Preliminary

Drainage Report

For

Tentative Tract Map No. 20485

Adelanto, CA

Prepared
October 7, 2021

United Engineering Group - California
8885 Haven Avenue
Suite 195
Rancho Cucamonga, CA 91730

Tel: (909) 466-9240

Provided for:

Hook and Cobalt, LLC
8800 N Gainey Center Dr
Suite 255
Scottsdale, AZ 85258

Project # 13852

This report has been prepared by or under the direction of the following registered civil engineer who attests to the technical information contained herein. The registered civil engineer has also judged the qualifications of any employees that have provided data and calculations upon which the recommendations, conclusions, and decisions are based.

Christopher F. Lenz, PE 63001

TABLE OF CONTENTS

DESCRIPTION **PAGE**

APPENDICES

I. INTRODUCTION

TTM 20485 is a residential subdivision of approximately 20 acres into 92 single family residential lots, located at the southwest intersection of Auburn Avenue and Verbena Road in the City of Adelanto. The property is rectangular shaped and is bordered by dirt roads, with no directly bordering development. Minimum lot size is 5,000 sf. For purposes of this report, WQMP calculations are provided, but a WQMP should be prepared with the final drainage report and project design.

VICINITY MAP

The purpose of this study is to determine the I0-year and I00-year storm runoff emanating from on-site and off-site areas for the Project. The study will determine the peak flow rates for the existing conditions, the peak flow rate and volumes for the proposed conditions, and proposed conditions flow rate and stored volume after routing through one (1) detention basin. Additional analysis will confirm hydraulic capacity of proposed street sections compared to rationale expected runoff.

The scope of the study includes the following:

- Determination of points of flow concentration and watershed areas
- Determination of the I00-year storm runoff based upon the on-site drainage conditions utilizing the San Bernardino County Flood Control District (SBCFCD) SCS Unit Hydrograph Method
- Determination of the 10-year and I00-year peak flow rates for the off-site area utilizing the San Bernardino County Flood Control District (SBCFCD) Rational Method.

II. SITE DISCUSSION

The current property is vacant, undeveloped and undisturbed land with varying slopes. The topography indicates that the runoff drains in a primarily northern direction in the form of sheet flow. There are no defined washes on the property. The on-site sheet flow is identified as area A. On-site runoff outlets the property at the northeastern corner of the site (see Exiting Condition Exhibit).

III. RAINFALL DATA

The San Bernardino County Flood Control District (SBCFCD) hydrology Manual, (Reference 1) was used to develop the hydrological parameters for the 10-year and 100-year storm events. The Rational Method was used to determine the peak flow rates associated with the existing project conditions as well as the time of concentration used in the Unit Hydrograph method. In addition, the Unit Hydrograph Method was utilized to determine the runoff volume. Computations were performed using the CivilCADD drainage software for San Bernardino County Developed by CivilDesign Corporation. Rainfall data was taken from NOAA Atlas 14.

Return Period – Duration	Isohyetal (in)
10 year – 1 hour	0.54
2 year – 6 hour	0.68
2 year – 24 hour	1.16
100 year – 1 hour	0.93
100 year – 6 hour	1.85
100 year – 24 hour	3.32

Hydrologic Soil Groups "C" and "A" an Antecedent Moisture Conditions (AMC) 2 (10yr) and 3 (100yr) are used for the study area. The percentage impervious is 50, and the SCS runoff is 32 and 69. Refer to Appendix C for additional detail.

The project's post developed runoff is designed to be contained in one (1) basin that will act as both water quality infiltration, and flood storage for peak runoff mitigation.

IV. ONSITE RUNOFF

Existing Condition/Pre-Development

The runoff from the subject site in the existing condition is primarily sheet flow with one concentration of flow as runoff exits the site. The site drains

northerly. It is shown as Areas A on the Existing Conditions Drainage Exhibit in Appendix A. The peak flow rate is 16.6 cfs. Therefore a peak flow of 14.9 cfs will be the limiting factor of design outflow of A (90% of 16.6 cfs).

Proposed Condition/Post Development

The proposed condition is to utilize a single basin for water quality and flood routing for the site. The design will incorporate a controlled basin outlet at the northeastern corner of the site. This approach will maintain the existing drainage patterns. The site run-off has been routed to the basin using the streets and typical surface collection facilities for water quality and flood control. The Rationale method was prepared for the determination of time of concentrations for use in the development of the Unit Hydrographs. The post development 100-year runoff is 28.8 cfs.

The post development runoff for Area A is then routed through the proposed basin to confirm post development runoff can be mitigated to less than pre-development runoff. The basin is proposed as dual-purpose retention and detention basin. Roughly the bottom 1-2 feet for the basin acts as water quality retention only, with no outfall, relying solely on infiltration. The volume above serves as detention area for flood storage and volume needed for peak flow mitigation. In order to drain the top flood storage, a scupper connected to a reverse parkway drain has been used for preliminary calculations. The following tables detail the proposed basin shown on the TTM;

Basin Detail				
N BASIN				
Depth	AREA BOTTOM (SF)	VOL Ac-ft	VOL TOTAL	Q (CFS)
0	16041			
1	21923	0.44	0.44	0.0
2	27991	0.57	1.01	0.0
2.25	29539	0.17	1.17	0.0
3	34246	0.38	1.73	18.0

After routing through the proposed basin, the post development 100-year runoff is 14.7 cfs with 1.63 ac-ft stored at a depth of 2.86 feet. Note that the basin has been preliminarily oversized at 1.73 ac-ft versus 1.63 ac-ft required. The basin has been designed at 3' deep. A preliminary scupper connected to a reverse parkway drain was used for calculations. At time of final design, the final outlet structure shall be specified and designed per this report. Refer to Appendices D and E for detailed output files and the TTM for grading detail.

The primary hydraulic design element studied for the onsite flows are the proposed roads within the project that will be used to carry runoff. At the

minimum design slope of 0.4% the roads yield a capacity of 33 cfs within the curbs and 47 cfs within the right-of-way. At time of final design, curb inlets will be designed to convey runoff to the basin, or to dewater intersections at the builder's discretion. The post development sub areas were analyzed using the Rationale Method to determine peak runoff and confirm containment in the curb and right of way. The 100 yr peak overall site runoff of 28.8 cfs is contained within the curb to curb capacity of 33 cfs. Therefore, storm drain inlets are shown at key location to de-water the street. At time of final design those facilities will be designed. Refer to the Proposed Conditions Drainage Exhibit in Appendix A and Appendix F for additional detail.

V. OFFSITE RUNOFF

The potential offsite contributing areas to the subject site are from the south. There is a natural ridge down the middle of the site that routes runoff east and west before it ultimately travels north. The subject site proposes no changes to these offsite drainage patterns.

VI. STORMWATER TREATMENT

Stormwater treatment will be provided by the bottom 1-2 feet of the basin, where the required volume will infiltrate into the ground. As shown on the TTM, the basins exceed the required water quality volume of 0.61 ac-ft. Infiltration testing will be required at time of final design to ensure sufficient rates to de-water the basin in 30 hours (with a factor of safety of 2). Water quality calculations were prepared based on the San Bernardino County Model Water Quality Management Plan Guidance document. The following calculations were used in the preliminary sizing of the proposed facilities;

- WQ Contributing area – 19.9 ac
- 2 yr 1 hour rainfall – 0.314"
- Impervious ratio – 50% (from SBCFCD hydrology Manual)
- $C_{BMP} = 0.34$
- Drainage Area Region – Desert – Regression Coefficient $P_6 = 1.2371$
- $P_6 = 1.2371 \times 0.314" = 0.39"$
- Regression Constant a = 1.963 for 48 hours
- $P_0 = a * C_{BMP} * P_6 = 1.963 \times 0.34 \times 0.39 = 0.26$
- $V_0 = (P_0 * A)/12 = (0.26 \times 19.9)/12 = 0.43$ ac-ft

VII. CONCLUSION

The proposed development of tract 20485, a 20-acre, 92 lot single family detached subdivision can be mitigated as designed and analyzed in this report to be compatible with the City of Adelanto Master Plan of Drainage. The development of the subject site will not significantly change area drainage patterns, impact any of the surrounding properties, or change any of the regional master plan facilities. The project will construct a combination retention and detention basin of sufficient size to handle water quality through infiltration, and flood mitigation through detention. As designed, the basin exceeds the required storage volume. The streets have been analyzed and are confirmed to contain the 10-year runoff within the curb, and the 100-year runoff within the right of way with the proposed addition of storm drain inlets at locations shown. At time of final design, the basins, outlet structures, street grades, and curb inlets will be designed and analyzed in conjunction with final grading and paving plans to confirm capacity.

REFERENCES

1. San Bernardino County Flood Control and Water Conservation District Hydrology Manual, August 1986.

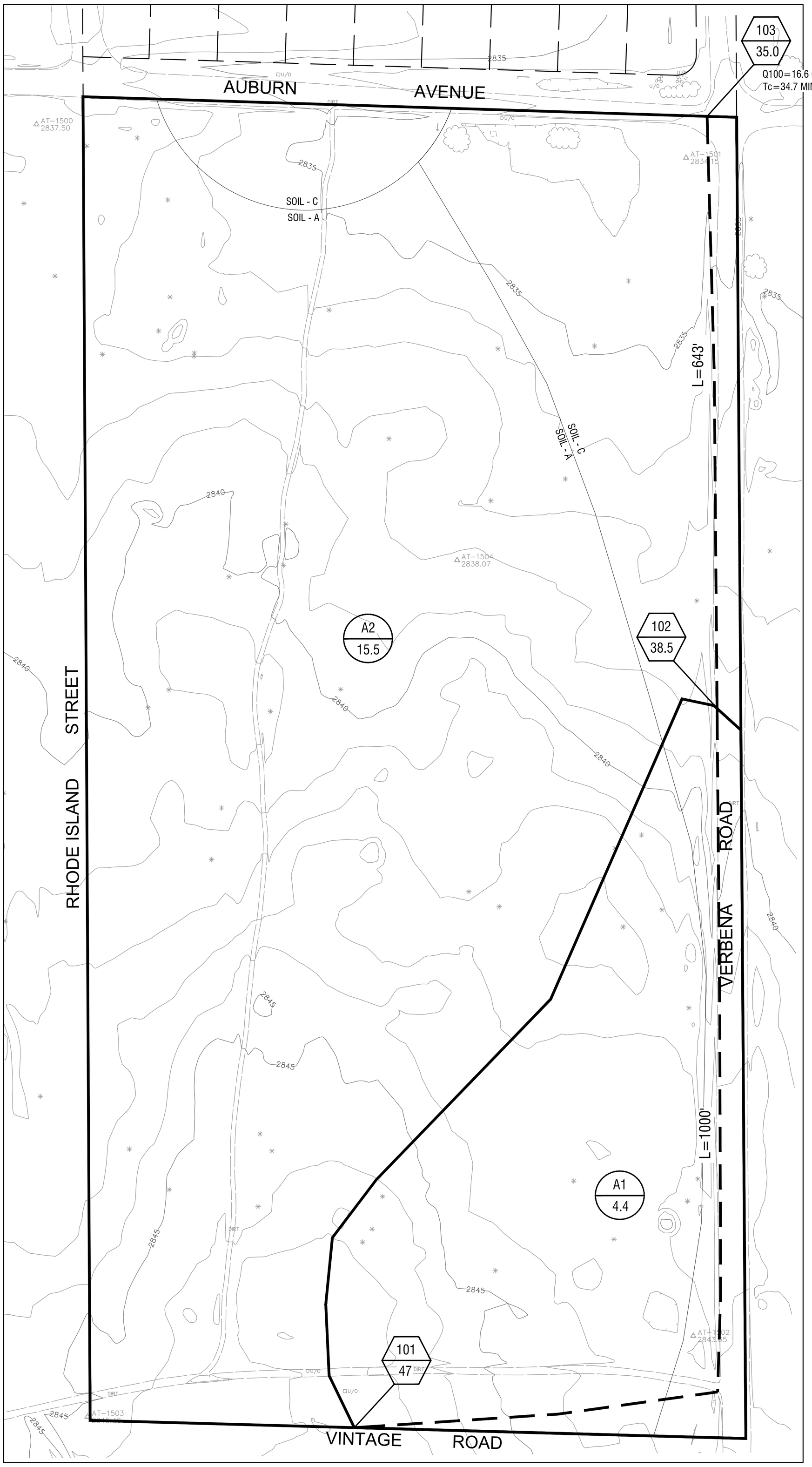
2. City of Adelanto Drainage Master Plan Update, Figure 3-1 Proposed Systems Map, So and Associates Engineers, March 1992.

APPENDIX A:
SITE PLANS – PRE AND POST CONDITIONS

IN THE CITY OF ADELANTO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

EXISTING CONDITIONS EXHIBIT
TENTATIVE MAP - TRACT NO. 20485

UNITED ENGINEERING GROUP CA., INC SEPTEMBER 2021



CONTRIBUTORY AREA
PROJECT BOUNDARY
FLOWPATH
FLOW DIRECTION

102 / XX — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION

A2 / 24.4 — SUBAREA / ACRES

N

50' 25' 0' 50'

GRAPHIC SCALE: 1"=50'

SUBMITTALS:	
DESIGNED BY:	
DRAWN BY:	
CHECKED BY:	

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER F. LENZ
NO. 63001
EXP. 6/30/23
CIVIL
STATE OF CALIFORNIA

CHRISTOPHER F. LENZ DATE
R.C.E. No. 63001

united engineering group
8885 Haven Avenue
Suite 195
Rancho Cucamonga,
CA 91730
Phone: 909.466.9240
www.unitedeng.com

AUBURN & VERBENA

EXISTING CONDITIONS EXHIBIT
TRACT XXXXX

SEPTEMBER 2021

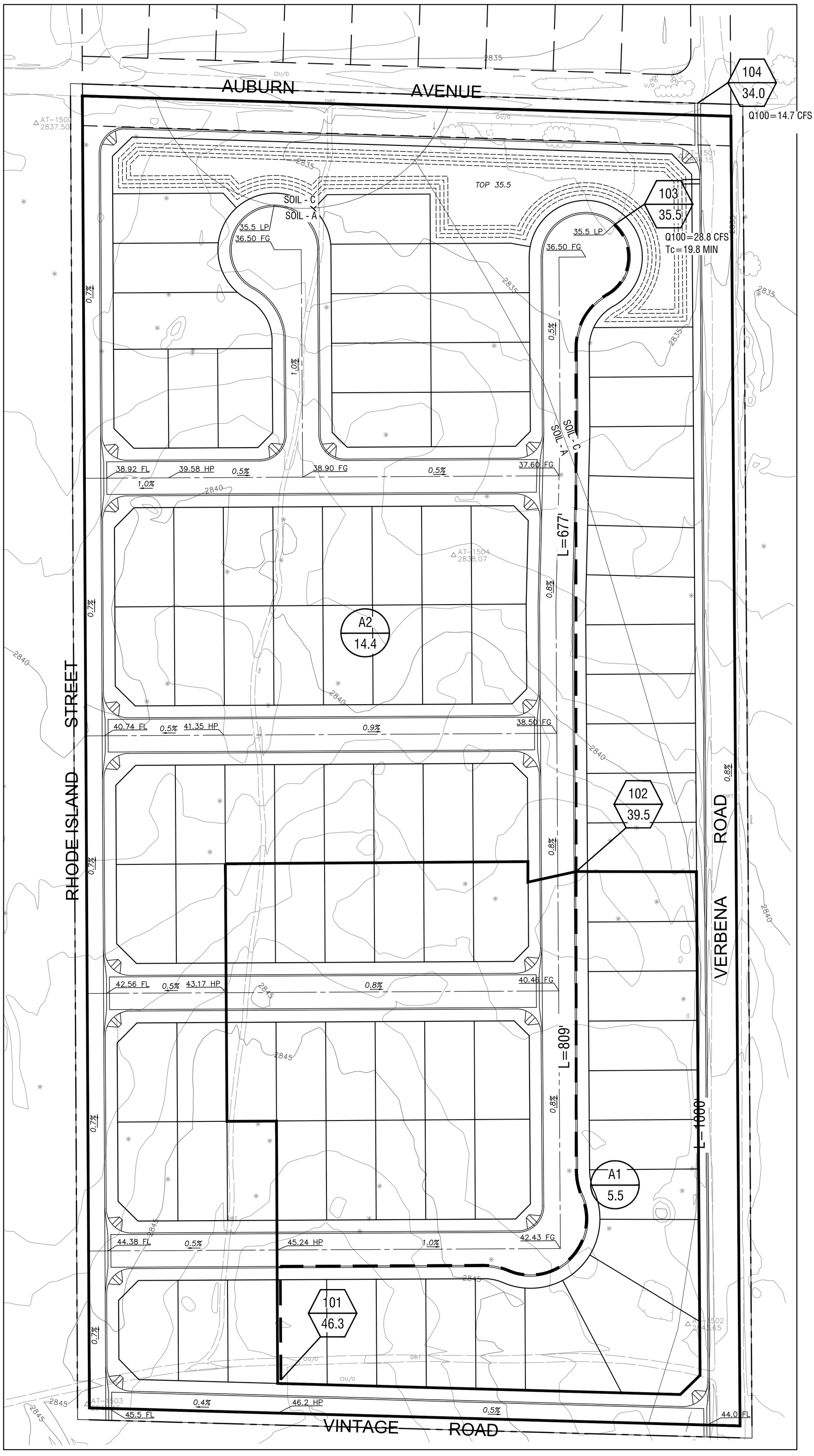
SHEET 1 OF 1

PROJECT NUMBER
CA-30200

IN THE CITY OF ADELANTO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

PROPOSED CONDITIONS EXHIBIT
TENTATIVE MAP - TRACT NO. 20485

UNITED ENGINEERING GROUP CA., INC SEPTEMBER 2021



CONTRIBUTORY AREA
PROJECT BOUNDARY
FLOWPATH
FLOW DIRECTION

102 / XX — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION

A2 / 24.4 — SUBAREA / ACRES

50' 25' 0' 50'
GRAPHIC SCALE: 1"=50'

SUBMITTALS:

DESIGNED BY:
DRAWN BY:
CHECKED BY:

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER F. LENZ
NO. 63001
EXP. 6/30/23
CIVIL
STATE OF CALIFORNIA

CHRISTOPHER F. LENZ DATE
R.C.E. No. 63001

united engineering group
8885 Haven Avenue
Suite 195
Rancho Cucamonga,
CA 91730
Phone: 909.466.9240
www.unitedeng.com

