0.8 ft, and a slope of 0.58% that transports the storm flow 137 ft north-west where its confluences with subarea 2B.

At this point, DMA A & B confluences at the north-east corner of the property.

B. PRE-DEVELOPED HYDROLOGY ANALYSIS

Using CivilDesign Rational Method Software, each of the 3-Draiange Management Areas was analyzed to determine the 25-year Pre-Developed 1-Hour Peak Storm flows (See appendix B). When combined, it gives a total Q of 7.86 cfs.

C. POST-DEVELOPED DRAINAGE DESCRIPTION

The site will be developed as a residential tract with an average of 20 - 8260 sq. ft. lots. Considering the accompanied streets and gutters, this will add a total impervious area of about 60%. 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 4.75-acre on-site developed site consists of one (1) Drainage Area subdivided into two (2) drainage management areas (DMA) (see Appendix A Exhibit C).

DMA-A has an Initial Area 1A consisting of 0.26 acres with a flow travel length of 155 ft., an elevation difference of 4.16 ft. resulting in a slope of 0.06%. Which flows through subarea 2A, that covers 0.68 acres and has a flow path of 228 ft., an elevation change of 1.3 ft. and a slope of 0.57%. Then it flows through Subarea 3A that covers an area of 1.21 acres and has a flow path of 289 ft., an elevation change of 1.4 ft. and a slope of 0.48%. At the end, this flow will be caught by a storm basin drain, that will direct the flow through a pipe, to another catch basin drain where it confluences with DMA-B flows.

DMA-B has mirrored areas of DMA-A, with an Initial Area 1B consisting of 0.26 acres with a flow travel length of 155 ft., an elevation difference of 2.3 ft. resulting in a slope of 1.48%. Which flows through subarea 2B, that covers 0.68 acres and has a flow path of 228 ft., an elevation change of 1.3 ft. and a slope of 0.57%. Then, it flows through subarea 3B that covers an area of 1.21 acres and has a flow path of 289 ft., an elevation change of 1.4 ft. and slope of 0.48%. When the flow is caught by the storm drain basin near the east end of subarea 3B, it confluences with DMA-A flow, these flows combined then travel inside a pipe, that fills the retention/detention basin on-site.

When filled, the retention/detention basin will release the excess storm water at the local historic conveyance point at the north-east corner.

D. POST-DEVELOPED DRAINAGE ANALYSIS

Using CivilDesign Rational Method Software we determined that for the 100-year storm the total flow is equal to Q= 10.11 cfs, and the total time of concentration is 11.62 min.

DMA-A storm flows through a gutter in subarea A1 followed by area A2 and A3(see Appendix A Exhibit C), with half street capacity of 4.42 CFS. Then, the water is captured by a curb opening to a storm drain where it will flow through an 18-in pipe to the other side of the street, where it confluences with DMA-B.

DMA-B storm flows similarly to DMA-A. Therefore, the storm water flows from B1, followed by B2 and B3(see Appendix A Exhibit C) through the half street capacity Q = 6.18 cfs. Curb and gutter sizing have been adjusted accordingly to have a capacity of 16.73 cfs (see Appendix D). Near the end of subarea B3, the water flow is caught thought a curb opening to a retention drain, where it confluences with DMA-A, then it flows inside a pipe sized 24-in (see Appendix D) to a retention/detention basin with the volume capacity of 0.61 Acre-ft. The basin when filled, will mitigate down the flow at the peak of the storm to a Q of maximum 7.046 through an 18-in pipe near the historical site conveyance point.

E. RETENTION BASIN

Per September 4th, 1987, interoffice memo of the San Bernardino County detention basin design criteria, the 100-year on-site developed peak storm flow of 13.69 CFS (see appendix C) must be mitigated by a retention/detention basin to a required Q(Q_R) having a rate of 90% of the 25-year storm or (7.862*0.9=)7.046 CFS as shown of Fig.1. In order to determine the volume, one must interpolate between the data presented in the unit hydrograph volume output shown on page(xxx) of this study. The required Q_R falls between upper Q (Q_U) and lower Q(Q_L) on the legging leg of the hydrograph output. $V_L$and V_U are the corresponded volumes for the respective Q's "Q_U and Q_L". The interpolation equation 1 is shown below.

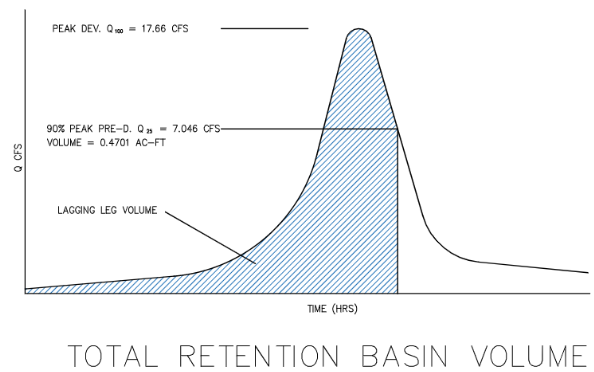


Figure 1: Total retention basing volume based on the flow according to the time on a 100-year 3-hour storm, developed condition.

$$V = V_U + \frac{(V_L - V_U).(Q_U - Q_R)}{Q_U - Q_L} \quad (1)$$

The minimum volume (V) obtained through the equation 1 was V = 0.4615 Ac.ft. Which is greater than the required volume of 0.6106 Acre-ft (see Appendix D).

IV. CONCLUSIONS AND RECOMENDATIONS:

When improvements made, the sizing of the half street curb will be able to bear the storm flow of a 100-year storm. As well as the curb opening and catch basin design to work at the determined Q's. The pipes sized by the civil design software, also should meet the capabilities of the required flow for the peak of the 100-Year storm when installed and purchased with no abnormalities. Also, the retention/detention basin was design according to the interoffice memo of the San Bernardino County detention basin design criteria, therefore it retains a volume 0.61 Ac.ft, 0.15Ac.ft more than the minimum required. Thus, after these improvements' completion, the project will be protected against flood.

V. 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

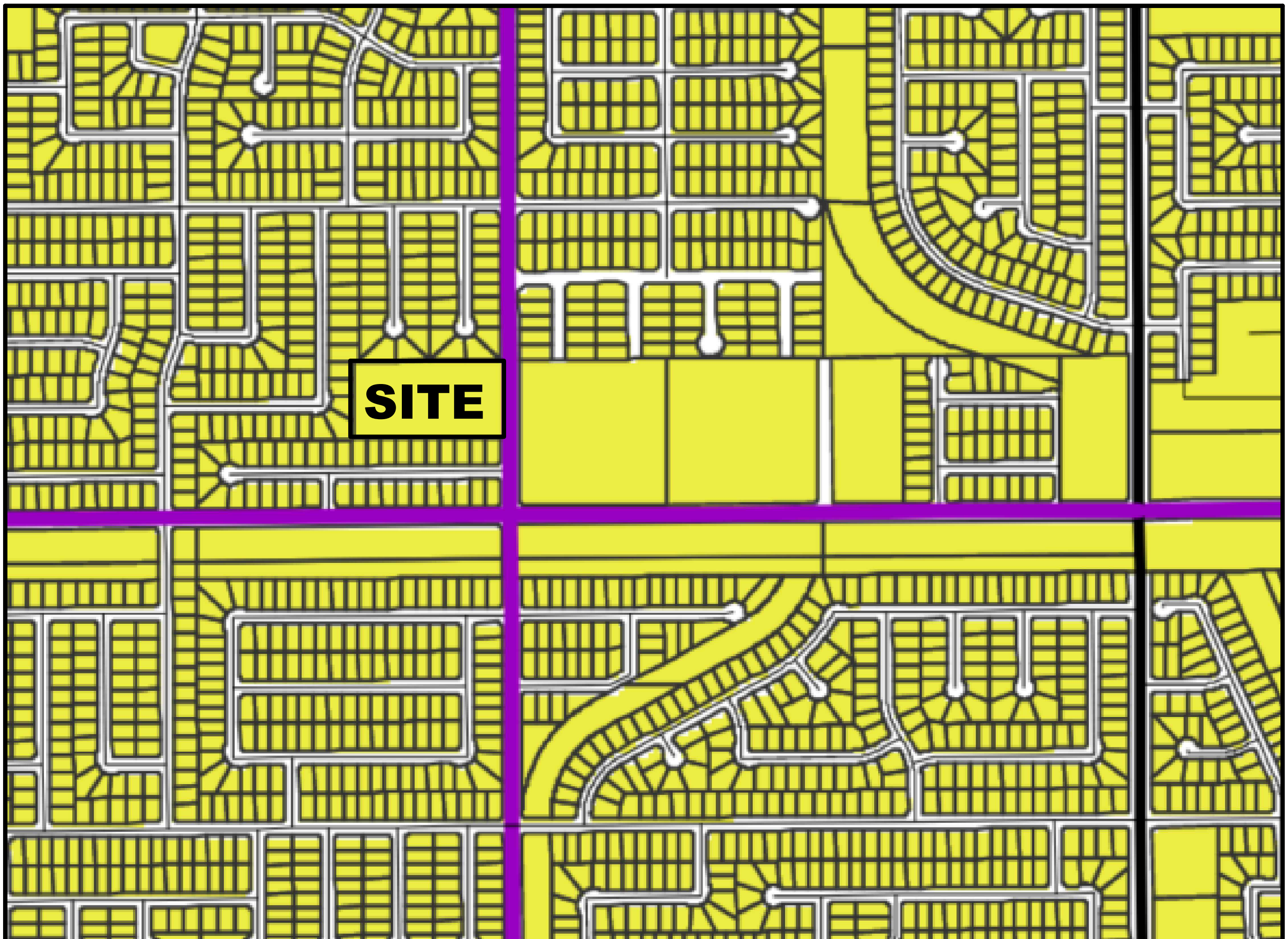
Federal Emergency Management Agency website: https://msc.fema.gov/portal accessed August 2020.