AUBURN & VERBENA

PROPOSED CONDITIONS EXHIBIT
TRACT XXXXX

SEPTEMBER 2021

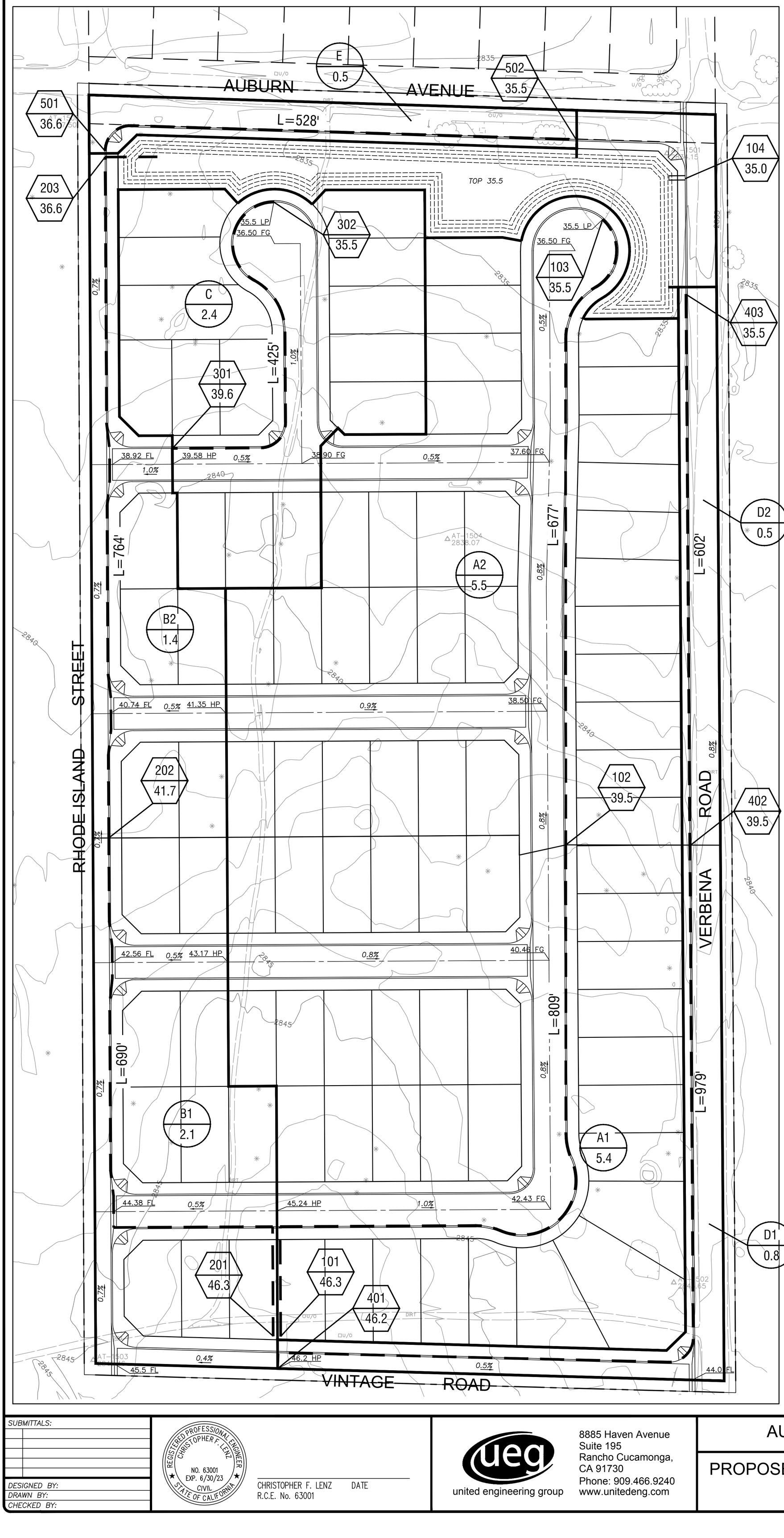
SHEET 1 OF 1

PROJECT NUMBER
CA-30200

IN THE CITY OF ADELANTO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

PROPOSED STORM DRAIN EXHIBIT
TENTATIVE MAP - TRACT NO. 20485

UNITED ENGINEERING GROUP CA., INC SEPTEMBER 2021



STORM DRAIN SIZING

POINT	Q[CFS]	SD
103	17.8	21' CURB OPENING IN SAG
203	5.6	7' COMBINATION OPENING W/ 2' GRATE ON GRADE
302	5.9	7' CURB OPENING IN SAG
403	2.5	7' COMBINATION OPENING W/ 2' GRATE ON GRADE
502	1.2	7' CURB OPENING ON GRADE
104	14.7	4' REVERSE SCUPPER INTO VERBENA

CONTRIBUTORY AREA

PROJECT BOUNDARY

FLOWPATH

FLOW DIRECTION

102 / XX — NODE/CONCENTRATION POINT / FLOWLINE ELEVATION

A2 / 24.4 — SUBAREA / ACRES

50' 25' 0' 50'

GRAPHIC SCALE: 1"=50'

SUBMITTALS:

DESIGNED BY:
DRAWN BY:
CHECKED BY:

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER F. LENZ
NO. 63001
EXP. 6/30/23
CIVIL
STATE OF CALIFORNIA

CHRISTOPHER F. LENZ DATE
R.C.E. No. 63001

united engineering group
8885 Haven Avenue
Suite 195
Rancho Cucamonga,
CA 91730
Phone: 909.466.9240
www.unitedeng.com

AUBURN & VERBENA

PROPOSED STORM DRAIN EXHIBIT
TRACT XXXXX

SEPTEMBER 2021

SHEET 1 OF 1

PROJECT NUMBER
CA-30200

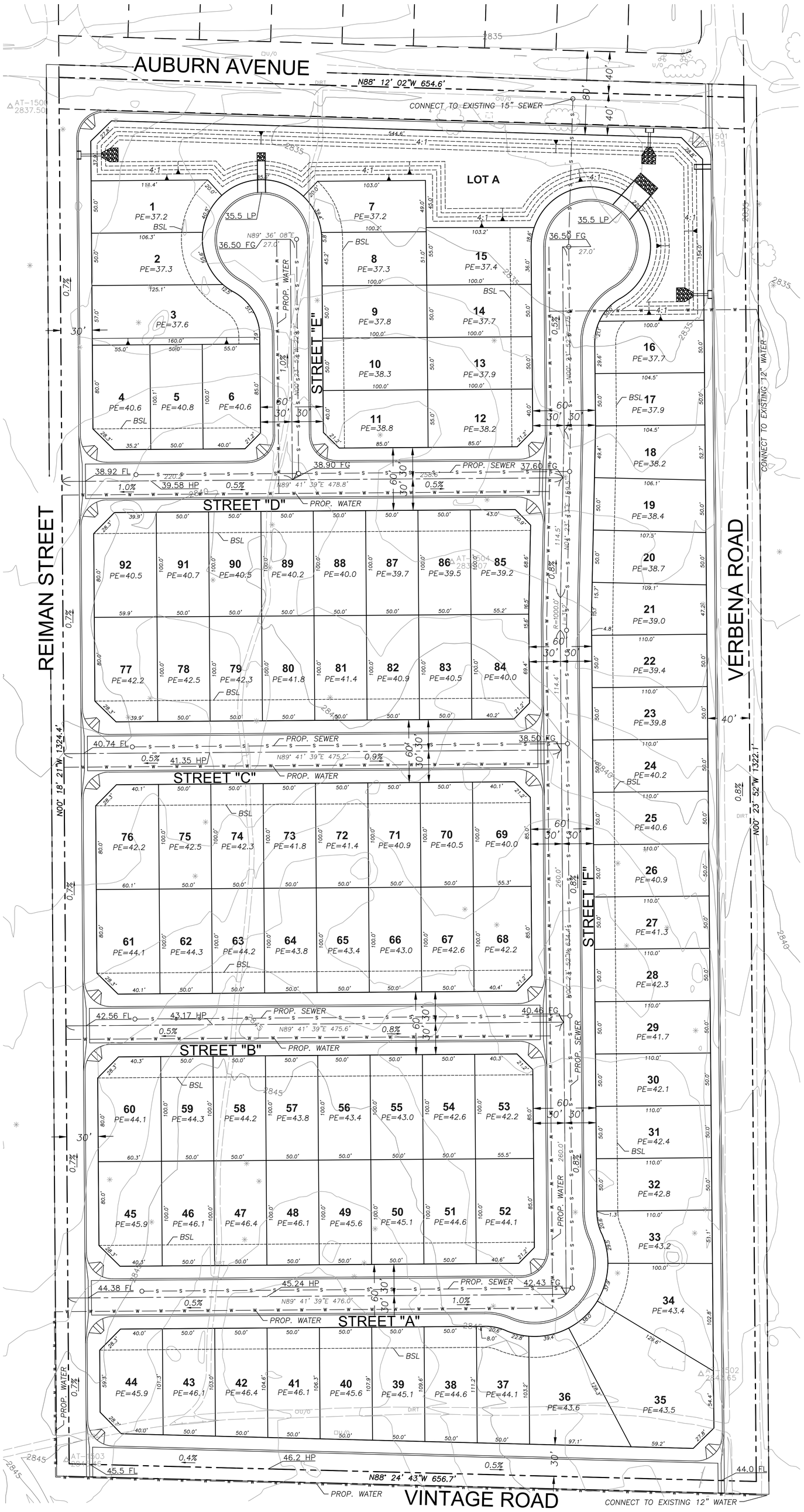
APPENDIX B:
TENTATIVE TRACT MAP 20485

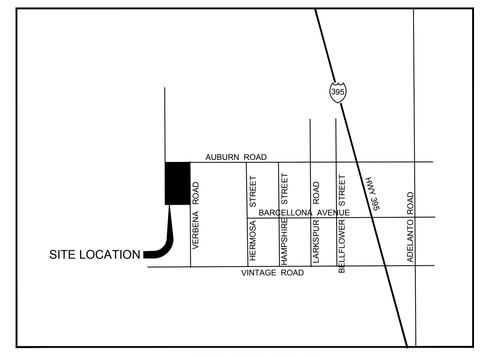
IN THE CITY OF ADELANTO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

TENTATIVE MAP - TRACT NO. 20485

BEING A SUBDIVISION OF A PORTION OF THE EAST HALF OF THE EAST HALF OF THE NORTH HALF OF THE SOUTHWEST $\frac{1}{4}$ OF SECTION 20, TOWNSHIP 6 NORTH, RANGE 5 WEST, SAN BERNARDINO MERIDIAN IN THE CITY OF ADELANTO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

UNITED ENGINEERING GROUP CA., INC OCTOBER 2021





VICINITY MAP

N.T.S.

LEGAL DESCRIPTION:

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF ADELANTO, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA AND IS DESCRIBED AS FOLLOWS:

APN: 3132-081-04
THE EAST ONE-HALF OF THE EAST ONE-HALF OF THE NORTH ONE-HALF OF THE SOUTHWEST ONE-QUARTER OF SECTION 20, TOWNSHIP 6 NORTH, RANGE 5 WEST, SAN BERNARDINO MERIDIAN.

LETTERED LOT DESCRIPTIONS:

LOT "A" TO BE MAINTAINED BY THE CITY OF ADELANTO FOR WATER QUALITY/RETENTION BASIN AND PUBLIC UTILITIES.

GENERAL NOTES:

1. ASSESSOR'S PARCEL NUMBER: 0459-082-080
2. THE PROPERTY SHOWN HEREIN CONTAINS THE ENTIRE CONTIGUOUS OWNERSHIP.
3. TOTAL GROSS AREA = 19.90 AC.
   TOTAL NET AREA = 12.40 AC.
   TOTAL AREA TO BE DEDICATED FOR R/W = 7.50 AC.
4. STREETS "A", "B", "C", "D", "E", AND "F" ARE STREETS FOR PUBLIC DEDICATION.
5. LOTS 1 THROUGH 92 ARE 5,000 SQ. FT. MIN. (RESIDENTIAL LOTS)
6. GROSS DENSITY: 4.62 DU/AC
   AVERAGE LOT SIZE = 5,399 SQ. FT.
   MINIMUM LOT SIZE = 5,000 SQ. FT.
   MAXIMUM LOT SIZE = 11,645 SQ. FT.
7. TOTAL NUMBER OF RESIDENTIAL LOTS = 92
   TOTAL NUMBER OF LETTERED LOTS = 1
8. LINEAR FEET OF STREETS:
   "A" STREET = 476'
   "B" STREET = 476'
   "C" STREET = 475'
   "D" STREET = 479'
   "E" STREET = 257'
   "F" STREET = 1,028'
9. ALL FRONT YARD BUILDING SETBACK LINES (BSL) ARE SHOWN TO AN AVERAGE DEPTH. MINIMUM FRONT YARD BSL = 20'.
10. TOPOGRAPHY SOURCE: ARROWHEAD MAPPING.
    CONTOUR INTERVAL: 1 FOOT
11. ALL SLOPES ARE 2:1 OR FLATTER UNLESS OTHERWISE NOTED.
12. LOT DIMENSION SHOWN HEREIN ARE APPROXIMATE.
13. FEMA 100 YEAR FLOOD ZONE "D" (FLOOD HAZARDS ARE UNDETERMINED, BUT POSSIBLE)
14. THIS MAP IS COMPILED FROM RECORD INFORMATION ONLY AND IS NOT TO BE USED AS A BOUNDARY SURVEY.
15. THE LOCATIONS OF ALL EXISTING UTILITIES SHOWN ON THIS MAP ARE APPROXIMATE. (NO RECORDS AVAILABLE)
16. ADD 2800 FEET TO ALL ELEVATIONS SHOWN HEREIN TO OBTAIN TRUE DATUM.

LAND USE/ZONING INFORMATION:

ADJACENT LAND USE:
NORTH.....VACANT
SOUTH.....VACANT
EAST.....VACANT
WEST.....VACANT

ADJACENT EXISTING ZONING:
NORTH.....DL-2.5
SOUTH.....R-S5
EAST.....R-S5
WEST.....R-S5
EXISTING ZONING: MEDIUM DENSITY RESIDENTIAL (R-S5)
PROPOSED ZONING: MEDIUM DENSITY RESIDENTIAL (R-S5)

APPLICANT/OWNER:

HOOK AND COBALT, LLC
8800 N GAINEY CENTER DR
SUITE 255
SCOTTSDALE, AZ 85258

PREPARED BY:

UNITED ENGINEERING GROUP-CA, INC.
8885 HAVEN AVENUE
SUITE 195
RANCHO CUCAMONGA, CA 91730
PHONE: 909.466.9240
www.unitedeng.com

UTILITY PURVEYORS:

WATER
ADELANTO PUBLIC UTILITY AUTHORITY
11600 AIR EXPRESSWAY
ADELANTO, CA. 92301
(760) 246-2300

SEWER
ADELANTO PUBLIC UTILITY AUTHORITY
11600 AIR EXPRESSWAY
ADELANTO, CA. 92301
(760) 246-2300

ELECTRIC
SOUTHERN CALIFORNIA EDISON
12353 HESPERIA ROAD
VICTORVILLE, CA. 92395
(800) 684-8123

GAS
SOUTHWEST GAS CORP.
13471 MARIPOSA ROAD
VICTORVILLE, CA. 92395
(877) 860-6020

TELEPHONE
VERIZON
12133 HESPERIA ROAD
VICTORVILLE, CA. 92395
(760) 243-3801

CABLE
SPECTRUM
12180 RIDGECREST ROAD, #102
VICTORVILLE, CA. 92395
(833) 267-6097

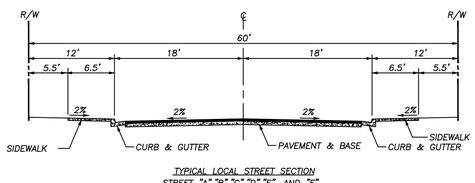
LEGEND

BSL	BUILDING SETBACK LINE
FG	FINISH GRADE
FL	FLOW LINE
FS	FINISH SURFACE
LP	LOW POINT
HP	HIGH POINT
GB	GRADE BREAK
TC	TOP OF CURB
(XXX.XX)	EXISTING ELEVATION
40	LOT NUMBER
141.1 PAD	PAD ELEVATION
	2:1 SLOPE (UNLESS NOTED)
	TRACT BOUNDARY
(S)	EXISTING SEWER
(W)	EXISTING WATER
S	PROPOSED SEWER
W	PROPOSED WATER

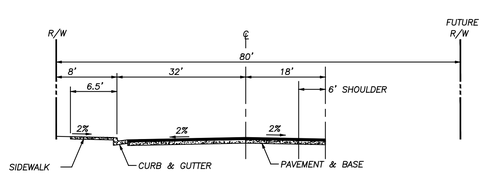
LOT TABLE	
LOT #	AREA
1	5720.09
2	5545.35
3	8602.04
4	5308.02
5	5000.01
6	5387.51
7	5255.83
8	5098.40
9	5000.01
10	5000.01
11	5385.08
12	5389.94
13	5000.01
14	5000.01
15	5513.63
16	5196.99
17	5227.28
18	5366.06
19	5338.22
20	5415.95
21	5368.51
22	5500.00
23	5500.00
24	5500.00
25	5500.00
26	5500.00
27	5500.00
28	5500.00
29	5500.00
30	5500.00
31	5500.00
32	5500.00

LOT TABLE	
LOT #	AREA
33	5292.48
34	7410.67
35	11645.01
36	7329.70
37	5409.02
38	5520.83
39	5438.16
40	5355.49
41	5272.82
42	5190.16
43	5107.49
44	5619.97
45	5831.93
46	5000.00
47	5000.00
48	5000.00
49	5000.00
50	5000.00
51	5000.00
52	5443.54
53	5427.47
54	5000.00
55	5000.00
56	5000.00
57	5000.00
58	5000.00
59	5000.00
60	5831.93
61	5811.06
62	5000.01
63	5000.01
64	5000.01

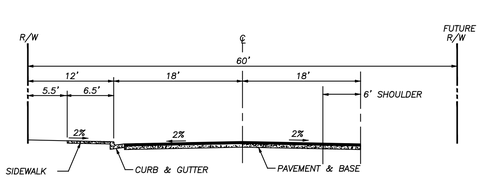
LOT TABLE	
LOT #	AREA
65	5000.01
66	5000.01
67	5000.00
68	5422.65
69	5406.57
70	5000.00
71	5000.00
72	5000.00
73	5000.00
74	5000.00
75	5000.00
76	5811.02
77	5790.08
78	5000.00
79	5000.00
80	5000.00
81	5000.00
82	5000.00
83	5000.00
84	5400.84
85	5542.38
86	5000.97
87	5000.82
88	5000.67
89	5000.52
90	5000.37
91	5000.22
92	5790.21
LOT A	43421.30



TYPICAL LOCAL STREET SECTION
STREET "A", "B", "C", "D", "E", AND "F"
N.T.S.



AUBURN ROAD AND VERBENA ROAD
N.T.S.



REIMAN STREET AND VINTAGE ROAD
N.T.S.

40' 20' 0' 40'
GRAPHIC SCALE: 1"=40'

SUBMITTALS:
DESIGNED BY:
DRAWN BY:
CHECKED BY:

REVISIONS		
NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER — CHRISTOPHER F. LENZ — NO. 63001 EXP. 6/30/23 CIVIL — STATE OF CALIFORNIA

CHRISTOPHER F. LENZ DATE
R.C.E. No. 63001

LICENSED LAND SURVEYOR — DEAN C. PHILLIPS — EXP. 9/30/23 NO. 6974 — STATE OF CALIFORNIA

DEAN C. PHILLIPS DATE
L.S. No. 6974
dphillips@unitedeng.com

ueg united engineering group

8885 Haven Avenue
Suite 195
Rancho Cucamonga,
CA 91730
Phone: 909.466.9240
www.unitedeng.com

AUBURN & VERBENA

TENTATIVE TRACT MAP
TRACT 20485

OCTOBER 2021

SHEET 1 OF 1

PROJECT NUMBER
CA-13852

APPENDIX C:
PROJECT RATIONAL
HYDROLOGY STUDY INFORMATION

NOAA Atlas 14, Volume 6, Version 2
Location name: Adelanto, California, USA*
Latitude: 34.5932°, Longitude: -117.4282°
Elevation: 2842.53 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	**0.076** (0.063-0.093)	**0.106** (0.087-0.130)	**0.147** (0.120-0.180)	**0.181** (0.148-0.224)	**0.231** (0.182-0.295)	**0.270** (0.209-0.353)	**0.312** (0.235-0.418)	**0.357** (0.262-0.491)	**0.419** (0.295-0.601)	**0.469** (0.319-0.696)
10-min	**0.109** (0.090-0.133)	**0.151** (0.125-0.186)	**0.210** (0.173-0.258)	**0.260** (0.212-0.322)	**0.330** (0.261-0.423)	**0.387** (0.299-0.506)	**0.447** (0.337-0.599)	**0.511** (0.375-0.704)	**0.600** (0.423-0.862)	**0.672** (0.457-0.997)
15-min	**0.132** (0.109-0.161)	**0.183** (0.151-0.225)	**0.254** (0.209-0.312)	**0.314** (0.256-0.389)	**0.400** (0.315-0.512)	**0.468** (0.362-0.612)	**0.541** (0.408-0.725)	**0.618** (0.453-0.851)	**0.726** (0.511-1.04)	**0.812** (0.552-1.21)
30-min	**0.181** (0.149-0.221)	**0.251** (0.207-0.307)	**0.348** (0.286-0.428)	**0.430** (0.350-0.533)	**0.547** (0.432-0.701)	**0.641** (0.496-0.839)	**0.741** (0.559-0.993)	**0.846** (0.621-1.17)	**0.994** (0.700-1.43)	**1.11** (0.757-1.65)
60-min	**0.226** (0.187-0.277)	**0.314** (0.259-0.385)	**0.436** (0.358-0.536)	**0.538** (0.439-0.667)	**0.685** (0.541-0.878)	**0.803** (0.621-1.05)	**0.928** (0.700-1.24)	**1.06** (0.778-1.46)	**1.25** (0.877-1.79)	**1.39** (0.948-2.07)
2-hr	**0.316** (0.261-0.387)	**0.426** (0.351-0.523)	**0.579** (0.476-0.712)	**0.709** (0.578-0.878)	**0.895** (0.706-1.15)	**1.04** (0.807-1.37)	**1.20** (0.906-1.61)	**1.37** (1.00-1.88)	**1.60** (1.13-2.30)	**1.79** (1.21-2.65)
3-hr	**0.382** (0.315-0.467)	**0.510** (0.420-0.625)	**0.687** (0.565-0.845)	**0.839** (0.684-1.04)	**1.06** (0.832-1.35)	**1.23** (0.950-1.61)	**1.41** (1.07-1.89)	**1.61** (1.18-2.21)	**1.88** (1.32-2.70)	**2.09** (1.42-3.11)
6-hr	**0.512** (0.423-0.627)	**0.680** (0.561-0.834)	**0.912** (0.749-1.12)	**1.11** (0.904-1.37)	**1.39** (1.10-1.78)	**1.61** (1.25-2.11)	**1.85** (1.40-2.48)	**2.10** (1.54-2.90)	**2.46** (1.73-3.52)	**2.73** (1.86-4.06)
12-hr	**0.640** (0.528-0.784)	**0.868** (0.715-1.06)	**1.18** (0.970-1.45)	**1.44** (1.18-1.79)	**1.81** (1.43-2.32)	**2.11** (1.63-2.76)	**2.42** (1.82-3.24)	**2.74** (2.01-3.77)	**3.19** (2.24-4.58)	**3.54** (2.41-5.26)
24-hr	**0.831** (0.737-0.957)	**1.16** (1.03-1.34)	**1.60** (1.42-1.85)	**1.97** (1.73-2.30)	**2.49** (2.11-3.00)	**2.90** (2.40-3.56)	**3.32** (2.69-4.18)	**3.77** (2.97-4.88)	**4.38** (3.31-5.92)	**4.87** (3.55-6.80)
2-day	**0.937** (0.831-1.08)	**1.33** (1.18-1.53)	**1.86** (1.64-2.14)	**2.29** (2.01-2.67)	**2.90** (2.46-3.49)	**3.38** (2.81-4.16)	**3.88** (3.14-4.89)	**4.40** (3.47-5.70)	**5.12** (3.87-6.91)	**5.68** (4.14-7.93)
3-day	**1.01** (0.894-1.16)	**1.43** (1.27-1.65)	**2.02** (1.79-2.33)	**2.51** (2.20-2.92)	**3.18** (2.69-3.82)	**3.70** (3.07-4.55)	**4.25** (3.44-5.35)	**4.82** (3.79-6.24)	**5.61** (4.24-7.57)	**6.23** (4.55-8.71)
4-day	**1.07** (0.945-1.23)	**1.52** (1.35-1.75)	**2.15** (1.90-2.49)	**2.68** (2.34-3.12)	**3.40** (2.88-4.09)	**3.96** (3.28-4.86)	**4.54** (3.68-5.72)	**5.15** (4.06-6.67)	**6.00** (4.53-8.10)	**6.66** (4.86-9.30)
7-day	**1.13** (0.998-1.29)	**1.61** (1.43-1.86)	**2.29** (2.03-2.65)	**2.86** (2.51-3.33)	**3.64** (3.09-4.39)	**4.26** (3.53-5.23)	**4.88** (3.95-6.14)	**5.52** (4.35-7.16)	**6.41** (4.84-8.65)	**7.08** (5.17-9.90)
10-day	**1.18** (1.04-1.35)	**1.70** (1.50-1.95)	**2.42** (2.14-2.80)	**3.03** (2.65-3.52)	**3.88** (3.29-4.67)	**4.54** (3.76-5.58)	**5.21** (4.22-6.56)	**5.91** (4.65-7.65)	**6.87** (5.19-9.27)	**7.60** (5.55-10.6)
20-day	**1.34** (1.18-1.54)	**1.96** (1.74-2.26)	**2.86** (2.53-3.31)	**3.62** (3.18-4.22)	**4.72** (4.00-5.68)	**5.59** (4.64-6.87)	**6.48** (5.25-8.17)	**7.42** (5.84-9.61)	**8.67** (6.55-11.7)	**9.64** (7.04-13.5)
30-day	**1.48** (1.31-1.71)	**2.20** (1.95-2.53)	**3.25** (2.87-3.75)	**4.16** (3.65-4.85)	**5.49** (4.65-6.61)	**6.55** (5.44-8.06)	**7.65** (6.20-9.64)	**8.80** (6.93-11.4)	**10.4** (7.83-14.0)	**11.5** (8.42-16.1)
45-day	**1.71** (1.51-1.96)	**2.55** (2.26-2.94)	**3.81** (3.36-4.40)	**4.92** (4.31-5.73)	**6.58** (5.58-7.93)	**7.94** (6.59-9.77)	**9.36** (7.58-11.8)	**10.8** (8.54-14.0)	**12.9** (9.73-17.4)	**14.4** (10.5-20.2)
60-day	**1.89** (1.68-2.17)	**2.82** (2.50-3.25)	**4.24** (3.75-4.90)	**5.52** (4.83-6.43)	**7.42** (6.29-8.94)	**9.01** (7.48-11.1)	**10.7** (8.67-13.5)	**12.5** (9.81-16.1)	**14.9** (11.3-20.1)	**16.8** (12.3-23.5)

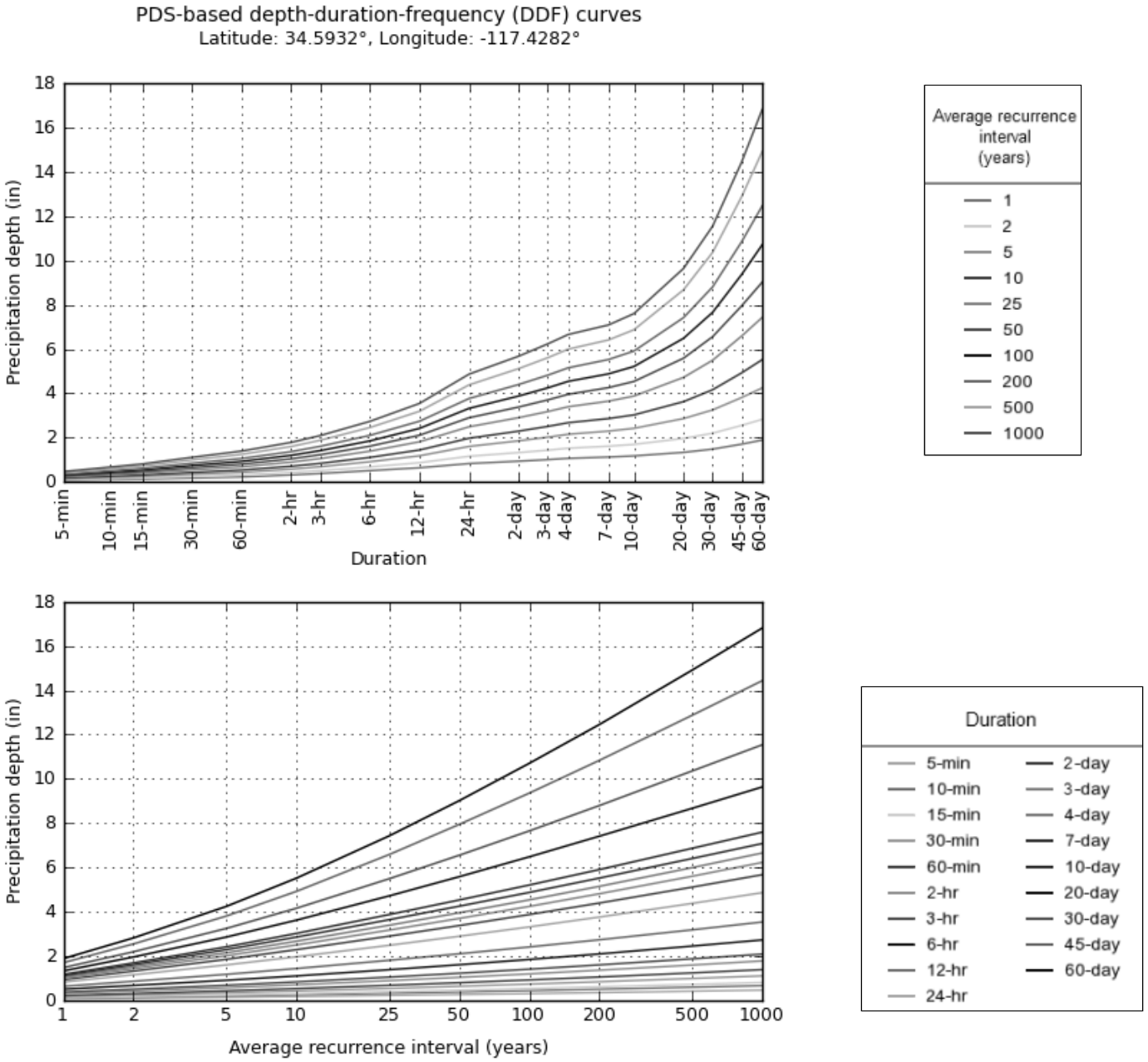
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



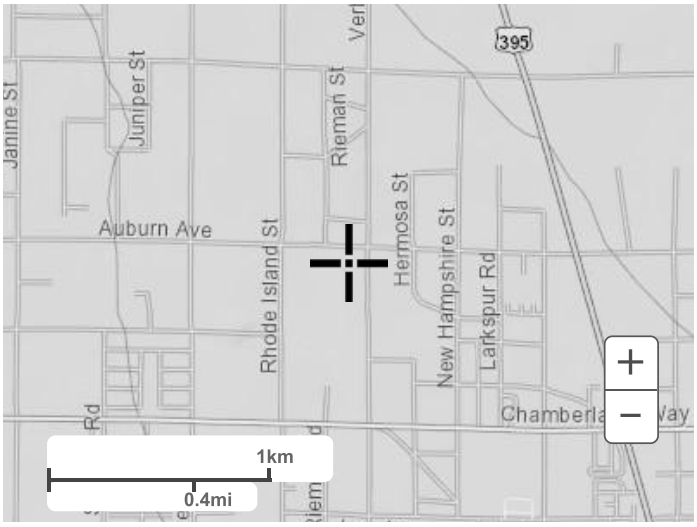
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Sep 16 22:14:48 2021

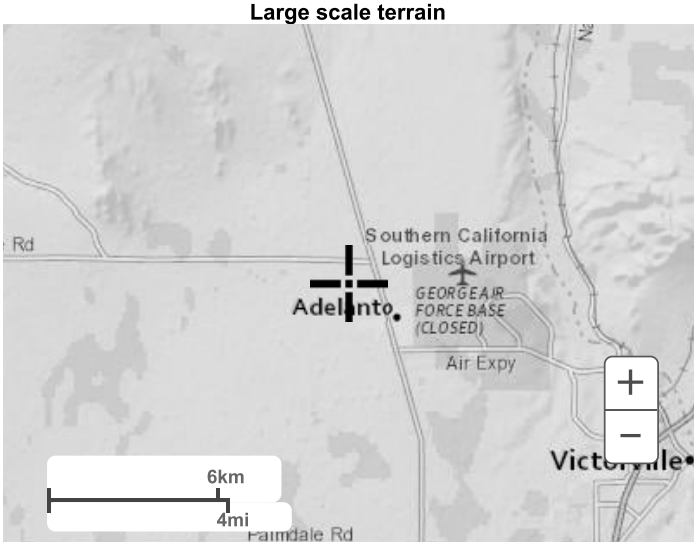
Back to Top

Maps & aerials

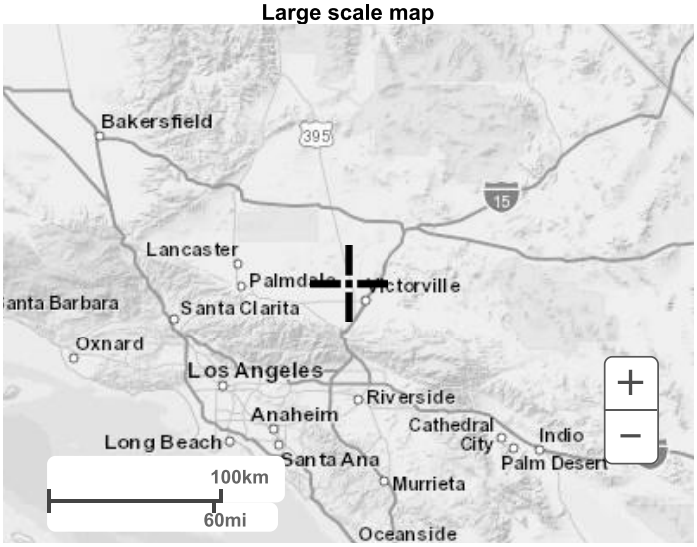
Small scale terrain



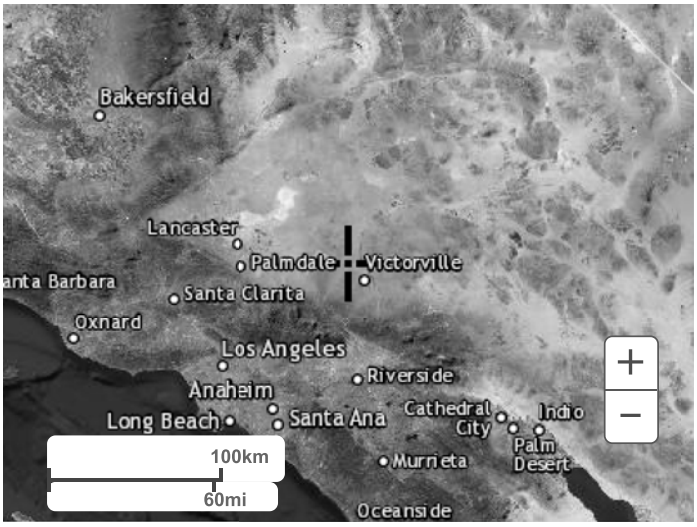
Large scale terrain



Large scale map



Large scale aerial



Back to Top

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

Disclaimer

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

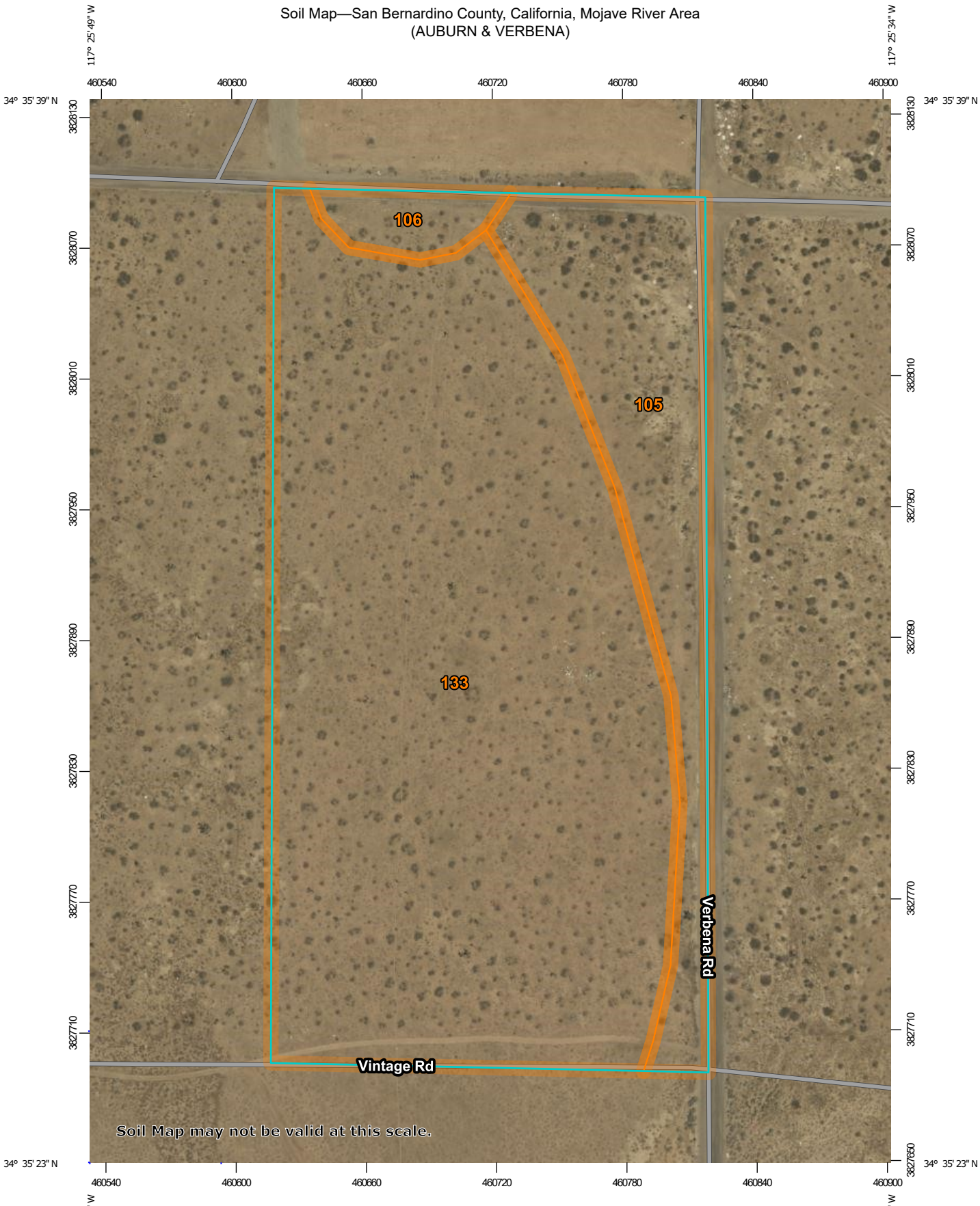
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER
FOR
DEVELOPED AREAS