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 AND ZONING DISTRICTS

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

DATE: 01/10/2022

SCALE: NTS

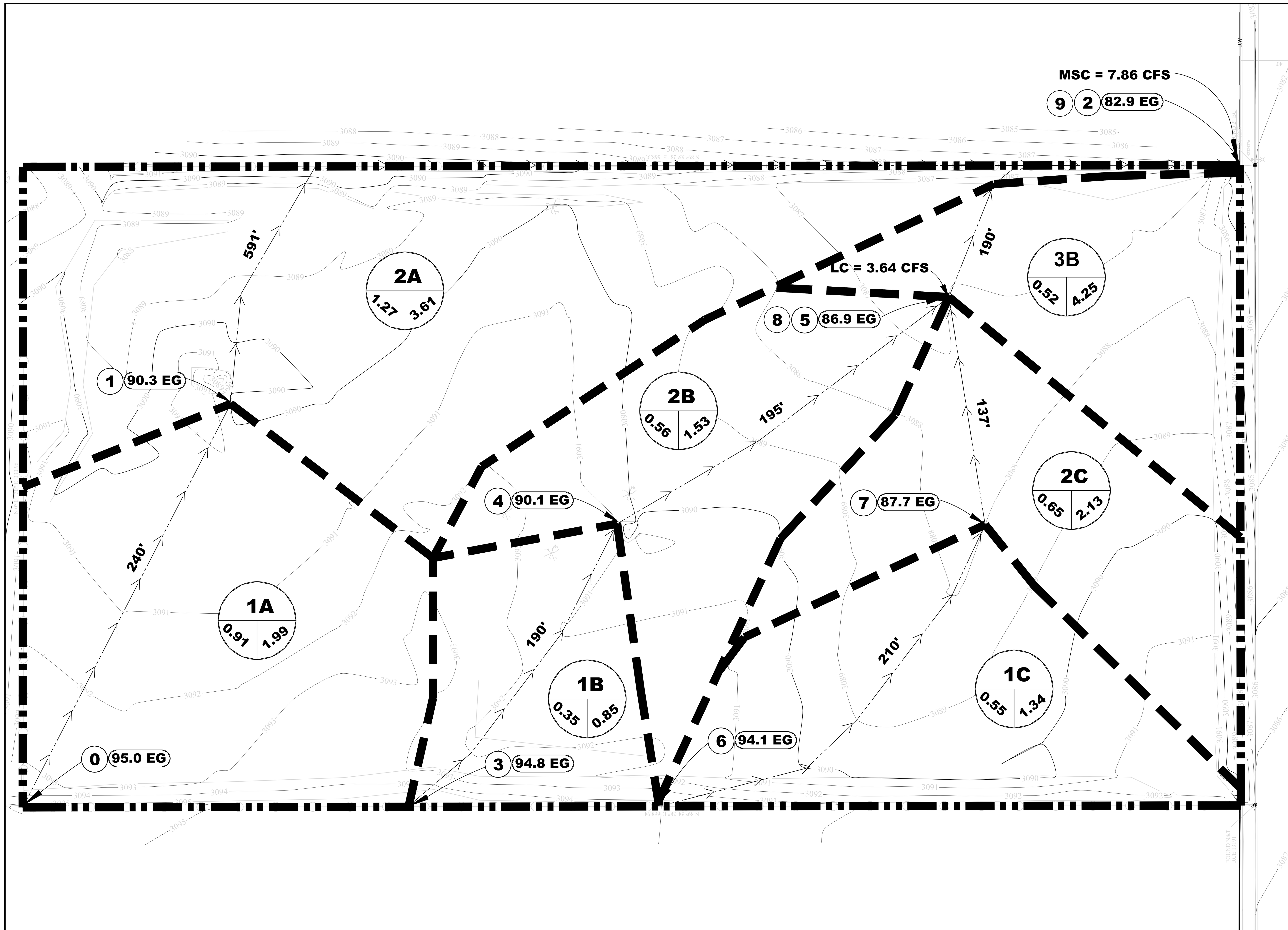
EXHIBIT A

TTM 20162

LAND USE & ZONNING

RED BRICK SOLUTION

CONSULTING ENGINEERS & ARCHITECTS



LEGEND:

XX — DRAINAGE SUB-AREA OR LOCATION

AREA (AC) — XX | X — Q_{25}(cfs)

OVERALL BOUNDARY

SUBAREA BOUNDARY

SUBAREA FLOWLINE

— NODE

XX.XX — SPOT ELEVATION

EG — EXISTING GRADE
FG — FINISH GRADE
FS — FINISH SURFACE
FF — FINISH FLOOR
IE — INVERT ELEVATION

GRAPHIC SCALE

30' 0' 30' 60'

(IN FEET)
1 inch = 60 ft.

HYDROLOGY STUDY MAP

PRE-DEVELOPED CONDITION

FOR:
TTM 20162

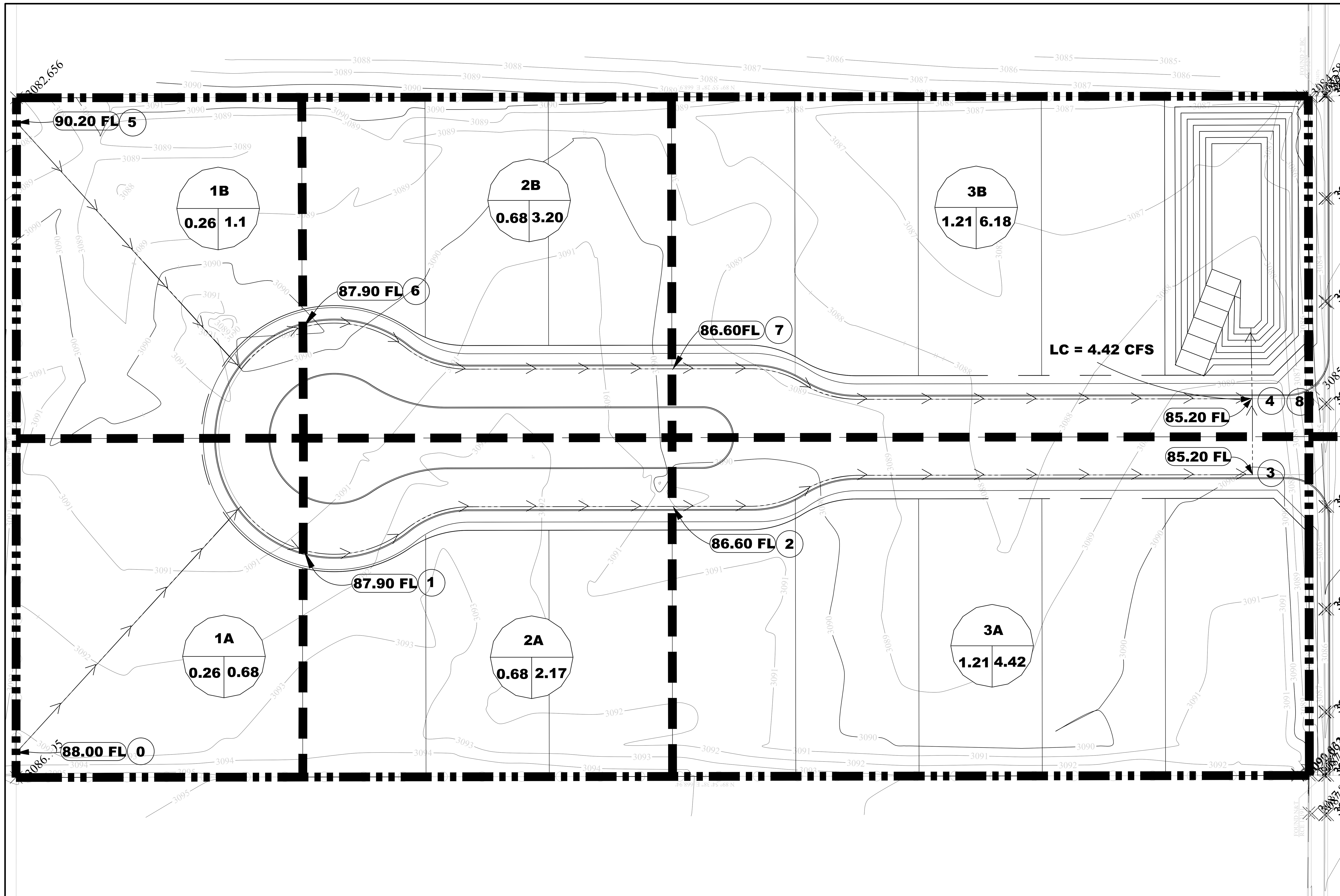
IN THE:
CITY OF ADELANTO

APN:
3132-161-61

RED BRICK SOLUTION

CONSULTING ENGINEERS
& ARCHITECTS

EXHIBIT B



LEGEND:

DRAINAGE SUB-AREA OR LOCATION

AREA (AC)

Q_{100} (cfs)

XX | XX | X

OVERALL BOUNDARY

SUBAREA BOUNDARY

SUBAREA FLOWLINE

NODE

XX.XX SPOT ELEVATION

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

30' 0' 30' 60'

(IN FEET)
1 inch = 60 ft.