Figure C-4

Soil Map—San Bernardino County, California, Mojave River Area
(AUBURN & VERBENA)



Map Scale: 1:2,380 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 12, May 27, 2020

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

Date(s) aerial images were photographed: Jun 26, 2019—Jul 8, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
105	BRYMAN LOAMY FINE SAND, 0 TO 2 PERCENT SLOPES	3.8	19.2%
106	BRYMAN LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	0.5	2.7%
133	HELENDALE-BRYMAN LOAMY SANDS, 2 TO 5 PERCENT SLOPES*	15.6	78.1%
Totals for Area of Interest		**19.9**	**100.0%**

San Bernardino County, California, Mojave River Area

133—HELENDALE-BRYMAN LOAMY SANDS, 2 TO 5 PERCENT SLOPES*

Map Unit Setting

National map unit symbol: hks6
Elevation: 2,500 to 4,000 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

Helendale and similar soils: 50 percent
Bryman and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Helendale

Setting

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

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 30 inches: sandy loam
H3 - 30 to 66 inches: sandy loam
H4 - 66 to 99 inches: loamy sand, sandy loam
H4 - 66 to 99 inches:

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 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: Low (about 5.8 inches)

Interpretive groups

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

Description of Bryman

Setting

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

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 12 inches: sandy loam
H3 - 12 to 44 inches: sandy clay loam
H4 - 44 to 60 inches: loamy sand, coarse sandy loam
H4 - 44 to 60 inches:

Properties and qualities

Slope: 2 to 5 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 8.2 inches)

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

Unnamed soils

Percent of map unit: 5 percent

Hydric soil rating: No

Mohave variant

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 12, May 27, 2020

San Bernardino County, California, Mojave River Area

106—BRYMAN LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrb
Elevation: 3,000 to 3,400 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): Backslope
Landform position (three-dimensional): Side slope
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 43 inches: sandy clay loam
H3 - 43 to 60 inches: sandy loam

Properties and qualities

Slope: 2 to 5 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 8.3 inches)

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

Bryman, gravelly surface
Percent of map unit: 5 percent

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

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

Cajon, loamy 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 12, May 27, 2020

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)

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

Bryman, gravelly surface

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

Helendale

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

Cajon

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

Mohave variant

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 12, May 27, 2020

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 09/17/21

Auburn & Verbena
Proposed Condition Q and Tc Check
Rationale 100yr Peak Runoff
Used in SCS Routing

Program License Serial Number 6232

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 0.928 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 101.000 to Point/Station 102.000

**** INITIAL AREA EVALUATION ****

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.471 (In/Hr)
Initial subarea data:
Initial area flow distance = 809.000(Ft.)
Top (of initial area) elevation = 46.300(Ft.)
Bottom (of initial area) elevation = 39.500(Ft.)
Difference in elevation = 6.800(Ft.)
Slope = 0.00841 s(%)= 0.84
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 15.601 min.
Rainfall intensity = 2.383(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.722
Subarea runoff = 9.462(CFS)

```
      Total initial stream area =        5.500(Ac.)
      Pervious area fraction = 0.600
      Initial area Fm value =    0.471(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station      102.000 to Point/Station
103.000
      **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
      ------------------------------------------------------------------------
____
      Top of street segment elevation =    39.500(Ft.)
      End of street segment elevation =    35.500(Ft.)
      Length of street segment  =   677.000(Ft.)
      Height of curb above gutter flowline  =    6.0(In.)
      Width of half street (curb to crown)  =  18.000(Ft.)
      Distance from crown to crossfall grade break  =  16.000(Ft.)
      Slope from gutter to grade break (v/hz) =   0.020
      Slope from grade break to crown (v/hz)  =   0.020
      Street flow is on [2] side(s) of the street
      Distance from curb to property line  =  12.000(Ft.)
      Slope from curb to property line (v/hz) =   0.020
      Gutter width =   2.000(Ft.)
      Gutter hike from flowline =  0.040(In.)
       Manning's N in gutter =  0.0120
       Manning's N from gutter to grade break =  0.0120
       Manning's N from grade break to crown =  0.0150
      Estimated mean flow rate at midpoint of street =     19.162(CFS)
      Depth of flow =   0.347(Ft.), Average velocity =   2.644(Ft/s)
      Note:  depth of flow exceeds top of street crown.
      Streetflow hydraulics at midpoint of street travel:
      Halfstreet flow width =  18.000(Ft.)
      Flow velocity =   2.64(Ft/s)
      Travel time =    4.27 min.     TC =   19.87  min.
       Adding area flow to street
      RESIDENTIAL(3 - 4 dwl/acre)
      Decimal fraction soil group A = 0.700
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 0.300
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 43.10
      Adjusted SCS curve number for AMC 3 = 63.10
      Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.381
(In/Hr)
      Rainfall intensity =      2.012(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.718
      Subarea runoff =     19.289(CFS) for   14.400(Ac.)
      Total runoff =     28.751(CFS)
      Effective area this stream =       19.90(Ac.)
      Total Study Area (Main Stream No. 1) =       19.90(Ac.)
      Area averaged Fm value =    0.406(In/Hr)
      Street flow at end of street =     28.751(CFS)
      Half street flow at end of street =     14.375(CFS)
      Depth of flow =   0.402(Ft.), Average velocity =   3.107(Ft/s)
      Note:  depth of flow exceeds top of street crown.
      Flow width (from curb towards crown)=  18.000(Ft.)
      End of computations, Total Study Area =           19.90 (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 = 40.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 09/17/21

Auburn & Verbena
Existing Condition
Rationale 100yr Peak Runoff

Program License Serial Number 6232

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 0.928 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 101.000 to Point/Station 102.000

**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.532 (In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 47.000(Ft.)
Bottom (of initial area) elevation = 38.500(Ft.)
Difference in elevation = 8.500(Ft.)
Slope = 0.00850 s(%)= 0.85
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 29.035 min.
Rainfall intensity = 1.542(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.589
Subarea runoff = 4.000(CFS)

```
      Total initial stream area =        4.400(Ac.)
      Pervious area fraction = 1.000
      Initial area Fm value =    0.532(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station      102.000 to Point/Station
103.000
      **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
      ____________________________________________________________________
____
      Estimated mean flow rate at midpoint of channel =      0.000(CFS)
      Depth of flow =   0.294(Ft.), Average velocity =   1.891(Ft/s)
            ******* Irregular Channel Data ***********
      ------------------------------------------------------------------
      Information entered for subchannel number 1 :
      Point number      'X' coordinate     'Y' coordinate
            1              0.00              1.00
            2              2.00              0.00
            3             20.00              0.00
            4             22.00              1.00
      Manning's 'N' friction factor =   0.025
      ------------------------------------------------------------------
      Sub-Channel flow  =     10.346(CFS)
        '     '    flow top width =     19.177(Ft.)
        '     '    velocity=    1.891(Ft/s)
        '     '    area =      5.471(Sq.Ft)
        '     '    Froude number =     0.624

      Upstream point elevation =    38.500(Ft.)
      Downstream point elevation =    35.000(Ft.)
      Flow length =   643.000(Ft.)
      Travel time  =    5.67 min.
      Time of concentration =   34.70 min.
      Depth of flow =   0.294(Ft.)
      Average velocity =   1.891(Ft/s)
      Total irregular channel flow =    10.346(CFS)
      Irregular channel normal depth above invert elev. =   0.294(Ft.)
      Average velocity of channel(s) =   1.891(Ft/s)
       Adding area flow to channel
      UNDEVELOPED (average cover) subarea
      Decimal fraction soil group A = 0.700
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 0.300
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 58.70
      Adjusted SCS curve number for AMC 3 = 77.96
      Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404
(In/Hr)
      Rainfall intensity =      1.361(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.614
      Subarea runoff =     12.638(CFS) for   15.500(Ac.)
      Total runoff =     16.637(CFS)
      Effective area this stream =       19.90(Ac.)
      Total Study Area (Main Stream No. 1) =       19.90(Ac.)
      Area averaged Fm value =    0.433(In/Hr)
      Depth of flow =   0.391(Ft.), Average velocity =   2.267(Ft/s)
```

End of computations, Total Study Area = 19.90 (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 = 56.8

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 09/20/21

Auburn & Verbena
Storm Drain Sizing
100 year peak runoff
Point 502

Program License Serial Number 6232

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 0.928 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 501.000 to Point/Station 502.000

**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 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) = 0.1000 Max loss rate(Fm)= 0.026 (In/Hr)
Initial subarea data:
Initial area flow distance = 528.000(Ft.)
Top (of initial area) elevation = 36.600(Ft.)
Bottom (of initial area) elevation = 35.500(Ft.)
Difference in elevation = 1.100(Ft.)
Slope = 0.00208 s(%)= 0.21
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.828 min.
Rainfall intensity = 2.732(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.891
Subarea runoff = 1.218(CFS)

Total initial stream area = 0.500(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.026(In/Hr)
End of computations, Total Study Area = 0.50 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 09/20/21

Auburn & Verbena
Storm Drain Sizing
100 year peak runoff
Point 403

Program License Serial Number 6232

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 0.928 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 401.000 to Point/Station 402.000

**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 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) = 0.1000 Max loss rate(Fm)= 0.026 (In/Hr)
Initial subarea data:
Initial area flow distance = 979.000(Ft.)
Top (of initial area) elevation = 46.200(Ft.)
Bottom (of initial area) elevation = 39.500(Ft.)
Difference in elevation = 6.700(Ft.)
Slope = 0.00684 s(%)= 0.68
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.946 min.
Rainfall intensity = 2.715(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.891
Subarea runoff = 1.936(CFS)

```
      Total initial stream area =        0.800(Ac.)
      Pervious area fraction = 0.100
      Initial area Fm value =    0.026(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station      402.000 to Point/Station
403.000
      **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
____
      Top of street segment elevation =    39.500(Ft.)
      End of street segment elevation =    35.500(Ft.)
      Length of street segment  =   602.000(Ft.)
      Height of curb above gutter flowline  =    6.0(In.)
      Width of half street (curb to crown)  =  18.000(Ft.)
      Distance from crown to crossfall grade break  =  16.000(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  =  12.000(Ft.)
      Slope from curb to property line (v/hz) =   0.030
      Gutter width =   2.000(Ft.)
      Gutter hike from flowline =  2.000(In.)
       Manning's N in gutter =  0.0150
       Manning's N from gutter to grade break =  0.0150
       Manning's N from grade break to crown =  0.0150
      Estimated mean flow rate at midpoint of street =      2.244(CFS)
      Depth of flow =   0.334(Ft.), Average velocity =   1.876(Ft/s)
      Streetflow hydraulics at midpoint of street travel:
      Halfstreet flow width =  10.343(Ft.)
      Flow velocity =   1.88(Ft/s)
      Travel time =    5.35 min.     TC =   18.29  min.
       Adding area flow to street
      COMMERCIAL subarea type
      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) = 0.1000     Max loss rate(Fm)=     0.026
(In/Hr)
      Rainfall intensity =      2.131(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.889
      Subarea runoff =      0.527(CFS) for    0.500(Ac.)
      Total runoff =      2.463(CFS)
      Effective area this stream =        1.30(Ac.)
      Total Study Area (Main Stream No. 1) =        1.30(Ac.)
      Area averaged Fm value =    0.026(In/Hr)
      Street flow at end of street =      2.463(CFS)
      Half street flow at end of street =      2.463(CFS)
      Depth of flow =   0.342(Ft.), Average velocity =   1.917(Ft/s)
      Flow width (from curb towards crown)=  10.763(Ft.)
      End of computations, Total Study Area =            1.30 (Ac.)
      The following figures may
      be used for a unit hydrograph study of the same area.
```

Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 09/20/21

Auburn & Verbena
Storm Drain Sizing
100 year peak runoff
Point 302

Program License Serial Number 6232

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 0.928 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 301.000 to Point/Station 302.000

**** 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 = 425.000(Ft.)
Top (of initial area) elevation = 39.600(Ft.)
Bottom (of initial area) elevation = 35.500(Ft.)
Difference in elevation = 4.100(Ft.)
Slope = 0.00965 s(%)= 0.96
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.732 min.
Rainfall intensity = 2.909(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.851
Subarea runoff = 5.944(CFS)

Total initial stream area = 2.400(Ac.)
Pervious area fraction = 0.600
Initial area Fm value = 0.157(In/Hr)
End of computations, Total Study Area = 2.40 (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) 1989-2005 Version 7.1

Rational Hydrology Study Date: 09/20/21

Auburn & Verbena
Storm Drain Sizing
100 year peak runoff
Point 203

Program License Serial Number 6232

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 0.928 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 201.000 to Point/Station 202.000

**** 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 = 690.000(Ft.)
Top (of initial area) elevation = 46.200(Ft.)
Bottom (of initial area) elevation = 41.700(Ft.)
Difference in elevation = 4.500(Ft.)
Slope = 0.00652 s(%)= 0.65
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 15.402 min.
Rainfall intensity = 2.404(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.841
Subarea runoff = 4.247(CFS)

```
      Total initial stream area =        2.100(Ac.)
      Pervious area fraction = 0.600
      Initial area Fm value =    0.157(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station      202.000 to Point/Station
203.000
      **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
      ------------------------------------------------------------------------
____
      Top of street segment elevation =    41.700(Ft.)
      End of street segment elevation =    36.600(Ft.)
      Length of street segment  =   764.000(Ft.)
      Height of curb above gutter flowline  =    6.0(In.)
      Width of half street (curb to crown)  =  18.000(Ft.)
      Distance from crown to crossfall grade break  =  16.000(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  =  12.000(Ft.)
      Slope from curb to property line (v/hz) =   0.030
      Gutter width =   2.000(Ft.)
      Gutter hike from flowline =  2.000(In.)
       Manning's N in gutter =  0.0150
       Manning's N from gutter to grade break =  0.0150
       Manning's N from grade break to crown =  0.0150
      Estimated mean flow rate at midpoint of street =      4.947(CFS)
      Depth of flow =   0.414(Ft.), Average velocity =   2.264(Ft/s)
      Streetflow hydraulics at midpoint of street travel:
      Halfstreet flow width =  14.347(Ft.)
      Flow velocity =   2.26(Ft/s)
      Travel time =    5.62 min.     TC =   21.03  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 =      1.933(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.827
      Subarea runoff =      1.349(CFS) for    1.400(Ac.)
      Total runoff =      5.596(CFS)
      Effective area this stream =        3.50(Ac.)
      Total Study Area (Main Stream No. 1) =        3.50(Ac.)
      Area averaged Fm value =    0.157(In/Hr)
      Street flow at end of street =      5.596(CFS)
      Half street flow at end of street =      5.596(CFS)
      Depth of flow =   0.428(Ft.), Average velocity =   2.332(Ft/s)
      Flow width (from curb towards crown)=  15.076(Ft.)
      End of computations, Total Study Area =            3.50 (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) 1989-2005 Version 7.1

Rational Hydrology Study Date: 09/20/21

Auburn & Verbena
Storm Drain Sozing
100 year peak runoff
Point 103

Program License Serial Number 6232

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 0.928 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 101.000 to Point/Station 102.000

**** 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 = 809.000(Ft.)
Top (of initial area) elevation = 46.200(Ft.)
Bottom (of initial area) elevation = 39.500(Ft.)
Difference in elevation = 6.700(Ft.)
Slope = 0.00828 s(%)= 0.83
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 15.648 min.
Rainfall intensity = 2.378(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.841
Subarea runoff = 10.793(CFS)

```
      Total initial stream area =        5.400(Ac.)
      Pervious area fraction = 0.600
      Initial area Fm value =    0.157(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station      102.000 to Point/Station
103.000
      **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
____
      Top of street segment elevation =    39.500(Ft.)
      End of street segment elevation =    35.500(Ft.)
      Length of street segment  =   677.000(Ft.)
      Height of curb above gutter flowline  =    6.0(In.)
      Width of half street (curb to crown)  =  18.000(Ft.)
      Distance from crown to crossfall grade break  =  16.000(Ft.)
      Slope from gutter to grade break (v/hz) =   0.020
      Slope from grade break to crown (v/hz)  =   0.020
      Street flow is on [2] side(s) of the street
      Distance from curb to property line  =  12.000(Ft.)
      Slope from curb to property line (v/hz) =   0.030
      Gutter width =   2.000(Ft.)
      Gutter hike from flowline =  2.000(In.)
       Manning's N in gutter =  0.0150
       Manning's N from gutter to grade break =  0.0150
       Manning's N from grade break to crown =  0.0150
      Estimated mean flow rate at midpoint of street =     14.376(CFS)
      Depth of flow =   0.468(Ft.), Average velocity =   2.366(Ft/s)
      Streetflow hydraulics at midpoint of street travel:
      Halfstreet flow width =  17.062(Ft.)
      Flow velocity =   2.37(Ft/s)
      Travel time =    4.77 min.     TC =   20.42  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 =      1.974(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.828
      Subarea runoff =      7.029(CFS) for    5.500(Ac.)
      Total runoff =     17.822(CFS)
      Effective area this stream =       10.90(Ac.)
      Total Study Area (Main Stream No. 1) =       10.90(Ac.)
      Area averaged Fm value =    0.157(In/Hr)
      Street flow at end of street =     17.822(CFS)
      Half street flow at end of street =      8.911(CFS)
      Depth of flow =   0.496(Ft.), Average velocity =   2.524(Ft/s)
      Note:  depth of flow exceeds top of street crown.
      Flow width (from curb towards crown)=  18.000(Ft.)
      End of computations, Total Study Area =           10.90 (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 D:
PROJECT SCS UNIT HYDROGRAPH HYDROLOGY STUDY INFORMATION

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

Study date 09/17/21

++

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

Program License Serial Number 6232

Auburn & Verbena
SCS Hydrograph
Proposed Condition
100yr 24hr Storm

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 10	19.90	1	0.54
Rainfall data for year 2	19.90	6	0.68
Rainfall data for year 2	19.90	24	1.16
Rainfall data for year 100	19.90	1	0.93

```
--
      Rainfall data for year 100
                19.90            6           1.85
      ------------------------------------------------------------------
--
      Rainfall data for year 100
                19.90           24           3.32
      ------------------------------------------------------------------
--
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++