HYDROLOGY STUDY MAP

POST-DEVELOPED CONDITION

FOR:
TTM 20162

IN THE:
CITY OF ADELANTO

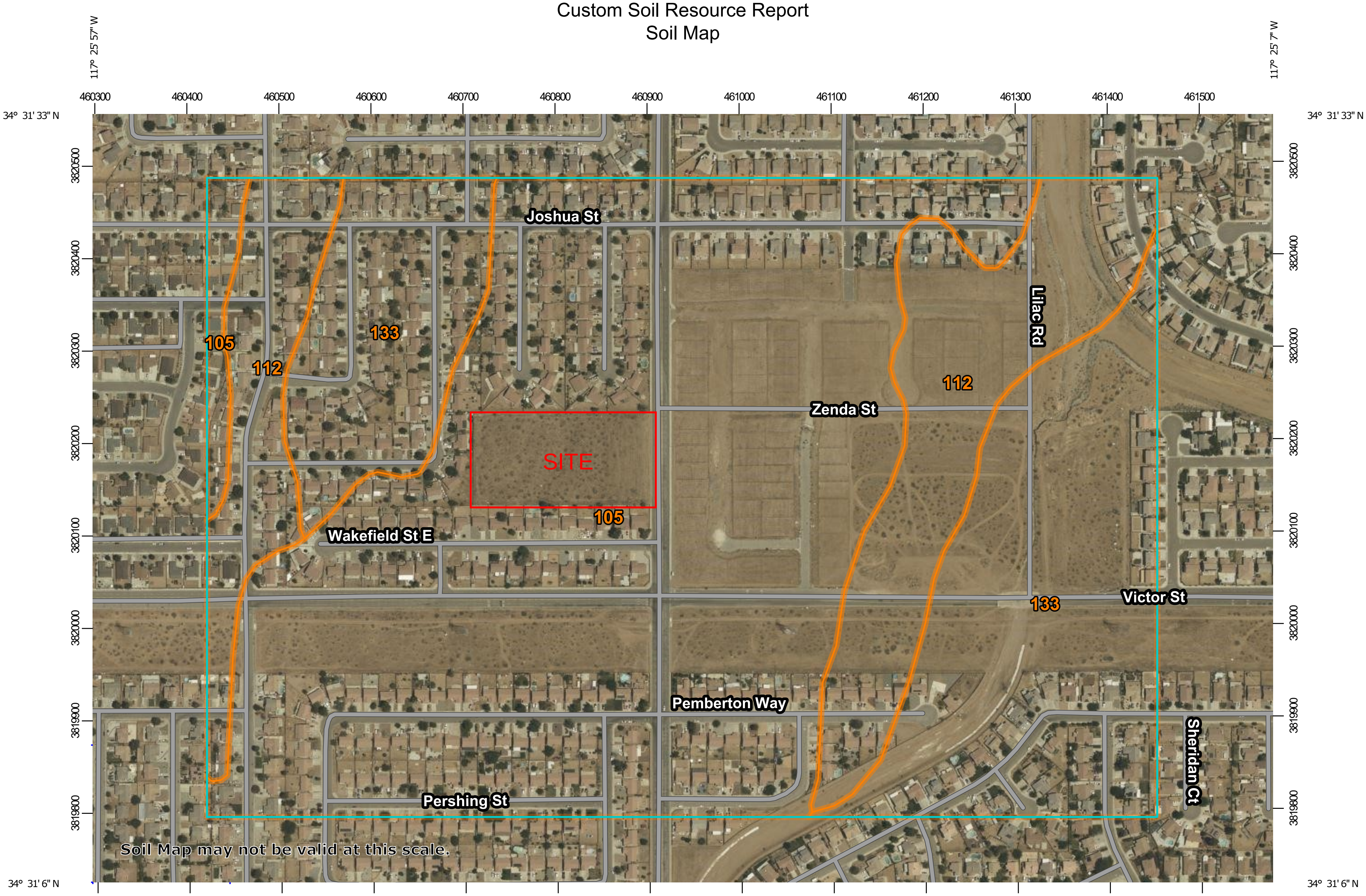
APN:
3132-161-61

RED BRICK SOLUTION

CONSULTING ENGINEERS & ARCHITECTS

EXHIBIT C

Soil Map



Map Scale: 1:5,870 if printed on A landscape (11" x 8.5") sheet.

N

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

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

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	100.7	56.9%
112	CAJON SAND, 0 TO 2 PERCENT SLOPES	30.8	17.4%
133	HELENDALE-BRYMAN LOAMY SANDS, 2 TO 5 PERCENT SLOPES*	45.6	25.7%
Totals for Area of Interest		**177.2**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

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

NOAA Atlas 14, Volume 6, Version 2
Location name: Adelanto, California, USA*
Latitude: 34.5226°, Longitude: -117.4271°
Elevation: 3092.86 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	0.079 (0.065-0.096)	0.111 (0.092-0.136)	0.155 (0.128-0.191)	0.192 (0.157-0.238)	0.243 (0.192-0.311)	0.284 (0.219-0.371)	0.326 (0.246-0.436)	0.370 (0.271-0.509)	0.431 (0.304-0.619)	0.480 (0.326-0.712)
10-min	0.113 (0.093-0.138)	0.160 (0.132-0.196)	0.223 (0.183-0.273)	0.275 (0.225-0.341)	0.349 (0.275-0.446)	0.407 (0.314-0.531)	0.467 (0.352-0.625)	0.530 (0.389-0.730)	0.618 (0.435-0.887)	0.687 (0.468-1.02)
15-min	0.137 (0.113-0.167)	0.193 (0.159-0.236)	0.269 (0.222-0.331)	0.333 (0.272-0.412)	0.422 (0.333-0.539)	0.492 (0.380-0.642)	0.565 (0.426-0.756)	0.641 (0.470-0.882)	0.747 (0.526-1.07)	0.831 (0.566-1.23)
30-min	0.196 (0.162-0.240)	0.278 (0.229-0.340)	0.387 (0.319-0.476)	0.479 (0.391-0.592)	0.606 (0.479-0.776)	0.707 (0.547-0.924)	0.812 (0.613-1.09)	0.922 (0.677-1.27)	1.08 (0.757-1.54)	1.20 (0.814-1.78)
60-min	0.255 (0.211-0.312)	0.361 (0.298-0.442)	0.503 (0.414-0.618)	0.622 (0.508-0.770)	0.788 (0.622-1.01)	0.919 (0.710-1.20)	1.06 (0.796-1.41)	1.20 (0.879-1.65)	1.40 (0.983-2.00)	1.55 (1.06-2.31)
2-hr	0.358 (0.296-0.437)	0.485 (0.400-0.594)	0.659 (0.542-0.809)	0.806 (0.658-0.998)	1.02 (0.802-1.30)	1.18 (0.915-1.55)	1.36 (1.03-1.82)	1.55 (1.13-2.13)	1.81 (1.27-2.59)	2.02 (1.37-2.99)
3-hr	0.442 (0.365-0.541)	0.592 (0.488-0.724)	0.797 (0.656-0.979)	0.973 (0.794-1.20)	1.22 (0.966-1.57)	1.43 (1.10-1.86)	1.64 (1.24-2.19)	1.87 (1.37-2.57)	2.19 (1.54-3.14)	2.45 (1.67-3.63)
6-hr	0.604 (0.499-0.738)	0.801 (0.661-0.981)	1.08 (0.885-1.32)	1.31 (1.07-1.62)	1.65 (1.30-2.11)	1.92 (1.49-2.51)	2.22 (1.67-2.97)	2.53 (1.86-3.49)	2.98 (2.10-4.28)	3.35 (2.28-4.97)
12-hr	0.760 (0.628-0.929)	1.04 (0.855-1.27)	1.42 (1.17-1.74)	1.75 (1.43-2.16)	2.22 (1.75-2.84)	2.60 (2.01-3.39)	3.00 (2.26-4.01)	3.43 (2.52-4.72)	4.05 (2.85-5.81)	4.55 (3.10-6.76)
24-hr	1.02 (0.907-1.18)	1.44 (1.28-1.66)	2.02 (1.78-2.33)	2.51 (2.20-2.92)	3.21 (2.72-3.86)	3.77 (3.13-4.64)	4.37 (3.54-5.51)	5.01 (3.95-6.49)	5.92 (4.48-8.00)	6.67 (4.87-9.31)
2-day	1.12 (0.994-1.29)	1.59 (1.41-1.83)	2.24 (1.98-2.58)	2.79 (2.44-3.25)	3.58 (3.03-4.31)	4.21 (3.50-5.18)	4.89 (3.96-6.16)	5.62 (4.43-7.28)	6.66 (5.03-8.99)	7.51 (5.48-10.5)
3-day	1.20 (1.06-1.38)	1.70 (1.51-1.96)	2.40 (2.12-2.77)	2.99 (2.62-3.49)	3.84 (3.26-4.63)	4.53 (3.76-5.57)	5.26 (4.26-6.63)	6.05 (4.76-7.84)	7.18 (5.43-9.69)	8.11 (5.92-11.3)
4-day	1.28 (1.14-1.47)	1.82 (1.61-2.09)	2.56 (2.26-2.96)	3.20 (2.80-3.73)	4.11 (3.48-4.94)	4.84 (4.02-5.95)	5.62 (4.55-7.08)	6.46 (5.09-8.37)	7.67 (5.80-10.4)	8.65 (6.32-12.1)
7-day	1.37 (1.22-1.58)	1.94 (1.72-2.24)	2.74 (2.42-3.16)	3.41 (2.99-3.97)	4.37 (3.71-5.27)	5.15 (4.27-6.33)	5.96 (4.83-7.51)	6.84 (5.39-8.86)	8.08 (6.11-10.9)	9.08 (6.63-12.7)
10-day	1.45 (1.29-1.67)	2.05 (1.82-2.36)	2.89 (2.55-3.34)	3.60 (3.16-4.20)	4.62 (3.92-5.57)	5.44 (4.52-6.69)	6.30 (5.10-7.94)	7.22 (5.69-9.35)	8.52 (6.44-11.5)	9.57 (6.99-13.4)
20-day	1.71 (1.51-1.97)	2.42 (2.15-2.79)	3.43 (3.03-3.97)	4.30 (3.77-5.01)	5.55 (4.70-6.68)	6.56 (5.44-8.06)	7.62 (6.17-9.60)	8.75 (6.90-11.3)	10.3 (7.82-14.0)	11.6 (8.48-16.2)
30-day	1.95 (1.73-2.25)	2.77 (2.45-3.19)	3.94 (3.48-4.55)	4.95 (4.34-5.77)	6.43 (5.45-7.74)	7.62 (6.32-9.37)	8.88 (7.19-11.2)	10.2 (8.05-13.2)	12.1 (9.15-16.3)	13.6 (9.93-19.0)
45-day	2.28 (2.02-2.62)	3.22 (2.85-3.71)	4.58 (4.04-5.29)	5.77 (5.05-6.72)	7.53 (6.38-9.06)	8.97 (7.45-11.0)	10.5 (8.50-13.2)	12.1 (9.55-15.7)	14.4 (10.9-19.5)	16.2 (11.9-22.7)
60-day	2.54 (2.25-2.92)	3.56 (3.15-4.10)	5.06 (4.47-5.84)	6.38 (5.59-7.43)	8.34 (7.07-10.0)	9.97 (8.27-12.3)	11.7 (9.48-14.8)	13.6 (10.7-17.6)	16.2 (12.2-21.9)	18.3 (13.4-25.6)