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


      SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap
Fm
      No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)
(In/Hr)
       40.1      60.1         19.90      1.000     0.678    0.500
0.339

      Area-averaged adjusted loss rate Fm (In/Hr) =  0.339

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

      Area       Area          SCS CN    SCS CN      S     Pervious
       (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
           9.95   0.500         40.1      60.1       6.63     0.139
           9.95   0.500         98.0      98.0       0.20     0.930

      Area-averaged catchment yield fraction, Y =  0.534
      Area-averaged low loss fraction, Yb =  0.466
      User entry of time of concentration  =   0.343 (hours)
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++
      Watershed area =      19.90(Ac.)
      Catchment Lag time =   0.274 hours
      Unit interval =   5.000 minutes
      Unit interval percentage of lag time = 30.3693
      Hydrograph baseflow =     0.00(CFS)
      Average maximum watershed loss rate(Fm) =  0.339(In/Hr)
      Average low loss rate fraction (Yb) = 0.466 (decimal)
      DESERT S-Graph Selected
      Computed peak 5-minute rainfall =  0.440(In)
      Computed peak 30-minute rainfall =  0.754(In)
      Specified peak 1-hour rainfall =  0.928(In)
      Computed peak 3-hour rainfall =  1.417(In)
      Specified peak 6-hour rainfall =  1.850(In)
      Specified peak 24-hour rainfall =  3.320(In)


      Rainfall depth area reduction factors:
      Using a total area of      19.90(Ac.) (Ref: fig. E-4)

      5-minute factor = 0.999     Adjusted rainfall =  0.440(In)
      30-minute factor = 0.999    Adjusted rainfall =  0.753(In)
      1-hour factor = 0.999       Adjusted rainfall =  0.927(In)
      3-hour factor = 1.000       Adjusted rainfall =  1.416(In)
      6-hour factor = 1.000       Adjusted rainfall =  1.850(In)
```

24-hour factor = 1.000 Adjusted rainfall = 3.320(In)

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

+++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 240.67 (CFS))	
1	1.795	4.319
2	9.657	18.922
3	31.501	52.571
4	52.935	51.585
5	64.760	28.457
6	72.311	18.173
7	77.766	13.128
8	81.838	9.801
9	85.072	7.781
10	87.775	6.507
11	89.827	4.938
12	91.530	4.099
13	92.996	3.527
14	94.235	2.983
15	95.268	2.486
16	96.139	2.096
17	96.894	1.816
18	97.466	1.379
19	97.917	1.084
20	98.224	0.739
21	98.571	0.835
22	98.935	0.877
23	99.300	0.877
24	99.585	0.687
25	99.775	0.457
26	100.000	0.229

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4399	0.4399
2	0.5416	0.1017
3	0.6117	0.0701
4	0.6668	0.0551
5	0.7130	0.0462
6	0.7531	0.0401
7	0.7887	0.0356
8	0.8209	0.0322
9	0.8505	0.0295
10	0.8778	0.0273
11	0.9032	0.0255
12	0.9271	0.0239
13	0.9562	0.0291
14	0.9839	0.0277
15	1.0105	0.0265
16	1.0360	0.0255
17	1.0605	0.0245

18	1.0841	0.0236
19	1.1070	0.0229
20	1.1291	0.0221
21	1.1505	0.0215
22	1.1714	0.0208
23	1.1916	0.0203
24	1.2114	0.0197
25	1.2306	0.0192
26	1.2494	0.0188
27	1.2677	0.0183
28	1.2856	0.0179
29	1.3031	0.0175
30	1.3203	0.0172
31	1.3371	0.0168
32	1.3536	0.0165
33	1.3697	0.0162
34	1.3856	0.0159
35	1.4012	0.0156
36	1.4165	0.0153
37	1.4315	0.0150
38	1.4463	0.0148
39	1.4608	0.0145
40	1.4751	0.0143
41	1.4892	0.0141
42	1.5031	0.0139
43	1.5168	0.0137
44	1.5303	0.0135
45	1.5436	0.0133
46	1.5567	0.0131
47	1.5697	0.0129
48	1.5824	0.0128
49	1.5951	0.0126
50	1.6075	0.0125
51	1.6198	0.0123
52	1.6320	0.0122
53	1.6440	0.0120
54	1.6559	0.0119
55	1.6676	0.0117
56	1.6792	0.0116
57	1.6907	0.0115
58	1.7021	0.0114
59	1.7133	0.0112
60	1.7244	0.0111
61	1.7355	0.0110
62	1.7464	0.0109
63	1.7572	0.0108
64	1.7678	0.0107
65	1.7784	0.0106
66	1.7889	0.0105
67	1.7993	0.0104
68	1.8096	0.0103
69	1.8198	0.0102
70	1.8299	0.0101
71	1.8399	0.0100
72	1.8499	0.0099
73	1.8607	0.0108
74	1.8714	0.0107
75	1.8820	0.0106
76	1.8926	0.0105
77	1.9030	0.0105

78	1.9134	0.0104
79	1.9237	0.0103
80	1.9340	0.0102
81	1.9441	0.0102
82	1.9542	0.0101
83	1.9642	0.0100
84	1.9742	0.0099
85	1.9841	0.0099
86	1.9939	0.0098
87	2.0036	0.0097
88	2.0133	0.0097
89	2.0229	0.0096
90	2.0325	0.0096
91	2.0420	0.0095
92	2.0514	0.0094
93	2.0608	0.0094
94	2.0701	0.0093
95	2.0794	0.0093
96	2.0886	0.0092
97	2.0977	0.0092
98	2.1068	0.0091
99	2.1159	0.0090
100	2.1249	0.0090
101	2.1338	0.0089
102	2.1427	0.0089
103	2.1515	0.0088
104	2.1603	0.0088
105	2.1690	0.0087
106	2.1777	0.0087
107	2.1864	0.0086
108	2.1950	0.0086
109	2.2035	0.0086
110	2.2120	0.0085
111	2.2205	0.0085
112	2.2289	0.0084
113	2.2373	0.0084
114	2.2456	0.0083
115	2.2539	0.0083
116	2.2622	0.0082
117	2.2704	0.0082
118	2.2785	0.0082
119	2.2867	0.0081
120	2.2947	0.0081
121	2.3028	0.0080
122	2.3108	0.0080
123	2.3188	0.0080
124	2.3267	0.0079
125	2.3346	0.0079
126	2.3425	0.0079
127	2.3503	0.0078
128	2.3581	0.0078
129	2.3658	0.0078
130	2.3735	0.0077
131	2.3812	0.0077
132	2.3889	0.0077
133	2.3965	0.0076
134	2.4041	0.0076
135	2.4116	0.0076
136	2.4192	0.0075
137	2.4266	0.0075

138	2.4341	0.0075
139	2.4415	0.0074
140	2.4489	0.0074
141	2.4563	0.0074
142	2.4636	0.0073
143	2.4709	0.0073
144	2.4782	0.0073
145	2.4854	0.0072
146	2.4927	0.0072
147	2.4998	0.0072
148	2.5070	0.0072
149	2.5141	0.0071
150	2.5212	0.0071
151	2.5283	0.0071
152	2.5354	0.0071
153	2.5424	0.0070
154	2.5494	0.0070
155	2.5564	0.0070
156	2.5633	0.0069
157	2.5702	0.0069
158	2.5771	0.0069
159	2.5840	0.0069
160	2.5908	0.0068
161	2.5976	0.0068
162	2.6044	0.0068
163	2.6112	0.0068
164	2.6180	0.0067
165	2.6247	0.0067
166	2.6314	0.0067
167	2.6381	0.0067
168	2.6447	0.0067
169	2.6513	0.0066
170	2.6579	0.0066
171	2.6645	0.0066
172	2.6711	0.0066
173	2.6776	0.0065
174	2.6842	0.0065
175	2.6906	0.0065
176	2.6971	0.0065
177	2.7036	0.0065
178	2.7100	0.0064
179	2.7164	0.0064
180	2.7228	0.0064
181	2.7292	0.0064
182	2.7355	0.0064
183	2.7419	0.0063
184	2.7482	0.0063
185	2.7545	0.0063
186	2.7607	0.0063
187	2.7670	0.0063
188	2.7732	0.0062
189	2.7794	0.0062
190	2.7856	0.0062
191	2.7918	0.0062
192	2.7980	0.0062
193	2.8041	0.0061
194	2.8102	0.0061
195	2.8163	0.0061
196	2.8224	0.0061
197	2.8285	0.0061

198	2.8345	0.0060
199	2.8406	0.0060
200	2.8466	0.0060
201	2.8526	0.0060
202	2.8585	0.0060
203	2.8645	0.0060
204	2.8704	0.0059
205	2.8764	0.0059
206	2.8823	0.0059
207	2.8882	0.0059
208	2.8941	0.0059
209	2.8999	0.0059
210	2.9058	0.0058
211	2.9116	0.0058
212	2.9174	0.0058
213	2.9232	0.0058
214	2.9290	0.0058
215	2.9347	0.0058
216	2.9405	0.0058
217	2.9462	0.0057
218	2.9520	0.0057
219	2.9577	0.0057
220	2.9633	0.0057
221	2.9690	0.0057
222	2.9747	0.0057
223	2.9803	0.0056
224	2.9860	0.0056
225	2.9916	0.0056
226	2.9972	0.0056
227	3.0028	0.0056
228	3.0083	0.0056
229	3.0139	0.0056
230	3.0194	0.0055
231	3.0250	0.0055
232	3.0305	0.0055
233	3.0360	0.0055
234	3.0415	0.0055
235	3.0470	0.0055
236	3.0524	0.0055
237	3.0579	0.0054
238	3.0633	0.0054
239	3.0687	0.0054
240	3.0741	0.0054
241	3.0795	0.0054
242	3.0849	0.0054
243	3.0903	0.0054
244	3.0957	0.0054
245	3.1010	0.0053
246	3.1063	0.0053
247	3.1117	0.0053
248	3.1170	0.0053
249	3.1223	0.0053
250	3.1275	0.0053
251	3.1328	0.0053
252	3.1381	0.0053
253	3.1433	0.0052
254	3.1486	0.0052
255	3.1538	0.0052
256	3.1590	0.0052
257	3.1642	0.0052

258	3.1694	0.0052
259	3.1746	0.0052
260	3.1797	0.0052
261	3.1849	0.0052
262	3.1900	0.0051
263	3.1951	0.0051
264	3.2003	0.0051
265	3.2054	0.0051
266	3.2105	0.0051
267	3.2156	0.0051
268	3.2206	0.0051
269	3.2257	0.0051
270	3.2307	0.0051
271	3.2358	0.0050
272	3.2408	0.0050
273	3.2458	0.0050
274	3.2509	0.0050
275	3.2559	0.0050
276	3.2608	0.0050
277	3.2658	0.0050
278	3.2708	0.0050
279	3.2757	0.0050
280	3.2807	0.0049
281	3.2856	0.0049
282	3.2906	0.0049
283	3.2955	0.0049
284	3.3004	0.0049
285	3.3053	0.0049
286	3.3102	0.0049
287	3.3150	0.0049
288	3.3199	0.0049

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0049	0.0023	0.0026
2	0.0049	0.0023	0.0026
3	0.0049	0.0023	0.0026
4	0.0049	0.0023	0.0026
5	0.0049	0.0023	0.0026
6	0.0049	0.0023	0.0026
7	0.0050	0.0023	0.0026
8	0.0050	0.0023	0.0027
9	0.0050	0.0023	0.0027
10	0.0050	0.0023	0.0027
11	0.0050	0.0023	0.0027
12	0.0050	0.0023	0.0027
13	0.0051	0.0024	0.0027
14	0.0051	0.0024	0.0027
15	0.0051	0.0024	0.0027
16	0.0051	0.0024	0.0027
17	0.0051	0.0024	0.0027
18	0.0051	0.0024	0.0027
19	0.0052	0.0024	0.0028
20	0.0052	0.0024	0.0028
21	0.0052	0.0024	0.0028
22	0.0052	0.0024	0.0028

23	0.0052	0.0024	0.0028
24	0.0052	0.0024	0.0028
25	0.0053	0.0024	0.0028
26	0.0053	0.0025	0.0028
27	0.0053	0.0025	0.0028
28	0.0053	0.0025	0.0028
29	0.0053	0.0025	0.0029
30	0.0053	0.0025	0.0029
31	0.0054	0.0025	0.0029
32	0.0054	0.0025	0.0029
33	0.0054	0.0025	0.0029
34	0.0054	0.0025	0.0029
35	0.0054	0.0025	0.0029
36	0.0055	0.0025	0.0029
37	0.0055	0.0026	0.0029
38	0.0055	0.0026	0.0029
39	0.0055	0.0026	0.0030
40	0.0055	0.0026	0.0030
41	0.0056	0.0026	0.0030
42	0.0056	0.0026	0.0030
43	0.0056	0.0026	0.0030
44	0.0056	0.0026	0.0030
45	0.0057	0.0026	0.0030
46	0.0057	0.0026	0.0030
47	0.0057	0.0027	0.0030
48	0.0057	0.0027	0.0031
49	0.0058	0.0027	0.0031
50	0.0058	0.0027	0.0031
51	0.0058	0.0027	0.0031
52	0.0058	0.0027	0.0031
53	0.0058	0.0027	0.0031
54	0.0059	0.0027	0.0031
55	0.0059	0.0027	0.0031
56	0.0059	0.0028	0.0032
57	0.0059	0.0028	0.0032
58	0.0060	0.0028	0.0032
59	0.0060	0.0028	0.0032
60	0.0060	0.0028	0.0032
61	0.0060	0.0028	0.0032
62	0.0061	0.0028	0.0032
63	0.0061	0.0028	0.0033
64	0.0061	0.0028	0.0033
65	0.0062	0.0029	0.0033
66	0.0062	0.0029	0.0033
67	0.0062	0.0029	0.0033
68	0.0062	0.0029	0.0033
69	0.0063	0.0029	0.0034
70	0.0063	0.0029	0.0034
71	0.0063	0.0029	0.0034
72	0.0064	0.0030	0.0034
73	0.0064	0.0030	0.0034
74	0.0064	0.0030	0.0034
75	0.0065	0.0030	0.0034
76	0.0065	0.0030	0.0035
77	0.0065	0.0030	0.0035
78	0.0065	0.0030	0.0035
79	0.0066	0.0031	0.0035
80	0.0066	0.0031	0.0035
81	0.0067	0.0031	0.0036
82	0.0067	0.0031	0.0036

83	0.0067	0.0031	0.0036
84	0.0067	0.0031	0.0036
85	0.0068	0.0032	0.0036
86	0.0068	0.0032	0.0036
87	0.0069	0.0032	0.0037
88	0.0069	0.0032	0.0037
89	0.0069	0.0032	0.0037
90	0.0070	0.0032	0.0037
91	0.0070	0.0033	0.0038
92	0.0071	0.0033	0.0038
93	0.0071	0.0033	0.0038
94	0.0071	0.0033	0.0038
95	0.0072	0.0033	0.0038
96	0.0072	0.0034	0.0039
97	0.0073	0.0034	0.0039
98	0.0073	0.0034	0.0039
99	0.0074	0.0034	0.0039
100	0.0074	0.0034	0.0040
101	0.0075	0.0035	0.0040
102	0.0075	0.0035	0.0040
103	0.0076	0.0035	0.0040
104	0.0076	0.0035	0.0041
105	0.0077	0.0036	0.0041
106	0.0077	0.0036	0.0041
107	0.0078	0.0036	0.0041
108	0.0078	0.0036	0.0042
109	0.0079	0.0037	0.0042
110	0.0079	0.0037	0.0042
111	0.0080	0.0037	0.0043
112	0.0080	0.0037	0.0043
113	0.0081	0.0038	0.0043
114	0.0081	0.0038	0.0043
115	0.0082	0.0038	0.0044
116	0.0082	0.0038	0.0044
117	0.0083	0.0039	0.0045
118	0.0084	0.0039	0.0045
119	0.0085	0.0039	0.0045
120	0.0085	0.0040	0.0045
121	0.0086	0.0040	0.0046
122	0.0086	0.0040	0.0046
123	0.0087	0.0041	0.0047
124	0.0088	0.0041	0.0047
125	0.0089	0.0041	0.0047
126	0.0089	0.0042	0.0048
127	0.0090	0.0042	0.0048
128	0.0091	0.0042	0.0049
129	0.0092	0.0043	0.0049
130	0.0093	0.0043	0.0049
131	0.0094	0.0044	0.0050
132	0.0094	0.0044	0.0050
133	0.0096	0.0045	0.0051
134	0.0096	0.0045	0.0051
135	0.0097	0.0045	0.0052
136	0.0098	0.0046	0.0052
137	0.0099	0.0046	0.0053
138	0.0100	0.0047	0.0054
139	0.0102	0.0047	0.0054
140	0.0102	0.0048	0.0055
141	0.0104	0.0048	0.0056
142	0.0105	0.0049	0.0056

143	0.0106	0.0049	0.0057
144	0.0107	0.0050	0.0057
145	0.0099	0.0046	0.0053
146	0.0100	0.0047	0.0054
147	0.0102	0.0048	0.0055
148	0.0103	0.0048	0.0055
149	0.0105	0.0049	0.0056
150	0.0106	0.0049	0.0057
151	0.0108	0.0050	0.0058
152	0.0109	0.0051	0.0058
153	0.0111	0.0052	0.0059
154	0.0112	0.0052	0.0060
155	0.0115	0.0053	0.0061
156	0.0116	0.0054	0.0062
157	0.0119	0.0055	0.0063
158	0.0120	0.0056	0.0064
159	0.0123	0.0057	0.0066
160	0.0125	0.0058	0.0067
161	0.0128	0.0059	0.0068
162	0.0129	0.0060	0.0069
163	0.0133	0.0062	0.0071
164	0.0135	0.0063	0.0072
165	0.0139	0.0065	0.0074
166	0.0141	0.0066	0.0075
167	0.0145	0.0068	0.0078
168	0.0148	0.0069	0.0079
169	0.0153	0.0071	0.0082
170	0.0156	0.0073	0.0083
171	0.0162	0.0075	0.0086
172	0.0165	0.0077	0.0088
173	0.0172	0.0080	0.0092
174	0.0175	0.0082	0.0094
175	0.0183	0.0085	0.0098
176	0.0188	0.0087	0.0100
177	0.0197	0.0092	0.0105
178	0.0203	0.0094	0.0108
179	0.0215	0.0100	0.0115
180	0.0221	0.0103	0.0118
181	0.0236	0.0110	0.0126
182	0.0245	0.0114	0.0131
183	0.0265	0.0124	0.0142
184	0.0277	0.0129	0.0148
185	0.0239	0.0111	0.0128
186	0.0255	0.0119	0.0136
187	0.0295	0.0137	0.0158
188	0.0322	0.0150	0.0172
189	0.0401	0.0187	0.0214
190	0.0462	0.0215	0.0247
191	0.0701	0.0282	0.0418
192	0.1017	0.0282	0.0734
193	0.4399	0.0282	0.4117
194	0.0551	0.0257	0.0295
195	0.0356	0.0166	0.0190
196	0.0273	0.0127	0.0146
197	0.0291	0.0135	0.0155
198	0.0255	0.0119	0.0136
199	0.0229	0.0106	0.0122
200	0.0208	0.0097	0.0111
201	0.0192	0.0090	0.0103
202	0.0179	0.0083	0.0096

203	0.0168	0.0078	0.0090
204	0.0159	0.0074	0.0085
205	0.0150	0.0070	0.0080
206	0.0143	0.0067	0.0076
207	0.0137	0.0064	0.0073
208	0.0131	0.0061	0.0070
209	0.0126	0.0059	0.0067
210	0.0122	0.0057	0.0065
211	0.0117	0.0055	0.0063
212	0.0114	0.0053	0.0061
213	0.0110	0.0051	0.0059
214	0.0107	0.0050	0.0057
215	0.0104	0.0048	0.0056
216	0.0101	0.0047	0.0054
217	0.0108	0.0050	0.0058
218	0.0105	0.0049	0.0056
219	0.0103	0.0048	0.0055
220	0.0101	0.0047	0.0054
221	0.0099	0.0046	0.0053
222	0.0097	0.0045	0.0052
223	0.0095	0.0044	0.0051
224	0.0093	0.0043	0.0050
225	0.0092	0.0043	0.0049
226	0.0090	0.0042	0.0048
227	0.0088	0.0041	0.0047
228	0.0087	0.0040	0.0046
229	0.0086	0.0040	0.0046
230	0.0084	0.0039	0.0045
231	0.0083	0.0039	0.0044
232	0.0082	0.0038	0.0044
233	0.0080	0.0037	0.0043
234	0.0079	0.0037	0.0042
235	0.0078	0.0036	0.0042
236	0.0077	0.0036	0.0041
237	0.0076	0.0035	0.0041
238	0.0075	0.0035	0.0040
239	0.0074	0.0035	0.0040
240	0.0073	0.0034	0.0039
241	0.0072	0.0034	0.0039
242	0.0072	0.0033	0.0038
243	0.0071	0.0033	0.0038
244	0.0070	0.0033	0.0037
245	0.0069	0.0032	0.0037
246	0.0068	0.0032	0.0037
247	0.0068	0.0032	0.0036
248	0.0067	0.0031	0.0036
249	0.0066	0.0031	0.0035
250	0.0066	0.0031	0.0035
251	0.0065	0.0030	0.0035
252	0.0064	0.0030	0.0034
253	0.0064	0.0030	0.0034
254	0.0063	0.0029	0.0034
255	0.0063	0.0029	0.0033
256	0.0062	0.0029	0.0033
257	0.0061	0.0029	0.0033
258	0.0061	0.0028	0.0033
259	0.0060	0.0028	0.0032
260	0.0060	0.0028	0.0032
261	0.0059	0.0028	0.0032
262	0.0059	0.0027	0.0031