[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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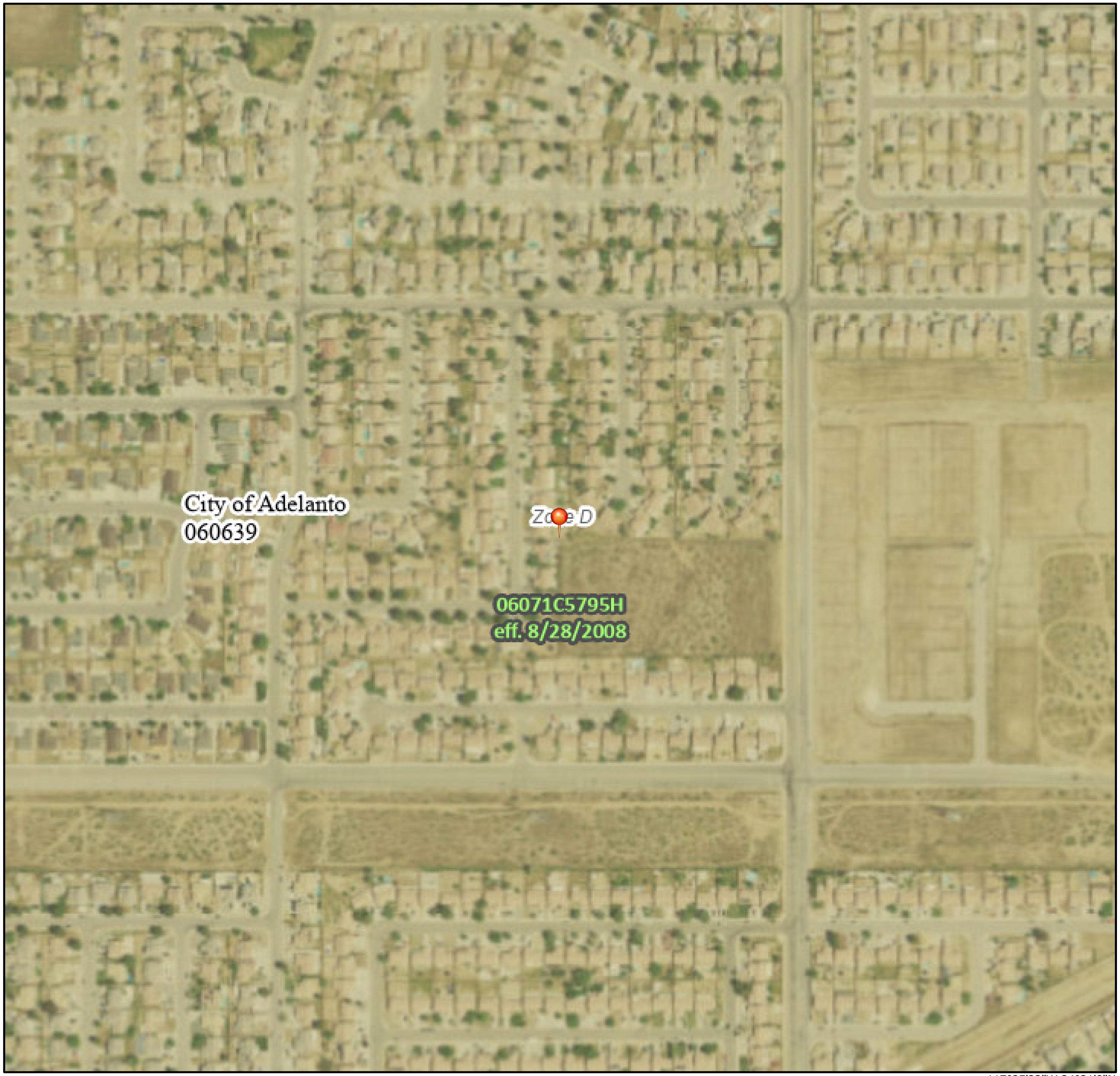
PF graphical

National Flood Hazard Layer FIRMette

FEMA

117°26'W 34°31'38"N



117°25'22"W 34°31'8"N

Feet

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

1:6,000

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	Cross Sections with 1% Annual Chance
	17.5	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 1/4/2022 at 2:30 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: 11/24/21
------------------------------------------------------------------------
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PRE-DEVELOPED
25-YEAR
AMCII

```
------------------------------------------------------------------------


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 =     0.788 (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 ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
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)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Initial subarea data:
Initial area flow distance =   240.000(Ft.)
Top (of initial area) elevation =     95.000(Ft.)
Bottom (of initial area) elevation =     90.330(Ft.)
Difference in elevation =     4.670(Ft.)
Slope =    0.01946  s(%)=      1.95
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.338 min.
Rainfall intensity =      2.699(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.812
Subarea runoff =      1.993(CFS)
Total initial stream area =        0.910(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.265(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       2.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
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Upstream point elevation =    90.330(Ft.)
Downstream point elevation =    82.980(Ft.)
Channel length thru subarea  =   591.000(Ft.)
Channel base width     =    1.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   0.100
Estimated mean flow rate at midpoint of channel =      2.842(CFS)
Manning's 'N'    = 0.033
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      2.842(CFS)
Depth of flow =   0.537(Ft.), Average velocity =   2.237(Ft/s)
Channel flow top width =    3.736(Ft.)
Flow Velocity =    2.24(Ft/s)
Travel time  =    4.40 min.
Time of concentration =   14.74 min.
Critical depth =      0.441(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
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)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Rainfall intensity =      2.105(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.787
Subarea runoff =      1.617(CFS) for    1.270(Ac.)
Total runoff =      3.610(CFS)
Effective area this stream =        2.18(Ac.)
Total Study Area (Main Stream No. 1) =        2.18(Ac.)
Area averaged Fm value =    0.265(In/Hr)
Depth of flow =   0.600(Ft.), Average velocity =   2.377(Ft/s)
Critical depth =      0.496(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       2.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.180(Ac.)
Runoff from this stream =      3.610(CFS)
Time of concentration =   14.74 min.
Rainfall intensity =     2.105(In/Hr)
Area averaged loss rate (Fm) =    0.2651(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.000 to Point/Station       4.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Initial subarea data:
Initial area flow distance =   190.000(Ft.)
Top (of initial area) elevation =    94.830(Ft.)
Bottom (of initial area) elevation =    90.150(Ft.)
Difference in elevation =     4.680(Ft.)
Slope =    0.02463  s(%)=      2.46
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.982 min.
Rainfall intensity =      2.978(In/Hr) for a    25.0 year storm
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Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      0.854(CFS)
Total initial stream area =        0.350(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.265(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.000 to Point/Station       5.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    90.150(Ft.)
Downstream point elevation =    86.900(Ft.)
Channel length thru subarea  =   195.000(Ft.)
Channel base width    =   60.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  25.000
Estimated mean flow rate at midpoint of channel =      1.244(CFS)
Manning's 'N'    = 0.033
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      1.244(CFS)
Depth of flow =   0.034(Ft.), Average velocity =   0.600(Ft/s)
Channel flow top width =   62.538(Ft.)
Flow Velocity =    0.60(Ft/s)
Travel time  =    5.42 min.
Time of concentration =   14.40 min.
Critical depth =      0.024(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
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)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Rainfall intensity =      2.140(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.789
Subarea runoff =      0.681(CFS) for    0.560(Ac.)
Total runoff =      1.536(CFS)
Effective area this stream =        0.91(Ac.)
Total Study Area (Main Stream No. 2) =        3.09(Ac.)
Area averaged Fm value =    0.265(In/Hr)
Depth of flow =   0.038(Ft.), Average velocity =   0.651(Ft/s)
Critical depth =      0.027(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.000 to Point/Station       5.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.910(Ac.)
Runoff from this stream =      1.536(CFS)
Time of concentration =   14.40 min.
Rainfall intensity =     2.140(In/Hr)
Area averaged loss rate (Fm) =    0.2651(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station       7.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
```

```
Initial subarea data:
Initial area flow distance =   210.000(Ft.)
Top (of initial area) elevation =    94.060(Ft.)
Bottom (of initial area) elevation =    87.750(Ft.)
Difference in elevation =     6.310(Ft.)
Slope =    0.03005  s(%)=      3.00
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.984 min.
Rainfall intensity =      2.977(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
Subarea runoff =      1.342(CFS)
Total initial stream area =        0.550(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.265(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    87.750(Ft.)
Downstream point elevation =    86.900(Ft.)
Channel length thru subarea  =   137.000(Ft.)
Channel base width    =   60.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =      1.765(CFS)
Manning's 'N'    = 0.033
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      1.765(CFS)
Depth of flow =   0.056(Ft.), Average velocity =   0.503(Ft/s)
Channel flow top width =   65.585(Ft.)
Flow Velocity =    0.50(Ft/s)
Travel time  =    4.54 min.
Time of concentration =   13.52 min.
Critical depth =      0.030(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
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)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Rainfall intensity =      2.236(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.793
Subarea runoff =      0.787(CFS) for    0.650(Ac.)
Total runoff =      2.129(CFS)
Effective area this stream =        1.20(Ac.)
Total Study Area (Main Stream No. 2) =        4.29(Ac.)
Area averaged Fm value =    0.265(In/Hr)
Depth of flow =   0.062(Ft.), Average velocity =   0.540(Ft/s)
Critical depth =      0.034(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      1.200(Ac.)
Runoff from this stream =      2.129(CFS)
Time of concentration =   13.52 min.
Rainfall intensity =     2.236(In/Hr)
Area averaged loss rate (Fm) =    0.2651(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      1.54     0.910     14.40    0.265      2.140
2      2.13     1.200     13.52    0.265      2.236
Qmax(1) =
          1.000 *    1.000 *     1.536) +
          0.951 *    1.000 *     2.129) + =       3.560
Qmax(2) =
          1.051 *    0.939 *     1.536) +
          1.000 *    1.000 *     2.129) + =       3.645

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.536       2.129
Maximum flow rates at confluence using above data:
        3.560       3.645
Area of streams before confluence:
        0.910       1.200
Effective area values after confluence:
        2.110       2.054
Results of confluence:
Total flow rate =      3.645(CFS)
Time of concentration =    13.520 min.
Effective stream area after confluence =      2.054(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.265(In/Hr)
Study area total (this main stream) =      2.11(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       8.000 to Point/Station       9.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    87.750(Ft.)
Downstream point elevation =    82.980(Ft.)
Channel length thru subarea  =   190.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      3.989(CFS)
Manning's 'N'    = 0.033
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      3.989(CFS)
Depth of flow =   0.253(Ft.), Average velocity =   2.515(Ft/s)
Channel flow top width =    7.532(Ft.)
Flow Velocity =    2.51(Ft/s)
Travel time  =    1.26 min.
Time of concentration =   14.78 min.
Critical depth =      0.248(Ft.)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
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)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Rainfall intensity =      2.101(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.786
Subarea runoff =      0.609(CFS) for    0.520(Ac.)
Total runoff =      4.254(CFS)
Effective area this stream =        2.57(Ac.)
Total Study Area (Main Stream No. 2) =        4.81(Ac.)
Area averaged Fm value =    0.265(In/Hr)
Depth of flow =   0.263(Ft.), Average velocity =   2.567(Ft/s)
Critical depth =      0.258(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       8.000 to Point/Station       9.000
```

**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area = 2.574(Ac.)
Runoff from this stream = 4.254(CFS)
Time of concentration = 14.78 min.
Rainfall intensity = 2.101(In/Hr)
Area averaged loss rate (Fm) = 0.2651(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream No.	Flow rate (CFS)	Area (Ac.)	TC (min)	Fm (In/Hr)	Rainfall Intensity (In/Hr)
1	3.61	2.180	14.74	0.265	2.105
2	4.25	2.574	14.78	0.265	2.101

```
Qmax(1) =
          1.000 *    1.000 *     3.610) +
          1.002 *    0.997 *     4.254) + =       7.862
Qmax(2) =
          0.998 *    1.000 *     3.610) +
          1.000 *    1.000 *     4.254) + =       7.857
```

Total of 2 main streams to confluence:
Flow rates before confluence point:
4.610 5.254
Maximum flow rates at confluence using above data:
7.862 7.857
Area of streams before confluence:
2.180 2.574
Effective area values after confluence:
4.748 4.754

Results of confluence:
Total flow rate = 7.862(CFS)
Time of concentration = 14.742 min.
Effective stream area after confluence = 4.748(Ac.)
Study area average Pervious fraction(Ap) = 1.000
Study area average soil loss rate(Fm) = 0.265(In/Hr)
Study area total = 4.75(Ac.)
End of computations, Total Study Area = 4.81 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 86.0

```
                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: 01/10/22
------------------------------------------------------------------------
```

DEVELOPED
10-YEAR 1-HOUR
AMC II

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


                   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 =     0.622 (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(3 - 4 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
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   155.000(Ft.)
Top (of initial area) elevation =    88.000(Ft.)
Bottom (of initial area) elevation =    87.900(Ft.)
Difference in elevation =     0.100(Ft.)
Slope =    0.00065  s(%)=      0.06
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.462 min.
Rainfall intensity =      1.771(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.733
Subarea runoff =      0.344(CFS)
Total initial stream area =       0.265(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(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 =    87.900(Ft.)
```

```
End of street segment elevation =    86.600(Ft.)
Length of street segment  =   228.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(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 [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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      0.743(CFS)
Depth of flow =   0.248(Ft.), Average velocity =   1.498(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.075(Ft.)
Flow velocity =   1.50(Ft/s)
Travel time =    2.54 min.     TC =   16.00  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 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
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      1.569(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.711
Subarea runoff =      0.711(CFS) for    0.680(Ac.)
Total runoff =      1.055(CFS)
Effective area this stream =        0.95(Ac.)
Total Study Area (Main Stream No. 1) =        0.95(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =      1.055(CFS)
Half street flow at end of street =      1.055(CFS)
Depth of flow =   0.273(Ft.), Average velocity =   1.586(Ft/s)
Flow width (from curb towards crown)=   7.338(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    86.600(Ft.)
End of street segment elevation =    85.200(Ft.)
Length of street segment  =   289.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(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 [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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      1.602(CFS)
Depth of flow =   0.313(Ft.), Average velocity =   1.610(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   9.321(Ft.)
Flow velocity =   1.61(Ft/s)
Travel time =    2.99 min.     TC =   18.99  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 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
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      1.392(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.687
Subarea runoff =      1.007(CFS) for    1.210(Ac.)
Total runoff =      2.061(CFS)
Effective area this stream =        2.16(Ac.)
Total Study Area (Main Stream No. 1) =        2.16(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =      2.061(CFS)
Half street flow at end of street =      2.061(CFS)
Depth of flow =   0.335(Ft.), Average velocity =   1.697(Ft/s)
Flow width (from curb towards crown)=  10.432(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.000 to Point/Station       4.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    85.200(Ft.)
Downstream point/station elevation =    84.800(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.061(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.061(CFS)
Normal flow depth in pipe =    5.41(In.)
Flow top width inside pipe =   16.50(In.)
Critical Depth =    6.50(In.)
Pipe flow velocity =      4.62(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    19.14 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.000 to Point/Station       4.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.155(Ac.)
Runoff from this stream =      2.061(CFS)
Time of concentration =   19.14 min.
Rainfall intensity =     1.384(In/Hr)
Area averaged loss rate (Fm) =    0.3287(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       5.000 to Point/Station       6.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 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
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   155.000(Ft.)
Top (of initial area) elevation =    90.200(Ft.)
Bottom (of initial area) elevation =    87.900(Ft.)
Difference in elevation =     2.300(Ft.)
Slope =    0.01484  s(%)=       1.48
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.190 min.
Rainfall intensity =      2.746(In/Hr) for a    10.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.792
Subarea runoff =      0.577(CFS)
Total initial stream area =        0.265(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station       7.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    87.900(Ft.)
End of street segment elevation =    86.600(Ft.)
Length of street segment  =   228.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(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 [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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      1.133(CFS)
Depth of flow =   0.279(Ft.), Average velocity =   1.607(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.608(Ft.)
Flow velocity =   1.61(Ft/s)
Travel time =    2.37 min.     TC =    9.56  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 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
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      2.251(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.769
Subarea runoff =      1.058(CFS) for    0.680(Ac.)
Total runoff =      1.635(CFS)
Effective area this stream =        0.95(Ac.)
Total Study Area (Main Stream No. 1) =        3.10(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =      1.635(CFS)
Half street flow at end of street =      1.635(CFS)
Depth of flow =   0.308(Ft.), Average velocity =   1.724(Ft/s)
Flow width (from curb towards crown)=   9.062(Ft.)


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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 =    86.600(Ft.)
End of street segment elevation =    85.200(Ft.)
Length of street segment  =   289.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(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 [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 =   2.000(Ft.)
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```
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      2.373(CFS)
Depth of flow =   0.349(Ft.), Average velocity =   1.749(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  11.092(Ft.)
Flow velocity =   1.75(Ft/s)
Travel time =    2.75 min.     TC =   12.31  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 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
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      1.885(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.743
Subarea runoff =      1.384(CFS) for    1.210(Ac.)
Total runoff =      3.018(CFS)
Effective area this stream =        2.16(Ac.)
Total Study Area (Main Stream No. 1) =        4.31(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =      3.018(CFS)
Half street flow at end of street =      3.018(CFS)
Depth of flow =   0.372(Ft.), Average velocity =   1.844(Ft/s)
Flow width (from curb towards crown)=  12.289(Ft.)


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Process from Point/Station        7.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.155(Ac.)
Runoff from this stream =      3.018(CFS)
Time of concentration =   12.31 min.
Rainfall intensity =     1.885(In/Hr)
Area averaged loss rate (Fm) =    0.3287(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

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


1      2.06     2.155     19.14    0.329      1.384
2      3.02     2.155     12.31    0.329      1.885
Qmax(1) =
          1.000 *    1.000 *     2.061) +
          0.678 *    1.000 *     3.018) + =       4.109
Qmax(2) =
          1.474 *    0.643 *     2.061) +
          1.000 *    1.000 *     3.018) + =       4.974

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.061       3.018
Maximum flow rates at confluence using above data:
        4.109        4.974
Area of streams before confluence:
        2.155        2.155
Effective area values after confluence:
        4.310        3.541
Results of confluence:
Total flow rate =      4.974(CFS)
Time of concentration =    12.310 min.
Effective stream area after confluence =      3.541(Ac.)
```

Study area average Pervious fraction(Ap) = 0.600
Study area average soil loss rate(Fm) = 0.329(In/Hr)
Study area total (this main stream) = 4.31(Ac.)
End of computations, Total Study Area = 4.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number = 69.0

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: 01/10/22

DEVELOPED
100-YEAR
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 =      1.060 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        0.000 to Point/Station        1.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 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) = 0.6000     Max loss rate(Fm)=     0.157(In/Hr)
Initial subarea data:
Initial area flow distance =   155.000(Ft.)
Top (of initial area) elevation =     88.000(Ft.)
Bottom (of initial area) elevation =    87.900(Ft.)
Difference in elevation =     0.100(Ft.)
Slope =    0.00065  s(%)=       0.06
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.462 min.
Rainfall intensity =      3.017(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.853
Subarea runoff =      0.682(CFS)
Total initial stream area =        0.265(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.157(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
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Top of street segment elevation =    87.900(Ft.)
End of street segment elevation =    86.600(Ft.)
Length of street segment  =   228.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(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 [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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      1.459(CFS)
Depth of flow =   0.299(Ft.), Average velocity =   1.686(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.597(Ft.)
Flow velocity =   1.69(Ft/s)
Travel time =    2.25 min.     TC =   15.72  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 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) = 0.6000     Max loss rate(Fm)=     0.157(In/Hr)
Rainfall intensity =      2.708(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =      1.487(CFS) for    0.680(Ac.)
Total runoff =      2.169(CFS)
Effective area this stream =        0.95(Ac.)
Total Study Area (Main Stream No. 1) =        0.95(Ac.)
Area averaged Fm value =    0.157(In/Hr)
Street flow at end of street =      2.169(CFS)
Half street flow at end of street =      2.169(CFS)
Depth of flow =   0.333(Ft.), Average velocity =   1.829(Ft/s)
Flow width (from curb towards crown)=  10.293(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    86.600(Ft.)
End of street segment elevation =    85.200(Ft.)
Length of street segment  =   289.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(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 [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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      3.329(CFS)
Depth of flow =   0.383(Ft.), Average velocity =   1.885(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.805(Ft.)
Flow velocity =   1.88(Ft/s)
Travel time =    2.56 min.     TC =   18.27  min.
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```
 Adding area flow to street
RESIDENTIAL(3 - 4 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) = 0.6000     Max loss rate(Fm)=     0.157(In/Hr)
Rainfall intensity =      2.437(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.842
Subarea runoff =      2.252(CFS) for    1.210(Ac.)
Total runoff =      4.421(CFS)
Effective area this stream =        2.16(Ac.)
Total Study Area (Main Stream No. 1) =        2.16(Ac.)
Area averaged Fm value =    0.157(In/Hr)
Street flow at end of street =      4.421(CFS)
Half street flow at end of street =      4.421(CFS)
Depth of flow =   0.415(Ft.), Average velocity =   2.010(Ft/s)
Flow width (from curb towards crown)=  14.398(Ft.)


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Process from Point/Station       3.000 to Point/Station       4.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    85.200(Ft.)
Downstream point/station elevation =    84.800(Ft.)
Pipe length  =    40.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.421(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.421(CFS)
Normal flow depth in pipe =    8.14(In.)
Flow top width inside pipe =   17.92(In.)
Critical Depth =    9.69(In.)
Pipe flow velocity =      5.69(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    18.39 min.


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Process from Point/Station       3.000 to Point/Station       4.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.155(Ac.)
Runoff from this stream =      4.421(CFS)
Time of concentration =   18.39 min.
Rainfall intensity =     2.426(In/Hr)
Area averaged loss rate (Fm) =    0.1569(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000


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Process from Point/Station       5.000 to Point/Station       6.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 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) = 0.6000     Max loss rate(Fm)=     0.157(In/Hr)
Initial subarea data:
Initial area flow distance =   155.000(Ft.)
Top (of initial area) elevation =    90.200(Ft.)
Bottom (of initial area) elevation =    87.900(Ft.)
Difference in elevation =     2.300(Ft.)
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Slope =    0.01484  s(%)=       1.48
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.190 min.
Rainfall intensity =      4.680(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      1.079(CFS)
Total initial stream area =       0.265(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.157(In/Hr)


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Process from Point/Station       6.000 to Point/Station       7.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    87.900(Ft.)
End of street segment elevation =    86.600(Ft.)
Length of street segment  =   228.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(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 [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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      2.182(CFS)
Depth of flow =   0.333(Ft.), Average velocity =   1.831(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.320(Ft.)
Flow velocity =   1.83(Ft/s)
Travel time =    2.08 min.     TC =    9.27  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 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) = 0.6000     Max loss rate(Fm)=     0.157(In/Hr)
Rainfall intensity =      3.919(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.864
Subarea runoff =      2.121(CFS) for    0.680(Ac.)
Total runoff =      3.200(CFS)
Effective area this stream =       0.95(Ac.)
Total Study Area (Main Stream No. 1) =       3.10(Ac.)
Area averaged Fm value =    0.157(In/Hr)
Street flow at end of street =      3.200(CFS)
Half street flow at end of street =      3.200(CFS)
Depth of flow =   0.370(Ft.), Average velocity =   1.990(Ft/s)
Flow width (from curb towards crown)=  12.170(Ft.)


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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 =    86.600(Ft.)
End of street segment elevation =    85.200(Ft.)
Length of street segment  =   289.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
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```
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 =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0110
 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 =      4.728(CFS)
Depth of flow =   0.423(Ft.), Average velocity =   2.041(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.796(Ft.)
Flow velocity =   2.04(Ft/s)
Travel time =    2.36 min.     TC =   11.63  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 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) = 0.6000     Max loss rate(Fm)=     0.157(In/Hr)
Rainfall intensity =      3.344(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.858
Subarea runoff =      2.981(CFS) for    1.210(Ac.)
Total runoff =      6.181(CFS)
Effective area this stream =        2.16(Ac.)
Total Study Area (Main Stream No. 1) =        4.31(Ac.)
Area averaged Fm value =    0.157(In/Hr)
Street flow at end of street =      6.181(CFS)
Half street flow at end of street =      6.181(CFS)
Depth of flow =   0.456(Ft.), Average velocity =   2.172(Ft/s)
Flow width (from curb towards crown)=  16.489(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 2
Stream flow area =      2.155(Ac.)
Runoff from this stream =      6.181(CFS)
Time of concentration =   11.63 min.
Rainfall intensity =     3.344(In/Hr)
Area averaged loss rate (Fm) =    0.1569(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

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


1      4.42     2.155     18.39    0.157      2.426
2      6.18     2.155     11.63    0.157      3.344
Qmax(1) =
          1.000 *    1.000 *     4.421) +
          0.712 *    1.000 *     6.181) + =       8.822
Qmax(2) =
          1.405 *    0.632 *     4.421) +
          1.000 *    1.000 *     6.181) + =      10.107

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.421       6.181
Maximum flow rates at confluence using above data:
        8.822       10.107
Area of streams before confluence:
        2.155        2.155
```

```
Effective area values after confluence:
        4.310        3.517
Results of confluence:
Total flow rate =     10.107(CFS)
Time of concentration =    11.625 min.
Effective stream area after confluence =      3.517(Ac.)
Study area average Pervious fraction(Ap) =  0.600
Study area average soil loss rate(Fm) =    0.157(In/Hr)
Study area total (this main stream) =       4.31(Ac.)
End of computations, Total Study Area =           4.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number =  69.0
```