```
      263              0.0058           0.0027              0.0031
      264              0.0058           0.0027              0.0031
      265              0.0057           0.0027              0.0031
      266              0.0057           0.0026              0.0030
      267              0.0056           0.0026              0.0030
      268              0.0056           0.0026              0.0030
      269              0.0056           0.0026              0.0030
      270              0.0055           0.0026              0.0029
      271              0.0055           0.0025              0.0029
      272              0.0054           0.0025              0.0029
      273              0.0054           0.0025              0.0029
      274              0.0054           0.0025              0.0029
      275              0.0053           0.0025              0.0028
      276              0.0053           0.0025              0.0028
      277              0.0052           0.0024              0.0028
      278              0.0052           0.0024              0.0028
      279              0.0052           0.0024              0.0028
      280              0.0051           0.0024              0.0027
      281              0.0051           0.0024              0.0027
      282              0.0051           0.0024              0.0027
      283              0.0050           0.0023              0.0027
      284              0.0050           0.0023              0.0027
      285              0.0050           0.0023              0.0027
      286              0.0049           0.0023              0.0026
      287              0.0049           0.0023              0.0026
      288              0.0049           0.0023              0.0026
      ------------------------------------------------------------------
--
      ------------------------------------------------------------------
--
      Total soil rain loss =      1.35(In)
      Total effective rainfall =      1.97(In)
      Peak flow rate in flood hydrograph =     28.73(CFS)
      ------------------------------------------------------------------
---
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++
                          24 - H O U R    S T O R M
                     R u n o f f      H y d r o g r a p h
      ------------------------------------------------------------------
--
                   Hydrograph in   5   Minute intervals ((CFS))

      ------------------------------------------------------------------
--
  Time(h+m) Volume Ac.Ft   Q(CFS)  0        7.5      15.0      22.5
30.0

------------------------------------------------------------------------
    0+ 5       0.0001      0.01  Q         |         |         |
|
    0+10       0.0005      0.06  Q         |         |         |
|
    0+15       0.0019      0.20  Q         |         |         |
|
    0+20       0.0041      0.33  Q         |         |         |
|
    0+25       0.0069      0.41  Q         |         |         |
|
    0+30       0.0101      0.46  Q         |         |         |
```

0+35	0.0135	0.49	Q			
0+40	0.0170	0.52	Q			
0+45	0.0207	0.54	Q			
0+50	0.0246	0.56	Q			
0+55	0.0285	0.57	Q			
1+ 0	0.0326	0.59	Q			
1+ 5	0.0367	0.60	Q			
1+10	0.0409	0.61	Q			
1+15	0.0451	0.61	Q			
1+20	0.0494	0.62	Q			
1+25	0.0537	0.63	Q			
1+30	0.0581	0.63	Q			
1+35	0.0625	0.64	Q			
1+40	0.0669	0.64	Q			
1+45	0.0714	0.65	Q			
1+50	0.0759	0.65	Q			
1+55	0.0804	0.66	Q			
2+ 0	0.0849	0.66	QV			
2+ 5	0.0895	0.66	QV			
2+10	0.0941	0.67	QV			
2+15	0.0987	0.67	QV			
2+20	0.1033	0.67	QV			
2+25	0.1079	0.67	QV			
2+30	0.1126	0.68	QV			
2+35	0.1173	0.68	QV			
2+40	0.1220	0.68	QV			
2+45	0.1267	0.68	QV			
2+50	0.1314	0.69	QV			
2+55	0.1361	0.69	QV			
3+ 0	0.1409	0.69	QV			

3+ 5	0.1456	0.69	QV			
3+10	0.1504	0.70	QV			
3+15	0.1552	0.70	QV			
3+20	0.1600	0.70	QV			
3+25	0.1649	0.70	Q V			
3+30	0.1697	0.71	Q V			
3+35	0.1746	0.71	Q V			
3+40	0.1795	0.71	Q V			
3+45	0.1844	0.71	Q V			
3+50	0.1894	0.72	Q V			
3+55	0.1943	0.72	Q V			
4+ 0	0.1993	0.72	Q V			
4+ 5	0.2043	0.72	Q V			
4+10	0.2093	0.73	Q V			
4+15	0.2143	0.73	Q V			
4+20	0.2194	0.73	Q V			
4+25	0.2244	0.74	Q V			
4+30	0.2295	0.74	Q V			
4+35	0.2346	0.74	Q V			
4+40	0.2397	0.74	Q V			
4+45	0.2449	0.75	Q V			
4+50	0.2501	0.75	|Q V			
4+55	0.2553	0.75	|Q V			
5+ 0	0.2605	0.76	|Q V			
5+ 5	0.2657	0.76	|Q V			
5+10	0.2710	0.76	|Q V			
5+15	0.2763	0.77	|Q V			
5+20	0.2816	0.77	|Q V			
5+25	0.2869	0.77	|Q V			
5+30	0.2922	0.78	|Q V			

5+35	0.2976	0.78	|Q V	|	|	|
5+40	0.3030	0.78	|Q V	|	|	|
5+45	0.3084	0.79	|Q V	|	|	|
5+50	0.3139	0.79	|Q V	|	|	|
5+55	0.3194	0.79	|Q V	|	|	|
6+ 0	0.3249	0.80	|Q V	|	|	|
6+ 5	0.3304	0.80	|Q V	|	|	|
6+10	0.3359	0.81	|Q V	|	|	|
6+15	0.3415	0.81	|Q V	|	|	|
6+20	0.3471	0.81	|Q V	|	|	|
6+25	0.3527	0.82	|Q V	|	|	|
6+30	0.3584	0.82	|Q V	|	|	|
6+35	0.3641	0.83	|Q V	|	|	|
6+40	0.3698	0.83	|Q V	|	|	|
6+45	0.3755	0.83	|Q V	|	|	|
6+50	0.3813	0.84	|Q V	|	|	|
6+55	0.3871	0.84	|Q V	|	|	|
7+ 0	0.3929	0.85	|Q V	|	|	|
7+ 5	0.3988	0.85	|Q V	|	|	|
7+10	0.4047	0.85	|Q V	|	|	|
7+15	0.4106	0.86	|Q V	|	|	|
7+20	0.4165	0.86	|Q V	|	|	|
7+25	0.4225	0.87	|Q V	|	|	|
7+30	0.4285	0.87	|Q V	|	|	|
7+35	0.4346	0.88	|Q V	|	|	|
7+40	0.4407	0.88	|Q V	|	|	|
7+45	0.4468	0.89	|Q V	|	|	|
7+50	0.4529	0.89	|Q V	|	|	|
7+55	0.4591	0.90	|Q V	|	|	|
8+ 0	0.4653	0.90	|Q V	|	|	|

8+ 5	0.4716	0.91	|Q V |	|	|
8+10	0.4779	0.91	|Q V |	|	|
8+15	0.4842	0.92	|Q V |	|	|
8+20	0.4906	0.92	|Q V |	|	|
8+25	0.4970	0.93	|Q V |	|	|
8+30	0.5034	0.94	|Q V |	|	|
8+35	0.5099	0.94	|Q V |	|	|
8+40	0.5164	0.95	|Q V |	|	|
8+45	0.5230	0.95	|Q V |	|	|
8+50	0.5296	0.96	|Q V |	|	|
8+55	0.5362	0.96	|Q V |	|	|
9+ 0	0.5429	0.97	|Q V |	|	|
9+ 5	0.5496	0.98	|Q V |	|	|
9+10	0.5564	0.98	|Q V |	|	|
9+15	0.5632	0.99	|Q V |	|	|
9+20	0.5701	1.00	|Q V |	|	|
9+25	0.5770	1.00	|Q V |	|	|
9+30	0.5839	1.01	|Q V |	|	|
9+35	0.5910	1.02	|Q V |	|	|
9+40	0.5980	1.02	|Q V |	|	|
9+45	0.6051	1.03	|Q V |	|	|
9+50	0.6123	1.04	|Q V |	|	|
9+55	0.6195	1.05	|Q V |	|	|
10+ 0	0.6268	1.06	|Q V |	|	|
10+ 5	0.6341	1.06	|Q V |	|	|
10+10	0.6415	1.07	|Q V |	|	|
10+15	0.6489	1.08	|Q V |	|	|
10+20	0.6564	1.09	|Q V |	|	|
10+25	0.6639	1.10	|Q V |	|	|
10+30	0.6716	1.11	|Q V |	|	|

10+35	0.6792	1.11	|Q	V |	|	|
10+40	0.6870	1.12	|Q	V |	|	|
10+45	0.6948	1.13	|Q	V |	|	|
10+50	0.7027	1.14	|Q	V |	|	|
10+55	0.7106	1.15	|Q	V |	|	|
11+ 0	0.7186	1.16	|Q	V |	|	|
11+ 5	0.7267	1.17	|Q	V |	|	|
11+10	0.7349	1.18	|Q	V |	|	|
11+15	0.7431	1.20	|Q	V|	|	|
11+20	0.7514	1.21	|Q	V|	|	|
11+25	0.7598	1.22	|Q	V|	|	|
11+30	0.7683	1.23	|Q	V|	|	|
11+35	0.7768	1.24	|Q	V|	|	|
11+40	0.7854	1.25	|Q	V|	|	|
11+45	0.7942	1.27	|Q	V|	|	|
11+50	0.8030	1.28	|Q	V|	|	|
11+55	0.8119	1.29	|Q	V|	|	|
12+ 0	0.8209	1.31	|Q	V	|	|
12+ 5	0.8300	1.32	|Q	V	|	|
12+10	0.8391	1.33	|Q	V	|	|
12+15	0.8482	1.31	|Q	V	|	|
12+20	0.8572	1.30	|Q	V	|	|
12+25	0.8662	1.31	|Q	V	|	|
12+30	0.8752	1.31	|Q	V	|	|
12+35	0.8843	1.32	|Q	V	|	|
12+40	0.8935	1.34	|Q	V	|	|
12+45	0.9028	1.35	|Q	|V	|	|
12+50	0.9122	1.37	|Q	|V	|	|
12+55	0.9218	1.38	|Q	|V	|	|
13+ 0	0.9314	1.40	|Q	|V	|	|

13+ 5	0.9412	1.42	Q	V		
13+10	0.9512	1.44	Q	V		
13+15	0.9612	1.46	Q	V		
13+20	0.9715	1.49	Q	V		
13+25	0.9819	1.51	Q	V		
13+30	0.9925	1.54	Q	V		
13+35	1.0033	1.56	Q	V		
13+40	1.0142	1.59	Q	V		
13+45	1.0254	1.62	Q	V		
13+50	1.0368	1.65	Q	V		
13+55	1.0484	1.69	Q	V		
14+ 0	1.0603	1.72	Q	V		
14+ 5	1.0724	1.76	Q	V		
14+10	1.0848	1.80	Q	V		
14+15	1.0975	1.84	Q	V		
14+20	1.1105	1.89	Q	V		
14+25	1.1238	1.94	Q	V		
14+30	1.1375	1.99	Q	V		
14+35	1.1516	2.05	Q	V		
14+40	1.1661	2.11	Q	V		
14+45	1.1811	2.17	Q	V		
14+50	1.1965	2.24	Q	V		
14+55	1.2125	2.32	Q	V		
15+ 0	1.2290	2.40	Q	V		
15+ 5	1.2462	2.50	Q	V		
15+10	1.2641	2.60	Q	V		
15+15	1.2829	2.72	Q	V		
15+20	1.3025	2.85	Q	V		
15+25	1.3231	2.99	Q	V		
15+30	1.3444	3.09	Q	V		

15+35	1.3658	3.11	Q	V			
15+40	1.3876	3.17	Q	V			
15+45	1.4107	3.36	Q	V			
15+50	1.4360	3.67	Q	V			
15+55	1.4648	4.18	Q	V			
16+ 0	1.5000	5.12	Q	V			
16+ 5	1.5581	8.44	Q	V			
16+10	1.6680	15.95	VQ				
16+15	1.8659	28.73	V				Q
16+20	2.0532	27.20	V			Q	
16+25	2.1728	17.37	Q V				
16+30	2.2591	12.53	Q	V			
16+35	2.3281	10.01	Q	V			
16+40	2.3853	8.31	Q	V			
16+45	2.4345	7.14	Q	V			
16+50	2.4778	6.28	Q	V			
16+55	2.5149	5.38	Q	V			
17+ 0	2.5480	4.80	Q	V			
17+ 5	2.5779	4.35	Q	V			
17+10	2.6050	3.94	Q	V			
17+15	2.6296	3.56	Q	V			
17+20	2.6520	3.25	Q	V			
17+25	2.6726	2.99	Q	V			
17+30	2.6911	2.69	Q	V			
17+35	2.7080	2.46	Q	V			
17+40	2.7234	2.24	Q	V			
17+45	2.7385	2.19	Q	V			
17+50	2.7531	2.13	Q	V			
17+55	2.7672	2.05	Q	V			
18+ 0	2.7802	1.89	Q	V			

18+ 5	2.7921	1.72	Q				V
18+10	2.8030	1.58	Q				V
18+15	2.8130	1.46	Q				V
18+20	2.8229	1.44	Q				V
18+25	2.8326	1.41	Q				V
18+30	2.8422	1.38	Q				V
18+35	2.8515	1.35	Q				V
18+40	2.8606	1.32	Q				V
18+45	2.8695	1.30	Q				V
18+50	2.8782	1.27	Q				V
18+55	2.8868	1.24	Q				V
19+ 0	2.8952	1.22	Q				V
19+ 5	2.9035	1.20	Q				V
19+10	2.9116	1.18	Q				V
19+15	2.9196	1.16	Q				V
19+20	2.9274	1.14	Q				V
19+25	2.9351	1.12	Q				V
19+30	2.9427	1.10	Q				V
19+35	2.9502	1.08	Q				V
19+40	2.9575	1.07	Q				V
19+45	2.9648	1.05	Q				V
19+50	2.9719	1.04	Q				V
19+55	2.9789	1.02	Q				V
20+ 0	2.9859	1.01	Q				V
20+ 5	2.9927	0.99	Q				V
20+10	2.9995	0.98	Q				V
20+15	3.0062	0.97	Q				V
20+20	3.0128	0.96	Q				V
20+25	3.0193	0.94	Q				V
20+30	3.0257	0.93	Q				V

20+35	3.0320	0.92	|Q	|	|	|	V
20+40	3.0383	0.91	|Q	|	|	|	V
20+45	3.0445	0.90	|Q	|	|	|	V
20+50	3.0506	0.89	|Q	|	|	|	V
20+55	3.0567	0.88	|Q	|	|	|	V
21+ 0	3.0627	0.87	|Q	|	|	|	V
21+ 5	3.0686	0.86	|Q	|	|	|	V
21+10	3.0745	0.85	|Q	|	|	|	V
21+15	3.0803	0.84	|Q	|	|	|	V
21+20	3.0861	0.84	|Q	|	|	|	V
21+25	3.0918	0.83	|Q	|	|	|	V
21+30	3.0974	0.82	|Q	|	|	|	V
21+35	3.1030	0.81	|Q	|	|	|	V
21+40	3.1085	0.80	|Q	|	|	|	V
21+45	3.1140	0.80	|Q	|	|	|	V
21+50	3.1195	0.79	|Q	|	|	|	V
21+55	3.1249	0.78	|Q	|	|	|	V
22+ 0	3.1302	0.78	|Q	|	|	|	V
22+ 5	3.1355	0.77	|Q	|	|	|	V
22+10	3.1407	0.76	|Q	|	|	|	V
22+15	3.1459	0.76	|Q	|	|	|	V
22+20	3.1511	0.75	Q	|	|	|	V
22+25	3.1562	0.74	Q	|	|	|	V
22+30	3.1613	0.74	Q	|	|	|	V
22+35	3.1663	0.73	Q	|	|	|	V
22+40	3.1713	0.73	Q	|	|	|	V
22+45	3.1763	0.72	Q	|	|	|	V
22+50	3.1812	0.71	Q	|	|	|	V
22+55	3.1861	0.71	Q	|	|	|	V
23+ 0	3.1909	0.70	Q	|	|	|	

23+ 5	3.1957	0.70	Q			
23+10	3.2005	0.69	Q			
23+15	3.2053	0.69	Q			
23+20	3.2100	0.68	Q			
23+25	3.2146	0.68	Q			
23+30	3.2193	0.67	Q			
23+35	3.2239	0.67	Q			
23+40	3.2285	0.67	Q			
23+45	3.2330	0.66	Q			
23+50	3.2375	0.66	Q			
23+55	3.2420	0.65	Q			
24+ 0	3.2465	0.65	Q			
24+ 5	3.2508	0.63	Q			
24+10	3.2548	0.58	Q			
24+15	3.2579	0.44	Q			
24+20	3.2599	0.30	Q			
24+25	3.2615	0.23	Q			
24+30	3.2627	0.18	Q			
24+35	3.2637	0.14	Q			
24+40	3.2645	0.12	Q			
24+45	3.2652	0.10	Q			
24+50	3.2657	0.08	Q			
24+55	3.2662	0.06	Q			
25+ 0	3.2665	0.05	Q			
25+ 5	3.2668	0.04	Q			
25+10	3.2671	0.04	Q			
25+15	3.2673	0.03	Q			
25+20	3.2675	0.02	Q			
25+25	3.2676	0.02	Q			
25+30	3.2677	0.02	Q			

25+35	3.2678	0.01	Q			
25+40	3.2679	0.01	Q			
25+45	3.2679	0.01	Q			
25+50	3.2680	0.01	Q			
25+55	3.2680	0.00	Q			
26+ 0	3.2680	0.00	Q			
26+ 5	3.2680	0.00	Q			

APPENDIX E:
BASIN ROUTING STUDY INFORMATION

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2012
Study date: 09/17/21

Auburn & Verbena
Basin Routing
100yr 24hr Storm - No Infiltration

Program License Serial Number 6232

********** HYDROGRAPH INFORMATION **********

From study/file name: averbena.rte
**********HYDROGRAPH DATA**********
Number of intervals = 313
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 28.731 (CFS)
Total volume = 3.268 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

++

Process from Point/Station 103.000 to Point/Station 104.000
**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 313
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

```
--
      Initial basin depth =   0.00 (Ft.)
      Initial basin storage =      0.00 (Ac.Ft)
      Initial basin outflow =   0.00 (CFS)
      ------------------------------------------------------------------
---
      ------------------------------------------------------------------
--
      Depth vs. Storage and Depth vs. Discharge data:
       Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
           (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
      ------------------------------------------------------------------
---
          0.000      0.000      0.000      0.000        0.000
          1.000      0.440      0.010      0.440        0.440
          2.000      1.010      0.010      1.010        1.010
          2.250      1.170      0.010      1.170        1.170
          3.000      1.730     18.000      1.668        1.792
      ------------------------------------------------------------------
--
                   Hydrograph Detention Basin Routing
      ------------------------------------------------------------------
---

      Graph values: 'I'= unit inflow; 'O'=outflow at time shown
      ------------------------------------------------------------------
---
  Time   Inflow  Outflow    Storage
Depth
 (Hours)  (CFS)   (CFS)     (Ac.Ft) .0       7.2   14.37   21.55   28.73
(Ft.)
  0.083    0.01    0.00      0.000  O       |       |       |       |
0.00
  0.167    0.06    0.00      0.000  O       |       |       |       |
0.00
  0.250    0.20    0.00      0.001  O       |       |       |       |
0.00
  0.333    0.33    0.00      0.003  O       |       |       |       |
0.01
  0.417    0.41    0.00      0.006  O       |       |       |       |
0.01
  0.500    0.46    0.00      0.009  O       |       |       |       |
0.02
  0.583    0.49    0.00      0.012  O       |       |       |       |
0.03
  0.667    0.52    0.00      0.015  O       |       |       |       |
0.03
  0.750    0.54    0.00      0.019  O       |       |       |       |
0.04
  0.833    0.56    0.00      0.023  O       |       |       |       |
0.05
  0.917    0.57    0.00      0.027  O       |       |       |       |
0.06
  1.000    0.59    0.00      0.031  O       |       |       |       |
0.07
  1.083    0.60    0.00      0.035  O       |       |       |       |
0.08
  1.167    0.61    0.00      0.039  O       |       |       |       |
0.09
  1.250    0.61    0.00      0.043  O       |       |       |       |
```

0.10								
1.333	0.62	0.00	0.047	O	|	|	|	|
0.11								
1.417	0.63	0.00	0.051	O	|	|	|	|
0.12								
1.500	0.63	0.00	0.056	O	|	|	|	|
0.13								
1.583	0.64	0.00	0.060	O	|	|	|	|
0.14								
1.667	0.64	0.00	0.065	O	|	|	|	|
0.15								
1.750	0.65	0.00	0.069	O	|	|	|	|
0.16								
1.833	0.65	0.00	0.074	O	|	|	|	|
0.17								
1.917	0.66	0.00	0.078	O	|	|	|	|
0.18								
2.000	0.66	0.00	0.083	O	|	|	|	|
0.19								
2.083	0.66	0.00	0.087	O	|	|	|	|
0.20								
2.167	0.67	0.00	0.092	O	|	|	|	|
0.21								
2.250	0.67	0.00	0.096	O	|	|	|	|
0.22								
2.333	0.67	0.00	0.101	O	|	|	|	|
0.23								
2.417	0.67	0.00	0.105	O	|	|	|	|
0.24								
2.500	0.68	0.00	0.110	O	|	|	|	|
0.25								
2.583	0.68	0.00	0.115	O	|	|	|	|
0.26								
2.667	0.68	0.00	0.119	O	|	|	|	|
0.27								
2.750	0.68	0.00	0.124	O	|	|	|	|
0.28								
2.833	0.69	0.00	0.129	O	|	|	|	|
0.29								
2.917	0.69	0.00	0.133	O	|	|	|	|
0.30								
3.000	0.69	0.00	0.138	O	|	|	|	|
0.31								
3.083	0.69	0.00	0.143	O	|	|	|	|
0.32								
3.167	0.70	0.00	0.148	O	|	|	|	|
0.34								
3.250	0.70	0.00	0.152	O	|	|	|	|
0.35								
3.333	0.70	0.00	0.157	O	|	|	|	|
0.36								
3.417	0.70	0.00	0.162	O	|	|	|	|
0.37								
3.500	0.71	0.00	0.167	O	|	|	|	|
0.38								
3.583	0.71	0.00	0.172	O	|	|	|	|
0.39								
3.667	0.71	0.00	0.177	O	|	|	|	|
0.40								
3.750	0.71	0.00	0.181	O	|	|	|	|

0.41
  3.833 0.72 0.00 0.186 O | | | |
0.42
  3.917 0.72 0.00 0.191 O | | | |
0.43
  4.000 0.72 0.00 0.196 O | | | |
0.45
  4.083 0.72 0.00 0.201 O | | | |
0.46
  4.167 0.73 0.00 0.206 O | | | |
0.47
  4.250 0.73 0.00 0.211 O | | | |
0.48
  4.333 0.73 0.00 0.216 O | | | |
0.49
  4.417 0.74 0.01 0.221 O | | | |
0.50
  4.500 0.74 0.01 0.226 O | | | |
0.51
  4.583 0.74 0.01 0.231 O | | | |
0.53
  4.667 0.74 0.01 0.236 O | | | |
0.54
  4.750 0.75 0.01 0.241 O | | | |
0.55
  4.833 0.75 0.01 0.246 O | | | |
0.56
  4.917 0.75 0.01 0.252 O | | | |
0.57
  5.000 0.76 0.01 0.257 O | | | |
0.58
  5.083 0.76 0.01 0.262 O | | | |
0.60
  5.167 0.76 0.01 0.267 O | | | |
0.61
  5.250 0.77 0.01 0.272 O | | | |
0.62
  5.333 0.77 0.01 0.278 O | | | |
0.63
  5.417 0.77 0.01 0.283 O | | | |
0.64
  5.500 0.78 0.01 0.288 O | | | |
0.66
  5.583 0.78 0.01 0.294 O | | | |
0.67
  5.667 0.78 0.01 0.299 O | | | |
0.68
  5.750 0.79 0.01 0.304 O | | | |
0.69
  5.833 0.79 0.01 0.310 O | | | |
0.70
  5.917 0.79 0.01 0.315 O | | | |
0.72
  6.000 0.80 0.01 0.321 O | | | |
0.73
  6.083 0.80 0.01 0.326 O | | | |
0.74
  6.167 0.81 0.01 0.331 O | | | |
0.75
  6.250 0.81 0.01 0.337 O | | | |

0.77								
6.333	0.81	0.01	0.342	O	|	|	|	|
0.78								
6.417	0.82	0.01	0.348	O	|	|	|	|
0.79								
6.500	0.82	0.01	0.354	O	|	|	|	|
0.80								
6.583	0.83	0.01	0.359	O	|	|	|	|
0.82								
6.667	0.83	0.01	0.365	O	|	|	|	|
0.83								
6.750	0.83	0.01	0.371	O	|	|	|	|
0.84								
6.833	0.84	0.01	0.376	O	|	|	|	|
0.86								
6.917	0.84	0.01	0.382	O	|	|	|	|
0.87								
7.000	0.85	0.01	0.388	O	|	|	|	|
0.88								
7.083	0.85	0.01	0.394	O	|	|	|	|
0.89								
7.167	0.85	0.01	0.399	O	|	|	|	|
0.91								
7.250	0.86	0.01	0.405	O	|	|	|	|
0.92								
7.333	0.86	0.01	0.411	O	|	|	|	|
0.93								
7.417	0.87	0.01	0.417	O	|	|	|	|
0.95								
7.500	0.87	0.01	0.423	O	|	|	|	|
0.96								
7.583	0.88	0.01	0.429	O	|	|	|	|
0.97								
7.667	0.88	0.01	0.435	O	|	|	|	|
0.99								
7.750	0.89	0.01	0.441	O	|	|	|	|
1.00								
7.833	0.89	0.01	0.447	O	|	|	|	|
1.01								
7.917	0.90	0.01	0.453	O	|	|	|	|
1.02								
8.000	0.90	0.01	0.459	OI	|	|	|	|
1.03								
8.083	0.91	0.01	0.465	OI	|	|	|	|
1.04								
8.167	0.91	0.01	0.472	OI	|	|	|	|
1.06								
8.250	0.92	0.01	0.478	OI	|	|	|	|
1.07								
8.333	0.92	0.01	0.484	OI	|	|	|	|
1.08								
8.417	0.93	0.01	0.490	OI	|	|	|	|
1.09								
8.500	0.94	0.01	0.497	OI	|	|	|	|
1.10								
8.583	0.94	0.01	0.503	OI	|	|	|	|
1.11								
8.667	0.95	0.01	0.510	OI	|	|	|	|
1.12								
8.750	0.95	0.01	0.516	OI	|	|	|	|

1.13 8.833	0.96	0.01	0.522	OI				
1.14 8.917	0.96	0.01	0.529	OI				
1.16 9.000	0.97	0.01	0.536	OI				
1.17 9.083	0.98	0.01	0.542	OI				
1.18 9.167	0.98	0.01	0.549	OI				
1.19 9.250	0.99	0.01	0.556	OI				
1.20 9.333	1.00	0.01	0.562	OI				
1.21 9.417	1.00	0.01	0.569	OI				
1.23 9.500	1.01	0.01	0.576	OI				
1.24 9.583	1.02	0.01	0.583	OI				
1.25 9.667	1.02	0.01	0.590	OI				
1.26 9.750	1.03	0.01	0.597	OI				
1.28 9.833	1.04	0.01	0.604	OI				
1.29 9.917	1.05	0.01	0.611	OI				
1.30 10.000	1.06	0.01	0.618	OI				
1.31 10.083	1.06	0.01	0.626	OI				
1.33 10.167	1.07	0.01	0.633	OI				
1.34 10.250	1.08	0.01	0.640	OI				
1.35 10.333	1.09	0.01	0.648	OI				
1.36 10.417	1.10	0.01	0.655	OI				
1.38 10.500	1.11	0.01	0.663	OI				
1.39 10.583	1.11	0.01	0.670	OI				
1.40 10.667	1.12	0.01	0.678	OI				
1.42 10.750	1.13	0.01	0.686	OI				
1.43 10.833	1.14	0.01	0.693	OI				
1.44 10.917	1.15	0.01	0.701	OI				
1.46 11.000	1.16	0.01	0.709	OI				
1.47 11.083	1.17	0.01	0.717	OI				
1.49 11.167	1.18	0.01	0.725	OI				
1.50 11.250	1.20	0.01	0.733	OI				

1.51								
11.333	1.21	0.01	0.741	OI				
1.53								
11.417	1.22	0.01	0.750	OI				
1.54								
11.500	1.23	0.01	0.758	OI				
1.56								
11.583	1.24	0.01	0.766	OI				
1.57								
11.667	1.25	0.01	0.775	OI				
1.59								
11.750	1.27	0.01	0.784	OI				
1.60								
11.833	1.28	0.01	0.792	OI				
1.62								
11.917	1.29	0.01	0.801	OI				
1.63								
12.000	1.31	0.01	0.810	OI				
1.65								
12.083	1.32	0.01	0.819	OI				
1.66								
12.167	1.33	0.01	0.828	OI				
1.68								
12.250	1.31	0.01	0.837	OI				
1.70								
12.333	1.30	0.01	0.846	OI				
1.71								
12.417	1.31	0.01	0.855	OI				
1.73								
12.500	1.31	0.01	0.864	OI				
1.74								
12.583	1.32	0.01	0.873	OI				
1.76								
12.667	1.34	0.01	0.882	OI				
1.78								
12.750	1.35	0.01	0.891	OI				
1.79								
12.833	1.37	0.01	0.900	OI				
1.81								
12.917	1.38	0.01	0.910	OI				
1.82								
13.000	1.40	0.01	0.919	OI				
1.84								
13.083	1.42	0.01	0.929	OI				
1.86								
13.167	1.44	0.01	0.939	OI				
1.88								
13.250	1.46	0.01	0.949	OI				
1.89								
13.333	1.49	0.01	0.959	OI				
1.91								
13.417	1.51	0.01	0.969	OI				
1.93								
13.500	1.54	0.01	0.980	OI				
1.95								
13.583	1.56	0.01	0.990	OI				
1.97								
13.667	1.59	0.01	1.001	OI				
1.98								
13.750	1.62	0.01	1.012	OI				

2.00
 13.833   1.65   0.01   1.023 OI | | | |
2.02
 13.917   1.69   0.01   1.035 OI | | | |
2.04
 14.000   1.72   0.01   1.046 OI | | | |
2.06
 14.083   1.76   0.01   1.058 OI | | | |
2.08
 14.167   1.80   0.01   1.070 O I | | | |
2.09
 14.250   1.84   0.01   1.083 O I | | | |
2.11
 14.333   1.89   0.01   1.096 O I | | | |
2.13
 14.417   1.94   0.01   1.109 O I | | | |
2.15
 14.500   1.99   0.01   1.122 O I | | | |
2.18
 14.583   2.05   0.01   1.136 O I | | | |
2.20
 14.667   2.11   0.01   1.150 O I | | | |
2.22
 14.750   2.17   0.01   1.165 O I | | | |
2.24
 14.833   2.24   0.30   1.179 O I | | | |
2.26
 14.917   2.32   0.70   1.191 O I | | | |
2.28
 15.000   2.40   1.03   1.202 |OI | | | |
2.29
 15.083   2.50   1.31   1.210 |OI | | | |
2.30
 15.167   2.60   1.56   1.218 |OI | | | |
2.31
 15.250   2.72   1.78   1.225 |O I | | | |
2.32
 15.333   2.85   1.98   1.231 | OI | | | |
2.33
 15.417   2.99   2.17   1.237 | OI | | | |
2.34
 15.500   3.09   2.34   1.243 | OI | | | |
2.35
 15.583   3.11   2.49   1.247 | OI | | | |
2.35
 15.667   3.17   2.62   1.251 | OI | | | |
2.36
 15.750   3.36   2.75   1.255 | O | | | |
2.36
 15.833   3.67   2.90   1.260 | OI | | | |
2.37
 15.917   4.18   3.10   1.266 | OI | | | |
2.38
 16.000   5.12   3.41   1.276 | O I | | | |
2.39
 16.083   8.44   4.08   1.297 | O |I | | |
2.42
 16.167   15.95   5.70   1.347 | O | |I | |
2.49
 16.250   28.73   9.01   1.450 | | O | | I

2.63
 16.333 27.20 12.79 1.568 | | O | | I |
2.78
 16.417 17.37 14.68 1.627 | | O I | |
2.86
 16.500 12.53 14.73 1.628 | | I O | |
2.86
 16.583 10.01 14.04 1.607 | | I O| | |
2.84
 16.667   8.31 13.07 1.577 | |I O | | |
2.79
 16.750   7.14 12.01 1.543 | I| O | | |
2.75
 16.833   6.28 10.95 1.511 | I | O | | |
2.71
 16.917   5.38   9.93 1.479 | I | O | | |
2.66
 17.000   4.80   8.97 1.449 | I |O | | |
2.62
 17.083   4.35   8.09 1.422 | I |O | | |
2.59
 17.167   3.94   7.31 1.397 | I O | | |
2.55
 17.250   3.56   6.60 1.375 | I O| | | |
2.52
 17.333   3.25   5.96 1.355 | I O | | | |
2.50
 17.417   2.99   5.40 1.338 | I O | | | |
2.47
 17.500   2.69   4.89 1.322 | I O | | | |
2.45
 17.583   2.46   4.43 1.307 | I O | | | |
2.43
 17.667   2.24   4.01 1.295 | I O | | | |
2.42
 17.750   2.19   3.65 1.283 | I O | | | |
2.40
 17.833   2.13   3.36 1.274 | IO | | | |
2.39
 17.917   2.05   3.10 1.266 | IO | | | |
2.38
 18.000   1.89   2.88 1.259 | IO | | | |
2.37
 18.083   1.72   2.66 1.253 |IO | | | |
2.36
 18.167   1.58   2.46 1.246 |IO | | | |
2.35
 18.250   1.46   2.27 1.240 |IO | | | |
2.34
 18.333   1.44   2.11 1.235 |IO | | | |
2.34
 18.417   1.41   1.97 1.231 |IO | | | |
2.33
 18.500   1.38   1.86 1.228 |IO | | | |
2.33
 18.583   1.35   1.76 1.224 |O | | | |
2.32
 18.667   1.32   1.68 1.222 |O | | | |
2.32
 18.750   1.30   1.60 1.220 |O | | | |

2.32							
18.833	1.27	1.54	1.218	O			
2.31							
18.917	1.24	1.48	1.216	O			
2.31							
19.000	1.22	1.43	1.214	O			
2.31							
19.083	1.20	1.39	1.213	O			
2.31							
19.167	1.18	1.35	1.212	O			
2.31							
19.250	1.16	1.31	1.211	O			
2.30							
19.333	1.14	1.28	1.210	O			
2.30							
19.417	1.12	1.25	1.209	O			
2.30							
19.500	1.10	1.22	1.208	O			
2.30							
19.583	1.08	1.20	1.207	O			
2.30							
19.667	1.07	1.17	1.206	O			
2.30							
19.750	1.05	1.15	1.205	O			
2.30							
19.833	1.04	1.13	1.205	O			
2.30							
19.917	1.02	1.11	1.204	O			
2.30							
20.000	1.01	1.09	1.204	O			
2.30							
20.083	0.99	1.07	1.203	O			
2.29							
20.167	0.98	1.06	1.203	O			
2.29							
20.250	0.97	1.04	1.202	O			
2.29							
20.333	0.96	1.02	1.202	O			
2.29							
20.417	0.94	1.01	1.201	O			
2.29							
20.500	0.93	1.00	1.201	O			
2.29							
20.583	0.92	0.98	1.200	O			
2.29							
20.667	0.91	0.97	1.200	O			
2.29							
20.750	0.90	0.96	1.199	O			
2.29							
20.833	0.89	0.94	1.199	IO			
2.29							
20.917	0.88	0.93	1.199	IO			
2.29							
21.000	0.87	0.92	1.198	IO			
2.29							
21.083	0.86	0.91	1.198	IO			
2.29							
21.167	0.85	0.90	1.198	IO			
2.29							
21.250	0.84	0.89	1.197	O			