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 01/10/22

++

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

Program License Serial Number 6434

Unit Hydro developed
10-year 24-hour
AMC II

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		
4.31	1	0.62
Rainfall data for year 10		
4.31	6	1.31
Rainfall data for year 10		
4.31	24	2.51

++

******** 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)
69.0	69.0	4.31	1.000	0.548	0.600	0.329

Area-averaged adjusted loss rate Fm (In/Hr) = 0.329

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     2.59   0.600         69.0      69.0       4.49     0.169
     1.72   0.400         98.0      98.0       0.20     0.909

Area-averaged catchment yield fraction, Y =  0.465
Area-averaged low loss fraction, Yb =  0.535
User entry of time of concentration  =   0.205 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       4.31(Ac.)
Catchment Lag time =   0.164 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 50.7717
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.329(In/Hr)
Average low loss rate fraction (Yb) = 0.535 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.295(In)
Computed peak 30-minute rainfall =  0.505(In)
Specified peak 1-hour rainfall =  0.622(In)
Computed peak 3-hour rainfall =  0.982(In)
Specified peak 6-hour rainfall =  1.310(In)
Specified peak 24-hour rainfall =  2.510(In)


Rainfall depth area reduction factors:
Using a total area of       4.31(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.295(In)
30-minute factor = 1.000    Adjusted rainfall =  0.505(In)
1-hour factor = 1.000       Adjusted rainfall =  0.622(In)
3-hour factor = 1.000       Adjusted rainfall =  0.982(In)
6-hour factor = 1.000       Adjusted rainfall =  1.310(In)
24-hour factor = 1.000      Adjusted rainfall =  2.510(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 =        52.12 (CFS))

  1                4.066                  2.119
  2               31.418                 14.257
  3               61.246                 15.548
  4               74.290                  6.799
  5               81.860                  3.945
  6               86.965                  2.661
  7               90.462                  1.823
  8               93.036                  1.341
  9               94.969                  1.008
 10               96.436                  0.765
 11               97.490                  0.550
 12               98.140                  0.339
 13               98.716                  0.300
 14               99.318                  0.314
 15               99.726                  0.213
 16              100.000                  0.143
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.20(In)
Total effective rainfall =      1.31(In)
Peak flow rate in flood hydrograph =      4.90(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        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0002      0.03  Q         |         |         |         |
  0+15       0.0007      0.06  Q         |         |         |         |
  0+20       0.0012      0.07  Q         |         |         |         |
  0+25       0.0017      0.08  Q         |         |         |         |
  0+30       0.0023      0.09  Q         |         |         |         |
  0+35       0.0030      0.09  Q         |         |         |         |
  0+40       0.0036      0.09  Q         |         |         |         |
  0+45       0.0043      0.10  Q         |         |         |         |
  0+50       0.0049      0.10  Q         |         |         |         |
  0+55       0.0056      0.10  Q         |         |         |         |
  1+ 0       0.0063      0.10  Q         |         |         |         |
  1+ 5       0.0070      0.10  Q         |         |         |         |
  1+10       0.0077      0.10  Q         |         |         |         |
  1+15       0.0084      0.10  Q         |         |         |         |
  1+20       0.0091      0.10  Q         |         |         |         |
  1+25       0.0098      0.10  Q         |         |         |         |
  1+30       0.0105      0.10  Q         |         |         |         |
  1+35       0.0112      0.10  Q         |         |         |         |
  1+40       0.0119      0.10  QV        |         |         |         |
  1+45       0.0127      0.10  QV        |         |         |         |
  1+50       0.0134      0.10  QV        |         |         |         |
  1+55       0.0141      0.10  QV        |         |         |         |
  2+ 0       0.0148      0.11  QV        |         |         |         |
  2+ 5       0.0156      0.11  QV        |         |         |         |
  2+10       0.0163      0.11  QV        |         |         |         |
  2+15       0.0170      0.11  QV        |         |         |         |
  2+20       0.0177      0.11  QV        |         |         |         |
  2+25       0.0185      0.11  QV        |         |         |         |
  2+30       0.0192      0.11  QV        |         |         |         |
  2+35       0.0200      0.11  QV        |         |         |         |
  2+40       0.0207      0.11  QV        |         |         |         |
  2+45       0.0215      0.11  QV        |         |         |         |
  2+50       0.0222      0.11  QV        |         |         |         |
  2+55       0.0229      0.11  QV        |         |         |         |
  3+ 0       0.0237      0.11  Q V       |         |         |         |
  3+ 5       0.0245      0.11  Q V       |         |         |         |
  3+10       0.0252      0.11  Q V       |         |         |         |
  3+15       0.0260      0.11  Q V       |         |         |         |
  3+20       0.0267      0.11  Q V       |         |         |         |
  3+25       0.0275      0.11  Q V       |         |         |         |
  3+30       0.0283      0.11  Q V       |         |         |         |
  3+35       0.0290      0.11  Q V       |         |         |         |
  3+40       0.0298      0.11  Q V       |         |         |         |
  3+45       0.0306      0.11  Q V       |         |         |         |
  3+50       0.0314      0.11  Q V       |         |         |         |
  3+55       0.0322      0.11  Q V       |         |         |         |
  4+ 0       0.0329      0.11  Q V       |         |         |         |
  4+ 5       0.0337      0.11  Q V       |         |         |         |
  4+10       0.0345      0.11  Q V       |         |         |         |
  4+15       0.0353      0.12  Q  V      |         |         |         |
  4+20       0.0361      0.12  Q  V      |         |         |         |
  4+25       0.0369      0.12  Q  V      |         |         |         |
  4+30       0.0377      0.12  Q  V      |         |         |         |
  4+35       0.0385      0.12  Q  V      |         |         |         |
  4+40       0.0393      0.12  Q  V      |         |         |         |
  4+45       0.0401      0.12  Q  V      |         |         |         |
  4+50       0.0409      0.12  Q  V      |         |         |         |
  4+55       0.0418      0.12  Q  V      |         |         |         |
  5+ 0       0.0426      0.12  Q  V      |         |         |         |
  5+ 5       0.0434      0.12  Q  V      |         |         |         |
  5+10       0.0442      0.12  Q  V      |         |         |         |
  5+15       0.0451      0.12  Q  V      |         |         |         |
  5+20       0.0459      0.12  Q  V      |         |         |         |
  5+25       0.0467      0.12  Q  V      |         |         |         |
```

5+30	0.0476	0.12	Q V | | | |
5+35	0.0484	0.12	Q V | | | |
5+40	0.0493	0.12	Q V | | | |
5+45	0.0501	0.12	Q V | | | |
5+50	0.0510	0.12	Q V | | | |
5+55	0.0518	0.12	Q V | | | |
6+ 0	0.0527	0.13	Q V | | | |
6+ 5	0.0536	0.13	Q V | | | |
6+10	0.0544	0.13	Q V | | | |
6+15	0.0553	0.13	Q V | | | |
6+20	0.0562	0.13	Q V | | | |
6+25	0.0571	0.13	Q V | | | |
6+30	0.0579	0.13	Q V | | | |
6+35	0.0588	0.13	Q V | | | |
6+40	0.0597	0.13	Q V | | | |
6+45	0.0606	0.13	Q V | | | |
6+50	0.0615	0.13	Q V | | | |
6+55	0.0624	0.13	Q V | | | |
7+ 0	0.0633	0.13	Q V | | | |
7+ 5	0.0643	0.13	Q V | | | |
7+10	0.0652	0.13	Q V | | | |
7+15	0.0661	0.13	Q V | | | |
7+20	0.0670	0.13	Q V | | | |
7+25	0.0680	0.14	Q V | | | |
7+30	0.0689	0.14	Q V | | | |
7+35	0.0698	0.14	Q V | | | |
7+40	0.0708	0.14	Q V | | | |
7+45	0.0717	0.14	Q V | | | |
7+50	0.0727	0.14	Q V | | | |
7+55	0.0737	0.14	Q V | | | |
8+ 0	0.0746	0.14	Q V | | | |
8+ 5	0.0756	0.14	Q V | | | |
8+10	0.0766	0.14	Q V | | | |
8+15	0.0776	0.14	Q V | | | |
8+20	0.0785	0.14	Q V | | | |
8+25	0.0795	0.14	Q V | | | |
8+30	0.0805	0.15	Q V | | | |
8+35	0.0815	0.15	Q V | | | |
8+40	0.0825	0.15	Q V | | | |
8+45	0.0836	0.15	Q V | | | |
8+50	0.0846	0.15	Q V | | | |
8+55	0.0856	0.15	Q V | | | |
9+ 0	0.0867	0.15	Q V | | | |
9+ 5	0.0877	0.15	Q V | | | |
9+10	0.0887	0.15	Q V | | | |
9+15	0.0898	0.15	Q V | | | |
9+20	0.0909	0.15	Q V | | | |
9+25	0.0919	0.16	Q V | | | |
9+30	0.0930	0.16	Q V | | | |
9+35	0.0941	0.16	Q V | | | |
9+40	0.0952	0.16	Q V | | | |
9+45	0.0963	0.16	Q V | | | |
9+50	0.0974	0.16	Q V | | | |
9+55	0.0985	0.16	Q V | | | |
10+ 0	0.0996	0.16	Q V | | | |
10+ 5	0.1007	0.16	Q V | | | |
10+10	0.1019	0.16	Q V | | | |
10+15	0.1030	0.17	Q V | | | |
10+20	0.1042	0.17	Q V | | | |
10+25	0.1053	0.17	Q V | | | |
10+30	0.1065	0.17	Q V| | | |
10+35	0.1077	0.17	Q V| | | |
10+40	0.1088	0.17	Q V| | | |
10+45	0.1100	0.17	Q V| | | |
10+50	0.1113	0.18	Q V| | | |
10+55	0.1125	0.18	Q V| | | |
11+ 0	0.1137	0.18	Q V| | | |
11+ 5	0.1149	0.18	Q V| | | |
11+10	0.1162	0.18	Q V| | | |
11+15	0.1174	0.18	Q V | | |
11+20	0.1187	0.18	Q V | | |