```
1.72
416.333    0.00    0.01      0.848  O       |       |       |       |
1.72
416.417    0.00    0.01      0.848  O       |       |       |       |
1.72
416.500    0.00    0.01      0.848  O       |       |       |       |
1.71
416.583    0.00    0.01      0.847  O       |       |       |       |
1.71
416.667    0.00    0.01      0.847  O       |       |       |       |
1.71


      Remaining water in basin =    0.85 (Ac.Ft)


      ****************************HYDROGRAPH
DATA****************************
                  Number of intervals =  5001
                  Time interval =    5.0 (Min.)
                  Maximum/Peak flow rate =       14.735 (CFS)
                  Total volume =       2.421 (Ac.Ft)
            Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000
0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000
0.000
      ****************************************************************
*****

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

APPENDIX F:
PROJECT HYDRAULIC CALCULATIONS

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Friday, Sep 17 2021

Preliinary Scupper Design

Rectangular

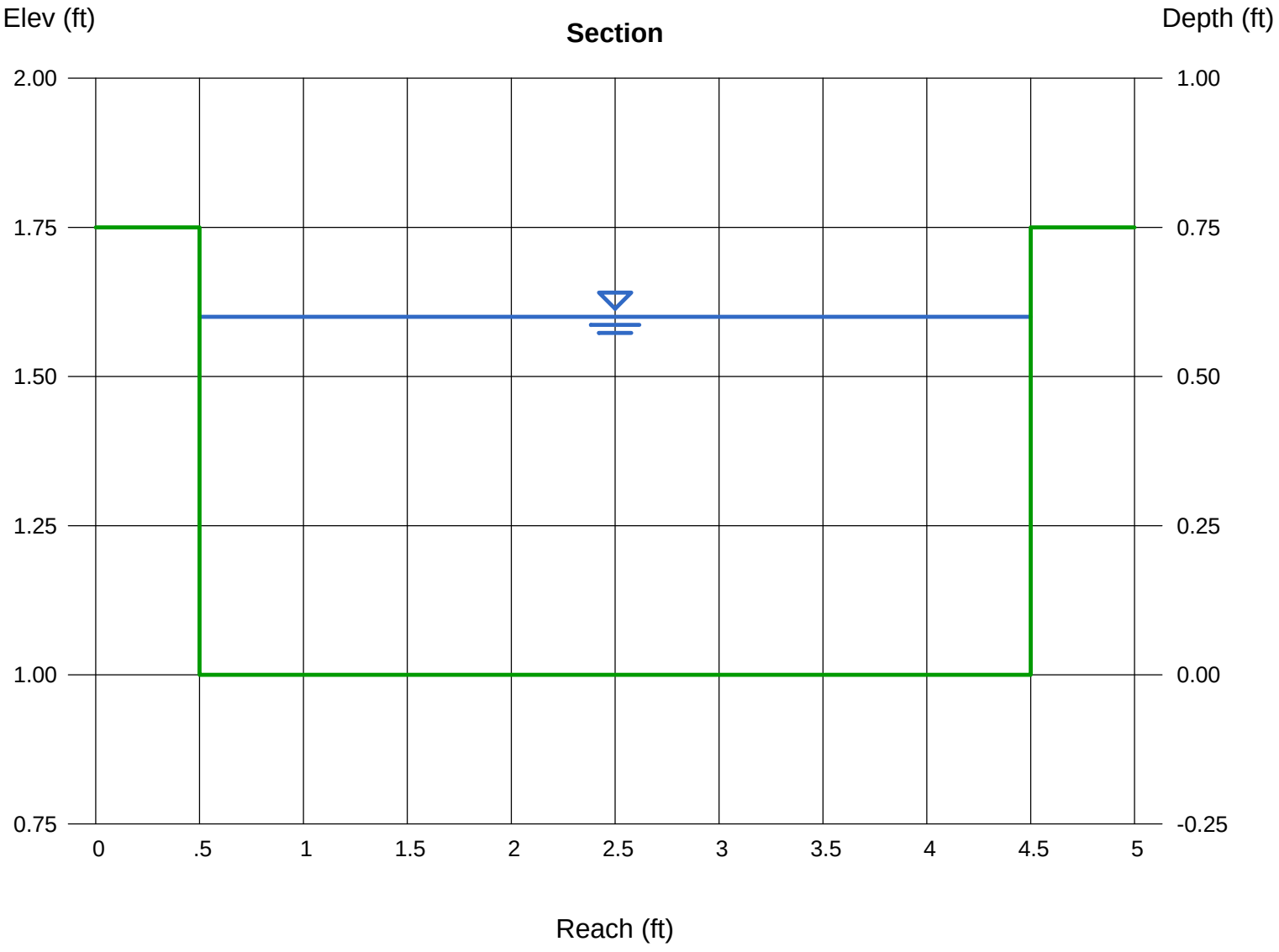
Bottom Width (ft)	= 4.00
Total Depth (ft)	= 0.75
Invert Elev (ft)	= 1.00
Slope (%)	= 0.66
N-Value	= 0.012

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 0.60

Highlighted

Depth (ft)	= 0.60
Q (cfs)	= 14.42
Area (sqft)	= 2.40
Velocity (ft/s)	= 6.01
Wetted Perim (ft)	= 5.20
Crit Depth, Yc (ft)	= 0.74
Top Width (ft)	= 4.00
EGL (ft)	= 1.16



Inlet Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Sep 20 2021

Point 502 Inlet Design

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	7.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

Slope, Sw (ft/ft)	=	0.020
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	0.40
Gutter n-value	=	0.012

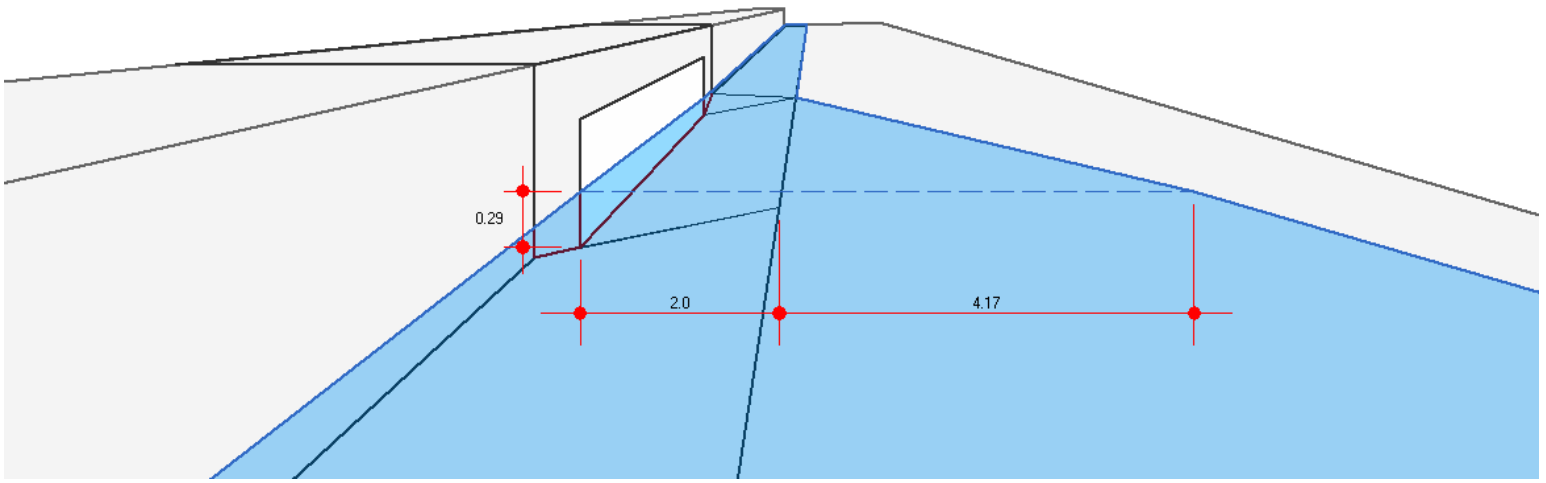
Calculations

Compute by:		Known Q
Q (cfs)	=	1.20

Highlighted

Q Total (cfs)	=	1.20
Q Capt (cfs)	=	1.18
Q Bypass (cfs)	=	0.02
Depth at Inlet (in)	=	3.48
Efficiency (%)	=	99
Gutter Spread (ft)	=	8.25
Gutter Vel (ft/s)	=	1.76
Bypass Spread (ft)	=	2.00
Bypass Depth (in)	=	0.48

All dimensions in feet



Inlet Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Sep 20 2021

Point 403 Inlet Design

Combination Inlet

Location	=	On grade
Curb Length (ft)	=	7.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	2.00
Grate Length (ft)	=	2.00

Gutter

Slope, Sw (ft/ft)	=	0.020
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	0.80
Gutter n-value	=	0.012

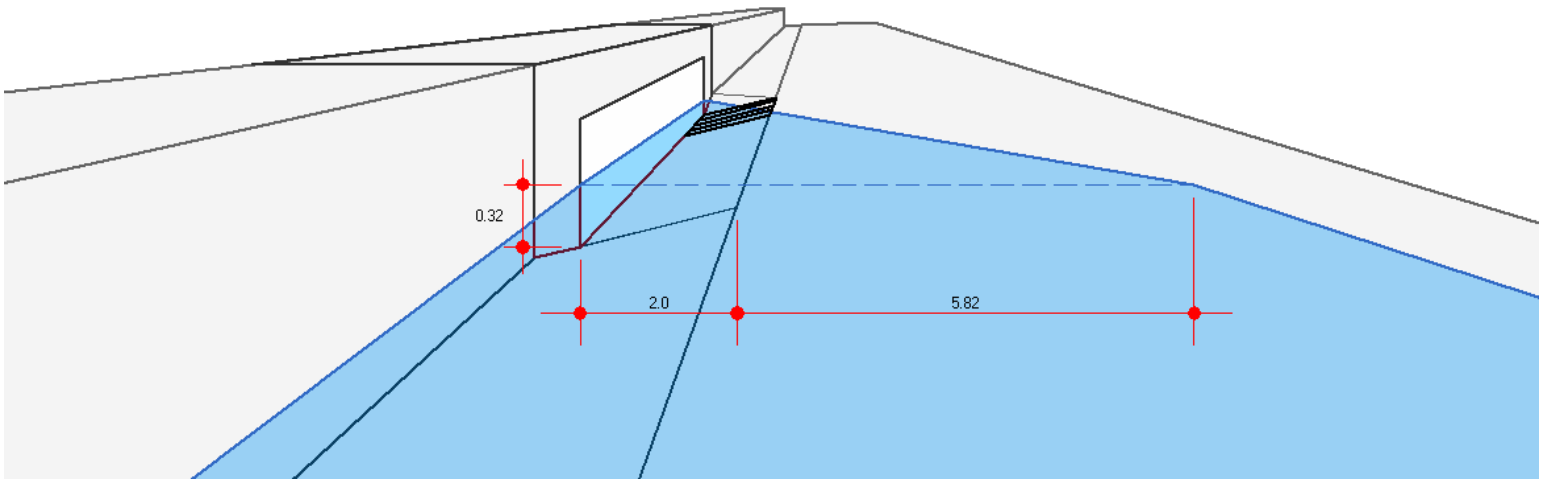
Calculations

Compute by:		Known Q
Q (cfs)	=	2.50

Highlighted

Q Total (cfs)	=	2.50
Q Capt (cfs)	=	2.50
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	3.88
Efficiency (%)	=	100
Gutter Spread (ft)	=	9.55
Gutter Vel (ft/s)	=	2.74
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-

All dimensions in feet



Inlet Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Sep 20 2021

Point 302 Inlet Design

Curb Inlet

Location	=	Sag
Curb Length (ft)	=	7.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

Slope, Sw (ft/ft)	=	0.020
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	-0-
Gutter n-value	=	-0-

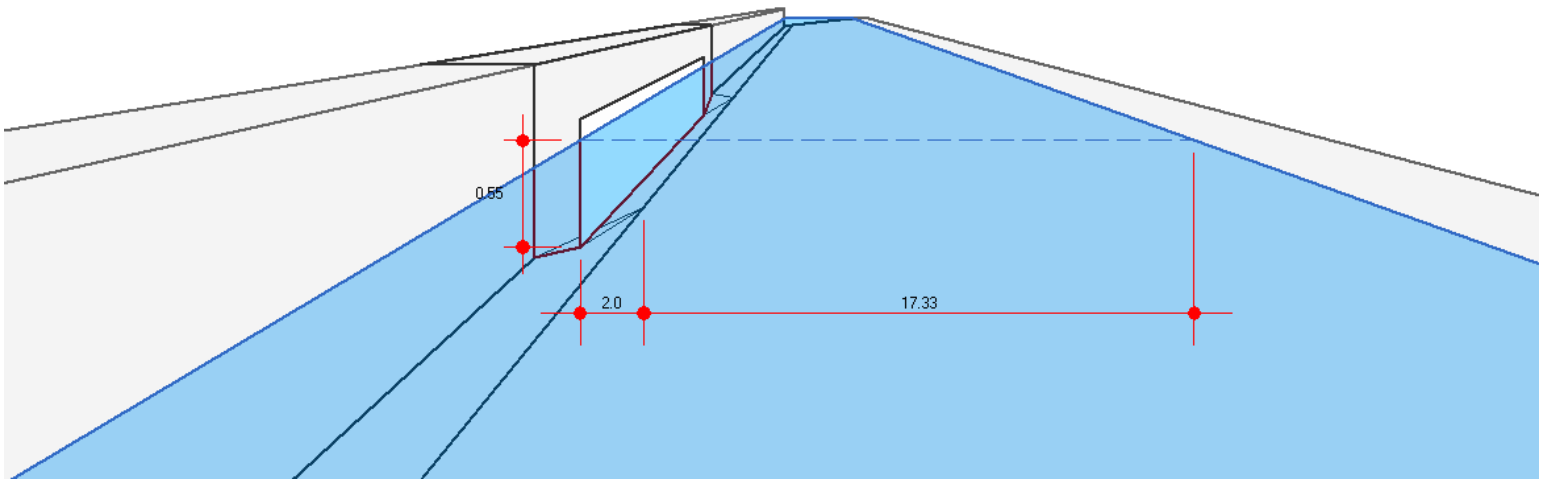
Calculations

Compute by:		Known Q
Q (cfs)	=	5.90

Highlighted

Q Total (cfs)	=	5.90
Q Capt (cfs)	=	5.90
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	6.64
Efficiency (%)	=	100
Gutter Spread (ft)	=	19.33
Gutter Vel (ft/s)	=	3.19
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-

All dimensions in feet



Inlet Report

Point 203 Inlet Design

Combination Inlet

Location	=	On grade
Curb Length (ft)	=	7.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	4.00
Grate Width (ft)	=	2.00
Grate Length (ft)	=	2.00

Gutter

Slope, Sw (ft/ft)	=	0.020
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	2.00
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	0.70
Gutter n-value	=	0.012

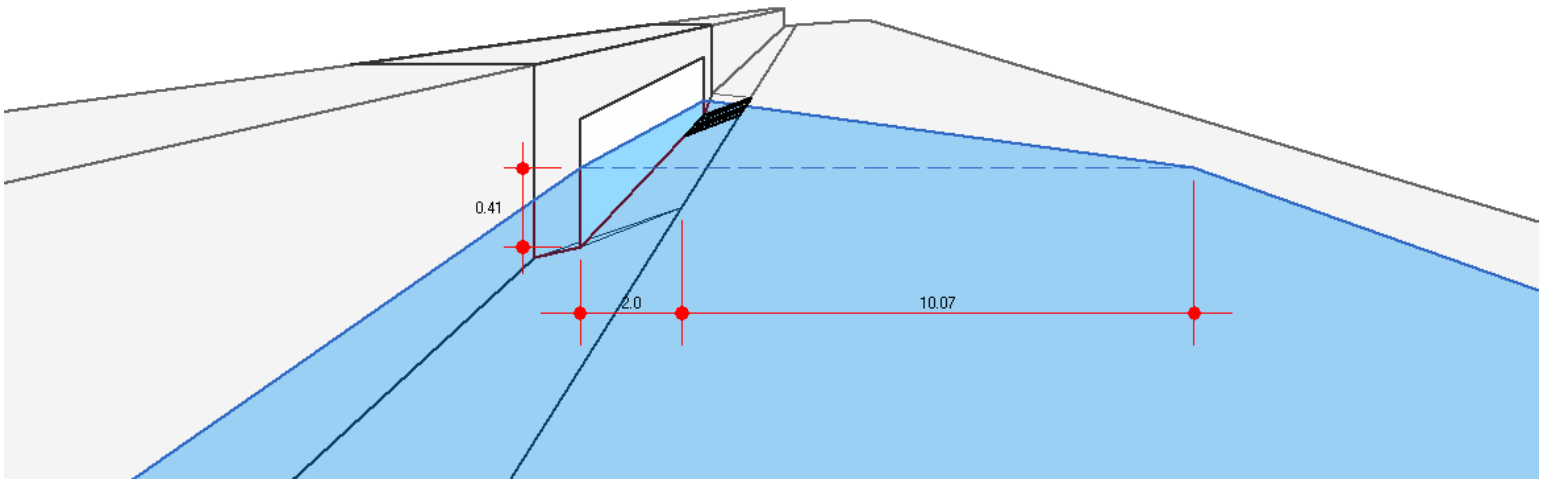
Calculations

Compute by:		Known Q
Q (cfs)	=	5.60

Highlighted

Q Total (cfs)	=	5.60
Q Capt (cfs)	=	5.60
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	4.90
Efficiency (%)	=	100
Gutter Spread (ft)	=	13.25
Gutter Vel (ft/s)	=	3.19
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-

All dimensions in feet



Inlet Report

Point 103 Inlet Design

Curb Inlet

Location	=	Sag
Curb Length (ft)	=	21.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

Slope, Sw (ft/ft)	=	0.020
Slope, Sx (ft/ft)	=	0.020
Local Depr (in)	=	-0-
Gutter Width (ft)	=	2.00
Gutter Slope (%)	=	-0-
Gutter n-value	=	-0-

Calculations

Compute by:		Known Q
Q (cfs)	=	17.80

Highlighted

Q Total (cfs)	=	17.80
Q Capt (cfs)	=	17.80
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	5.15
Efficiency (%)	=	100
Gutter Spread (ft)	=	21.44
Gutter Vel (ft/s)	=	-0-
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-

All dimensions in feet