```
11+25       0.1200      0.19  Q         V         |         |         |
11+30       0.1213      0.19  Q         V         |         |         |
11+35       0.1226      0.19  Q         V         |         |         |
11+40       0.1239      0.19  Q         V         |         |         |
11+45       0.1252      0.19  Q         V         |         |         |
11+50       0.1266      0.20  Q         V         |         |         |
11+55       0.1279      0.20  Q         V         |         |         |
12+ 0       0.1293      0.20  Q         |V        |         |         |
12+ 5       0.1307      0.20  Q         |V        |         |         |
12+10       0.1320      0.20  Q         |V        |         |         |
12+15       0.1333      0.19  Q         |V        |         |         |
12+20       0.1347      0.19  Q         |V        |         |         |
12+25       0.1360      0.19  Q         |V        |         |         |
12+30       0.1373      0.19  Q         |V        |         |         |
12+35       0.1386      0.19  Q         |V        |         |         |
12+40       0.1400      0.20  Q         |V        |         |         |
12+45       0.1413      0.20  Q         | V       |         |         |
12+50       0.1427      0.20  Q         | V       |         |         |
12+55       0.1441      0.20  Q         | V       |         |         |
13+ 0       0.1455      0.21  Q         | V       |         |         |
13+ 5       0.1470      0.21  Q         | V       |         |         |
13+10       0.1484      0.21  Q         | V       |         |         |
13+15       0.1499      0.21  Q         | V       |         |         |
13+20       0.1514      0.22  Q         | V       |         |         |
13+25       0.1529      0.22  Q         |  V      |         |         |
13+30       0.1545      0.23  Q         |  V      |         |         |
13+35       0.1561      0.23  Q         |  V      |         |         |
13+40       0.1577      0.23  Q         |  V      |         |         |
13+45       0.1593      0.24  Q         |  V      |         |         |
13+50       0.1610      0.24  Q         |  V      |         |         |
13+55       0.1627      0.25  Q         |  V      |         |         |
14+ 0       0.1645      0.25  |Q        |   V     |         |         |
14+ 5       0.1662      0.26  |Q        |   V     |         |         |
14+10       0.1681      0.27  |Q        |   V     |         |         |
14+15       0.1699      0.27  |Q        |   V     |         |         |
14+20       0.1718      0.28  |Q        |   V     |         |         |
14+25       0.1738      0.29  |Q        |   V     |         |         |
14+30       0.1758      0.29  |Q        |   V     |         |         |
14+35       0.1779      0.30  |Q        |    V    |         |         |
14+40       0.1800      0.31  |Q        |    V    |         |         |
14+45       0.1822      0.32  |Q        |    V    |         |         |
14+50       0.1845      0.33  |Q        |    V    |         |         |
14+55       0.1869      0.34  |Q        |    V    |         |         |
15+ 0       0.1893      0.36  |Q        |     V   |         |         |
15+ 5       0.1919      0.37  |Q        |     V   |         |         |
15+10       0.1945      0.39  |Q        |     V   |         |         |
15+15       0.1973      0.40  |Q        |     V   |         |         |
15+20       0.2002      0.43  |Q        |      V  |         |         |
15+25       0.2033      0.44  |Q        |      V  |         |         |
15+30       0.2063      0.43  |Q        |      V  |         |         |
15+35       0.2091      0.42  |Q        |      V  |         |         |
15+40       0.2122      0.44  |Q        |       V |         |         |
15+45       0.2154      0.48  |Q        |       V |         |         |
15+50       0.2191      0.54  | Q       |       V |         |         |
15+55       0.2234      0.63  | Q       |        V|         |         |
16+ 0       0.2291      0.83  |  Q      |        V|         |         |
16+ 5       0.2410      1.72  |     Q   |         V         |         |
16+10       0.2740      4.79  |         |        Q|  V      |         |
16+15       0.3077      4.90  |         |        Q|     V   |         |
16+20       0.3253      2.56  |         Q         |      V  |         |
16+25       0.3370      1.69  |     Q   |         |       V |         |
16+30       0.3459      1.29  |    Q    |         |        V|         |
16+35       0.3530      1.03  |   Q     |         |         V         |
16+40       0.3589      0.86  |  Q      |         |         V         |
16+45       0.3639      0.73  | Q       |         |         |V        |
16+50       0.3682      0.63  | Q       |         |         |V        |
16+55       0.3719      0.54  | Q       |         |         |V        |
17+ 0       0.3750      0.45  |Q        |         |         |V        |
17+ 5       0.3779      0.42  |Q        |         |         | V       |
17+10       0.3807      0.40  |Q        |         |         | V       |
17+15       0.3831      0.36  |Q        |         |         | V       |
```

```
17+20       0.3853      0.32  |Q        |         |         | V       |
17+25       0.3872      0.27  |Q        |         |         |  V      |
17+30       0.3889      0.25  |Q        |         |         |  V      |
17+35       0.3906      0.24  Q         |         |         |  V      |
17+40       0.3922      0.23  Q         |         |         |  V      |
17+45       0.3938      0.23  Q         |         |         |  V      |
17+50       0.3953      0.22  Q         |         |         |  V      |
17+55       0.3967      0.21  Q         |         |         |  V      |
18+ 0       0.3981      0.20  Q         |         |         |  V      |
18+ 5       0.3995      0.20  Q         |         |         |   V     |
18+10       0.4009      0.20  Q         |         |         |   V     |
18+15       0.4023      0.20  Q         |         |         |   V     |
18+20       0.4037      0.20  Q         |         |         |   V     |
18+25       0.4050      0.20  Q         |         |         |   V     |
18+30       0.4064      0.20  Q         |         |         |   V     |
18+35       0.4077      0.19  Q         |         |         |   V     |
18+40       0.4090      0.19  Q         |         |         |   V     |
18+45       0.4103      0.19  Q         |         |         |   V     |
18+50       0.4116      0.18  Q         |         |         |    V    |
18+55       0.4128      0.18  Q         |         |         |    V    |
19+ 0       0.4140      0.18  Q         |         |         |    V    |
19+ 5       0.4152      0.17  Q         |         |         |    V    |
19+10       0.4164      0.17  Q         |         |         |    V    |
19+15       0.4176      0.17  Q         |         |         |    V    |
19+20       0.4187      0.17  Q         |         |         |    V    |
19+25       0.4198      0.16  Q         |         |         |    V    |
19+30       0.4210      0.16  Q         |         |         |    V    |
19+35       0.4221      0.16  Q         |         |         |    V    |
19+40       0.4231      0.16  Q         |         |         |     V   |
19+45       0.4242      0.16  Q         |         |         |     V   |
19+50       0.4253      0.15  Q         |         |         |     V   |
19+55       0.4263      0.15  Q         |         |         |     V   |
20+ 0       0.4273      0.15  Q         |         |         |     V   |
20+ 5       0.4284      0.15  Q         |         |         |     V   |
20+10       0.4294      0.15  Q         |         |         |     V   |
20+15       0.4304      0.14  Q         |         |         |     V   |
20+20       0.4313      0.14  Q         |         |         |     V   |
20+25       0.4323      0.14  Q         |         |         |     V   |
20+30       0.4333      0.14  Q         |         |         |     V   |
20+35       0.4342      0.14  Q         |         |         |      V  |
20+40       0.4352      0.14  Q         |         |         |      V  |
20+45       0.4361      0.14  Q         |         |         |      V  |
20+50       0.4370      0.13  Q         |         |         |      V  |
20+55       0.4380      0.13  Q         |         |         |      V  |
21+ 0       0.4389      0.13  Q         |         |         |      V  |
21+ 5       0.4398      0.13  Q         |         |         |      V  |
21+10       0.4407      0.13  Q         |         |         |      V  |
21+15       0.4415      0.13  Q         |         |         |      V  |
21+20       0.4424      0.13  Q         |         |         |      V  |
21+25       0.4433      0.13  Q         |         |         |      V  |
21+30       0.4441      0.12  Q         |         |         |      V  |
21+35       0.4450      0.12  Q         |         |         |      V  |
21+40       0.4458      0.12  Q         |         |         |       V |
21+45       0.4467      0.12  Q         |         |         |       V |
21+50       0.4475      0.12  Q         |         |         |       V |
21+55       0.4483      0.12  Q         |         |         |       V |
22+ 0       0.4492      0.12  Q         |         |         |       V |
22+ 5       0.4500      0.12  Q         |         |         |       V |
22+10       0.4508      0.12  Q         |         |         |       V |
22+15       0.4516      0.12  Q         |         |         |       V |
22+20       0.4524      0.12  Q         |         |         |       V |
22+25       0.4532      0.11  Q         |         |         |       V |
22+30       0.4539      0.11  Q         |         |         |       V |
22+35       0.4547      0.11  Q         |         |         |       V |
22+40       0.4555      0.11  Q         |         |         |       V |
22+45       0.4563      0.11  Q         |         |         |       V |
22+50       0.4570      0.11  Q         |         |         |       V |
22+55       0.4578      0.11  Q         |         |         |        V|
23+ 0       0.4585      0.11  Q         |         |         |        V|
23+ 5       0.4593      0.11  Q         |         |         |        V|
23+10       0.4600      0.11  Q         |         |         |        V|
```

23+15	0.4607	0.11	Q	|	|	|	V|
23+20	0.4615	0.11	Q	|	|	|	V|
23+25	0.4622	0.11	Q	|	|	|	V|
23+30	0.4629	0.10	Q	|	|	|	V|
23+35	0.4636	0.10	Q	|	|	|	V|
23+40	0.4644	0.10	Q	|	|	|	V|
23+45	0.4651	0.10	Q	|	|	|	V|
23+50	0.4658	0.10	Q	|	|	|	V|
23+55	0.4665	0.10	Q	|	|	|	V|
24+ 0	0.4672	0.10	Q	|	|	|	V|
24+ 5	0.4678	0.10	Q	|	|	|	V|
24+10	0.4683	0.07	Q	|	|	|	V|
24+15	0.4686	0.04	Q	|	|	|	V|
24+20	0.4688	0.03	Q	|	|	|	V|
24+25	0.4689	0.02	Q	|	|	|	V|
24+30	0.4690	0.01	Q	|	|	|	V|
24+35	0.4690	0.01	Q	|	|	|	V|
24+40	0.4691	0.01	Q	|	|	|	V|
24+45	0.4691	0.01	Q	|	|	|	V|
24+50	0.4692	0.00	Q	|	|	|	V|
24+55	0.4692	0.00	Q	|	|	|	V|
25+ 0	0.4692	0.00	Q	|	|	|	V|
25+ 5	0.4692	0.00	Q	|	|	|	V|
25+10	0.4692	0.00	Q	|	|	|	V|
25+15	0.4692	0.00	Q	|	|	|	V

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

Study date 01/10/22

++

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

Program License Serial Number 6434

UNIT HYDROGRAPH
DEVELOPED
100-YEAR 3H
AMCIII

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		
4.31	1	1.06
Rainfall data for year 100		
4.31	6	2.22
Rainfall data for year 100		
4.31	24	4.37

++

******** 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)
69.0	86.2	4.31	0.902	0.262	0.600	0.157

Area-averaged adjusted loss rate Fm (In/Hr) = 0.141

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     2.59   0.541         69.0      86.2       1.60     0.664
     1.72   0.361         98.0      98.0       0.20     0.946

Area-averaged catchment yield fraction, Y =  0.701
Area-averaged low loss fraction, Yb =  0.299
User entry of time of concentration  =   0.194 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       4.78(Ac.)
Catchment Lag time =   0.155 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 53.7634
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.157(In/Hr)
Average low loss rate fraction (Yb) = 0.223 (decimal)
Note: user entry of the Fm value
Note: user entry of the Yb value
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.503(In)
Computed peak 30-minute rainfall =  0.861(In)
Specified peak 1-hour rainfall =  1.060(In)
Computed peak 3-hour rainfall =  1.668(In)
Specified peak 6-hour rainfall =  2.220(In)
Specified peak 24-hour rainfall =  4.370(In)


Rainfall depth area reduction factors:
Using a total area of       4.78(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.503(In)
30-minute factor = 1.000    Adjusted rainfall =  0.861(In)
1-hour factor = 1.000       Adjusted rainfall =  1.060(In)
3-hour factor = 1.000       Adjusted rainfall =  1.668(In)
6-hour factor = 1.000       Adjusted rainfall =  2.220(In)
24-hour factor = 1.000      Adjusted rainfall =  4.370(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 =        57.81 (CFS))

  1               5.265                   3.044
  2              34.096                  16.667
  3              74.463                  23.335
  4              92.551                  10.456
  5              97.903                   3.094
  6              99.123                   0.705
  7             100.000                   0.507
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      0.25(In)
Total effective rainfall =      1.41(In)
Peak flow rate in flood hydrograph =     13.69(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        5.0      10.0      15.0      20.0
-----------------------------------------------------------------------
```

```
    0+ 5       0.0003      0.05  Q         |         |         |         |
    0+10       0.0024      0.30  Q         |         |         |         |
    0+15       0.0068      0.65  VQ        |         |         |         |
    0+20       0.0125      0.82  VQ        |         |         |         |
    0+25       0.0187      0.89  |Q        |         |         |         |
    0+30       0.0251      0.93  |Q        |         |         |         |
    0+35       0.0317      0.96  |QV       |         |         |         |
    0+40       0.0385      0.99  |QV       |         |         |         |
    0+45       0.0456      1.03  | QV      |         |         |         |
    0+50       0.0529      1.06  | QV      |         |         |         |
    0+55       0.0605      1.10  | Q V     |         |         |         |
    1+ 0       0.0683      1.14  | Q V     |         |         |         |
    1+ 5       0.0766      1.19  | Q  V    |         |         |         |
    1+10       0.0851      1.25  | Q   V   |         |         |         |
    1+15       0.0941      1.31  | Q   V   |         |         |         |
    1+20       0.1036      1.38  | Q    V  |         |         |         |
    1+25       0.1135      1.44  | Q     V |         |         |         |
    1+30       0.1232      1.40  | Q     V |         |         |         |
    1+35       0.1324      1.33  | Q      V|         |         |         |
    1+40       0.1419      1.39  | Q       V         |         |         |
    1+45       0.1525      1.53  |  Q      V         |         |         |
    1+50       0.1646      1.76  |  Q      |V        |         |         |
    1+55       0.1792      2.13  |   Q     | V       |         |         |
    2+ 0       0.1991      2.88  |    Q    |   V     |         |         |
    2+ 5       0.2359      5.35  |         Q     V   |         |         |
    2+10       0.3157     11.59  |         |         | VQ      |         |
    2+15       0.4100     13.69  |         |         |      Q V|         |
    2+20       0.4601      7.28  |         |   Q     |         | V       |
    2+25       0.4833      3.37  |     Q   |         |         |   V     |
    2+30       0.4970      1.98  |  Q      |         |         |    V    |
    2+35       0.5091      1.75  |  Q      |         |         |     V   |
    2+40       0.5188      1.41  | Q       |         |         |     V   |
    2+45       0.5276      1.28  | Q       |         |         |      V  |
    2+50       0.5356      1.17  | Q       |         |         |       V |
    2+55       0.5431      1.08  | Q       |         |         |       V |
    3+ 0       0.5500      1.01  | Q       |         |         |        V|
    3+ 5       0.5563      0.91  |Q        |         |         |        V|
    3+10       0.5605      0.61  |Q        |         |         |        V|
    3+15       0.5621      0.23  Q         |         |         |        V|
    3+20       0.5626      0.07  Q         |         |         |        V|
    3+25       0.5627      0.02  Q         |         |         |        V|
    3+30       0.5627      0.01  Q         |         |         |        V|
-----------------------------------------------------------------------
```

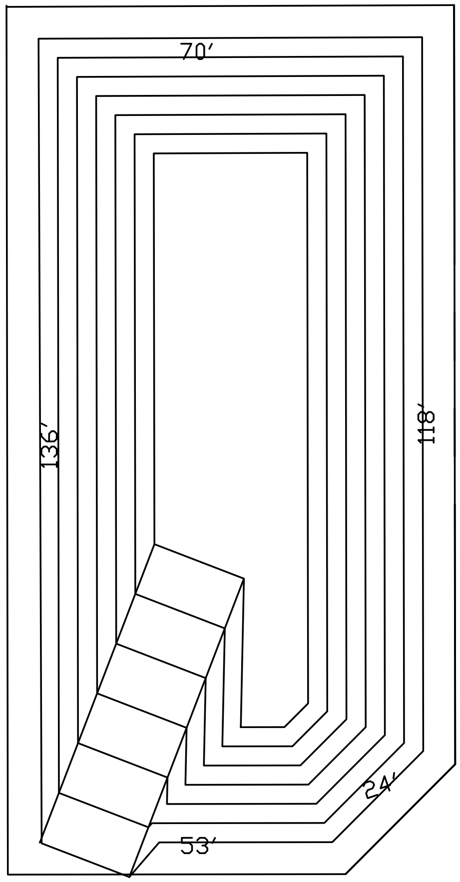
APPENDIX D:

Hydraulic Analysis:

Retention Basin Sizing

Street Capacity

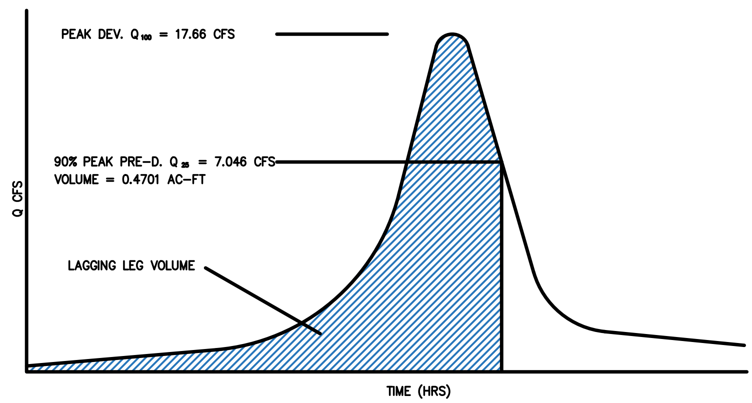
Curb Opening Sump Inlet Sizing



RETENTION BASIN

DESIGN VOLUME

BASIN CALC		
Areas	Average Area	V (Ac.ft)
7475.36	6917.5	0.158803949
6359.64	5833.225	0.13391242
5306.81	4815.195	0.110541667
4323.58	3866.675	0.088766644
3409.77	2987.585	0.068585514
2565.4	2177.93	0.049998393
1790.46		
TOTAL		0.610608586



TOTAL RETENTION BASIN VOLUME

DATE: 01/10/2022

SCALE: 1" = 30'

EXHIBIT G

TTM 20162

RETENTION BASIN

VOLUME CALCULATIONS

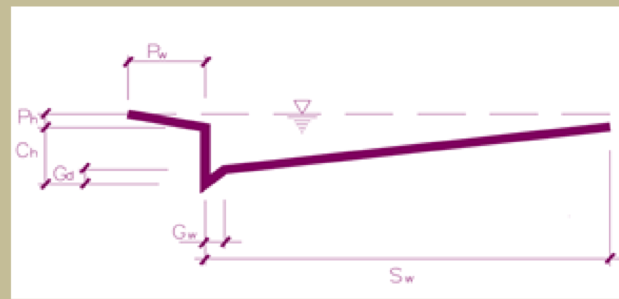
RED BRICK SOLUTION

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